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**Materiały do poznania rodziny *Lymnaeidae*. VIII.**

**Rodzaj *Pseudosuccinea* w Brazylii Południowej.**

**Contributions to the study of the Family**

***Lymnaeidae* VIII.**

**The Genus *Pseudosuccinea* from South Brazil.**

(Z wyników naukowych Polskiej Wyprawy Zoologicznej do Brazylii w latach  
1921 — 1924).

(From the scientific results of the Polish Zoological Expedition to Brazil  
1921 — 1924).

[Pl. I].

The Polish Zoological Expedition to Brazil brought back to the Zoological collections of the Polish Museum of Natural History several hundred specimens of *Lymnaeidae*, originating from a pond at Bacachery, in the neighbourhood of Curitiba (State of Paraná). According to Dr. T. Jaczewski, who collected these specimens, this pond measures about  $300 \times 100$  metres, the depth at the centre being about 5 or 6 metres. The *Lymnaeidae* were collected only from the margin of the pond, where the water was at most 20 cm. in depth. The pond-bottom in this region was of clay with an admixture of sand, and sparsely overgrown with water-plants. The pond is not of natural origin, having been formed by the damming of a small stream; its photograph is given by Dr. T. Jaczewski in his report on the expedition (7, Plate XXXIII, fig. 2).

The great majority of the specimens collected are young forms, collected on the following dates:

Early spring (15 VIII 1923)	. . . . .	45	specimens.	
Between spring and summer (7 X 23)	. . . . .	183	"	
Midsummer	}	(21 X 23)	123	"
		(Dec. 1923)	4	"
		(13 I 1924)	5	"

Apart from this, Mr. Szymon Tenenbaum donated to the Polish Museum of Natural Hist. 9 exemplars of *Lymnaeidae*, collected by him in shallow marsh water between Affonso Penna and Curityba on the 13 VIII 1923.

All the specimens from Bacachery I identified with the species described in 1882 by Clessin under the name of *Limnaea peregrina* (3), this description being repeated in „Systematisches Conchylien-Cabinet“, under the name of *Limnaeus peregrinus* (4). A study of the anatomy of these S. American exemplars, however, led me to the conclusion that this species belongs to the genus *Pseudosuccinea* Baker, and, as those specimens collected by Sz. Tenenbaum were anatomically identical with the above species, I have also classified them as *Pseudosuccinea peregrina* (Cless.).

The genus *Pseudosuccinea* was erected on anatomical grounds by F. C. Baker in 1908. In his monograph upon North American *Lymnaeidae* this author makes the following statement as to the necessity of the erection of this genus: „The *Succinea*-like shells of *Lymnaea columella* have been usually placed in *Radix* on account of the large, somewhat flaring aperture. Dr. Dall, in his Alaska Mollusca, has expressed the opinion that it belongs to *Stagnicola*. A study of the anatomy shows that it differs markedly from *Stagnicola* in its genitalia and in its radula. The peculiar shape and small size of the prostate, the number and position of the retractor muscles of the male organ <sup>1)</sup> and the *Succinea* like shape of the shell have led the author to erect a new genus for the reception of these peculiar shells“ (2, p. 163).

The above states that the grounds for the differentiation of the genus *Pseudosuccinea* both from the genus *Galba* (subgenus *Stagnicola*) and from *Radix* (Baker gives the anatomy of

<sup>1)</sup> My italics.

*Radix auricularia* in his monograph) are above all anatomical, amongst other details, in the structure of the prostate. It is therefore difficult to comprehend why this was ignored by Annàndale and Rao who, in their paper upon Indian *Lymnaeidae* (1, p. 145) distinguish the „group“ (these authors do not consider it to be a genus) of *Pseudosuccinea* exclusively on the basis of the shell, stating, as to the reproductive system, „Genitalia as in *Radix*“. By the above statement of the case, these authors have introduced fresh sources of confusion into the systematics of the *Lymnaeidae*, erroneously including the European *Radix peregra*, for example, into the *Pseudosuccinea* „group“. As far as I could judge from the somewhat obscure anatomical sketches of Indian *Lymnaeidae*, included in the above paper, and, unfortunately, hardly at all explained in the text, the species investigated by these authors have nothing in common with the genus *Pseudosuccinea*, into which we can in no case include *L. horae*, *L. acuminata* and *L. luteola*. Indeed, in my opinion, this genus is entirely absent from India.

The establishment of the occurrence of *Pseudosuccinea* in South Brazil greatly enlarges the limits of geographical distribution of this genus, the most southerly locality given by Baker (2) being Bigabo in South Panama (*Pseud. columella championi*).

**The shell** of adult specimens from Bacachery [Pl. I, fig. 1] is an elongated ovoid, very thin, delicate and fragile, transparent, and of a yellowish horn colour. Fine growth lines cover the entire shell, being much clearer and thicker at the suture. These lines are cut by fine, irregularly distributed spiral lines, forming in many places a delicate network, visible through a lens. The whorls are 4 — 4½, the spire being short, without any great convexity of the whorls, and constitutes a third or less of the total length of the shell. The whorls enlarge rapidly, the last one being very large; the suture is not very deep. The aperture of the shell is ovate, its lower portion being slightly widened, and the upper portion narrowed and ending acutely. The peristome is thin and acute, and the inner lip is reflected over the umbilicus, usually, however, leaving a narrow chink.

The dimensions of the 10 largest specimens from Bacachery (15 VIII 1923) are as follows:

Shell		Aperture	
Length	Breadth	Length	Breadth
18.50	10.15	12.50	7.0 mm.
17.90	9.80	12.25	6.60 „
16.80	9.10	11.50	7.50 „
16.75	9.75	12.35	7.0 „
16.0	9.10	10.90	6.0 „
16.0	9.0	11.00	6.0 „
15.15	8.75	11.15	7.80 „
15.0	8.50	11.50	6.10 „
14.50	7.50	11.0	6.0 „
13.0	7.75	9.35	5.50 „

The above specimens are not altogether identical with the drawing given by Clessin (4, pl. 52, fig. 10), in which the spire is somewhat more slender, and the last whorl slightly less dilated. Those, however, who are acquainted with the great variability in this respect of the shells of the *Lymnaeidae*, and who have compared various individuals of the related species *Pseudo-succinea columella*, as given in F. C. Baker's paper (2, pl. XXIII, figs. 8 — 20, XXIV, figs. 1 — 20) will agree with me that the specimens from Bacachery can and should be included in this species. Clessin's specimens originated from „Taquara del mundo nuovo Brasiliae“ (3, p. 188), and, although he states in his description that the number of whorls is 5, his drawing (4, pl. 52, fig. 10) allows one to accept at the utmost 4½ whorls.

The specimens collected by Sz. Tenenbaum differ from the Bacachery exemplars in possessing a shorter spire, in the greater convexity of the last whorl, as a result of which the entire shell has a more ovate, less elongated shape [Pl. I, fig. 2] and in their darker coloration. About the same difference exists between the specimens from Bacachery and from Affonso Penna as between a typical *columella* and its var. *macrostoma*. It is possible that this form might be identified with the „*Limnaeus megaspidus*“ of Ziegler (8, p. 34, Pl. 6, fig. 13) were it not for the great difference in the structure of the spire, and for the uncertainty as to the native country of Ziegler's species, of which Küster says: „Soll aus Brasilien sein, ist aber wohl eine ostindische Art“. Should, however, such an explanation turn out to be possible, we would have to use in place of the name

*Pseudosuccinea peregrina* (Cless.) that of *Pseudosuccinea me-gaspida* (Ziegl.).

The dimensions of the specimens collected by S z. T e n e n - b a u m are as follows.

Shell		Aperture	
Length	Breadth	Length	Breadth
16.0	10.0	12.90	7.25 mm.
15.50	9.25	11.75	7.0 "
15.0	8.75	11.15	6.90 "
13.75	—	9.65	— "
12.90	7.75	10.0	5.50 "
12.70	—	9.50	— "
12.50	7.50	9.50	5.50 "
12.0	7.0	8.25	5.75 "
10.0	—	7.50	— "

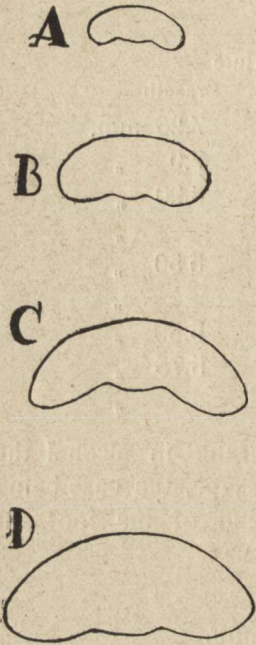
**The animal.** In specimens greatly shrunk in alcohol the foot is short and broad. It is triangular in shape, the base being the anterior, and the summit the posterior end of the foot. Its dimensions are:

Length	Breadth
6.10	4.90 mm.
6.25	4.85 "
5.25	4.10 "

The dorsal surface of the head is light grey in colour. The coloration of the mantle is similar to that of *Radix*, the margin of its free portion being unpigmented. More posteriorly, the dorsal surface of the free part of the mantle is dark grey with black spots, and on the part of the mantle covering the respiratory cavity may be found, on a black background, round yellow spots of various sizes, the pigmented parts forming a dense black network. From the respiratory cavity posteriorly a grey belt extends only in the vicinity of the columella, the remaining portions being usually unpigmented. At the apex more intense pigmentation again appears, the last whorl being usually of a dark brown colour.

**Jaws.** The superior jaw is fairly broad, and is trilobed ventrally. The size of the central lobe and its relation to the

two distal lobes varies with the individual, as can be seen from the drawings. Fig. 1A represents a jaw of a small individual, whose shell length is 5.50 mm., whilst in fig. 1B it is 8.90 mm., in fig. 1 C 15.5 mm., and in fig. 1 D 16.0 mm. (the last two are adult specimens). The lateral jaws present no particular interest.



**Radula.** The radula, while possessing the general character of the radulae of the *Lymnaeidae*, exhibits certain special and characteristic features.

For the characterisation of the radula, I give, as an example, the detailed formula of a specimen from Bacachary (shell length 17.90 mm.). The formula is for one side, i. e., it embraces only half of a horizontal row of teeth, beginning from the central tooth.

1 c	41	11	21	11	41	1 m	1 m	1 m
1	3	4	3	4	3	5	7	9
1 m	1 m	1 m	3 m	1 m	1 m	2 m	1 m	
8	6	10	11	10	9	8	11	

Fig. 1. The superior jaws.

$$\frac{1\ m}{10} \frac{1\ m}{6} \frac{1\ m}{7} \frac{1\ m}{4} \frac{1\ m}{11} \frac{1\ m}{9} \frac{1\ m}{6} \frac{1\ m}{7} \frac{1\ m}{3} = 1c - 121 - 23\ m.$$

Since on the other side of a given horizontal row about the same number of lateral and marginal teeth may be found, the total number of teeth in the above row would be 35—1—35=71.

The above is an individual formula, as are all detailed formulae of the radulae of the *Lymnaeidae*, — a synthetical elaboration of the radulae of this Family is, in view of their great variability, very difficult. I add further less detailed formulae (the ± signs placed after the numbers of marginal teeth indicate that this number may vary about the given value):

$$2) \frac{23\ m}{6\pm} \frac{101}{3-4} \frac{1\ c}{1} \frac{111}{3-4} \frac{24\ m}{6\pm} = 33 - 1 - 35 = 69$$

(Shell length 17.0 mm.)

$$3) \frac{24m}{6\pm} \frac{101}{3} \frac{1c}{1} \frac{101}{3-4(5-6)} \frac{27m}{6\pm} = 34 - 1 - 37 = 72$$

(Shell length 18.5 mm.)

$$4) \frac{23m}{6\pm} \frac{121}{3-4} \frac{1c}{1} \frac{121}{3-4} \frac{22m}{6\pm} = 35 - 1 - 34 = 70$$

(Shell length 16.75 mm.)

$$5) \frac{21m}{6\pm} \frac{121}{3-4} \frac{1c}{1(3)} \frac{101}{3} \frac{23m}{6\pm} = 33 - 1 - 33 = 67$$

(Shell length 16.0 mm.)

$$6) \frac{18m}{6\pm} \frac{71}{3-4} \frac{1c}{2} \frac{71}{3-4} \frac{17m}{6\pm} = 25 - 1 - 24 - 50$$

(Shell length 8.90 mm.)

$$7) \frac{18m}{6\pm} \frac{81}{3-4} \frac{1c}{2} \frac{81}{3-4} \frac{16m}{6\pm} = 26 - 1 - 24 = 51$$

(Small individual, but bursa copulatrix full of sperm)

$$8) \frac{17m}{6\pm} \frac{71}{2-4} \frac{1c}{1} \frac{71}{2-4} \frac{15m}{6\pm} = 24 - 1 - 22 - 47$$

(Shell length 6.40 mm.)

$$9) \frac{15m}{6\pm} \frac{71}{2-3} \frac{1c}{2} \frac{61}{2-3} \frac{17m}{6\pm} = 22 - 1 - 23 = 46$$

(Shell length 5.50 mm.)

$$10) \frac{14m}{6\pm} \frac{71}{3-4} \frac{1c}{2} \frac{61}{3-4} \frac{14m}{6\pm} = 21 - 1 - 20 = 42$$

(Shell length 5.50 mm.)

$$11) \frac{15m}{6\pm} \frac{61}{3-4} \frac{1c}{1} \frac{61}{3-4} \frac{16m}{6\pm} = 21 - 1 - 22 = 44$$

(Shell length 5.25 mm.)

The central tooth is relatively broad, much more so than that given by Baker for *Pseudosuccinea columella* from N. America (2, pl. VII, fig. B), usually monocuspid, the cusp being small, as a rule [fig. 2C, fig. 3 B, fig. 5, black portion]<sup>1)</sup>, and

<sup>1)</sup> All drawings of the teeth of the radulae are on the same scale. The shell lengths of the specimens from which drawings are made are as follows: fig. 2 — 17.90, fig. 3A — 5.50, fig. 3B 6.40, fig. 3C — 5.50, fig. 3D — 7.20, fig. 4 — 17.0, fig. 5 — 18.50, fig. 6 — 17.0, fig. 7 and 8 — 17.0.

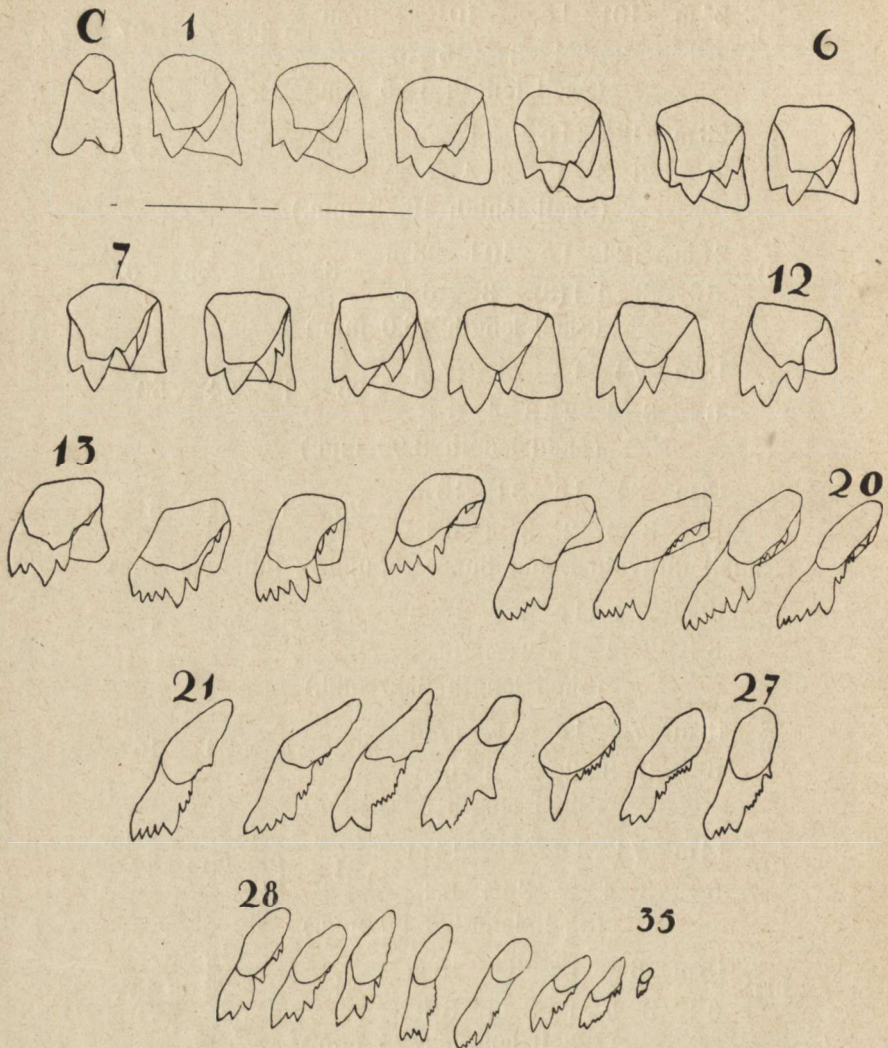


Fig. 2. The teeth of the radula, C is the central, 1 — 12 the lateral, and 13 — 35 the marginal teeth.

only occasionally is it somewhat more developed. Sometimes deviations from the normal may be observed; thus, for example, fig. 7 represents the perpendicular row of central teeth placed one above the other, possessing a variable number of cusps—4, 1, 4, 2, 3; fig. 3C represents a bicuspid central tooth with well developed cusps.



Normally the cusp is the free posteriorly directed edge of a flat plate (called a reflexion), fixed to a larger base of attachment. The cusps shown in fig. 3 D appear to represent the front edge of the base of attachment, raised and bent backwards, thus forming a kind of spoon. Here, therefore, the reflexion is perpendicular to the base of attachment, and the cusps are raised high above the latter. On the same figure 3 D we see, apart from this, that the cusps of the central tooth of different horizontal rows are inclined in different directions — in the upper row to the left, in the next row normally, in the third row to the right, and in the fourth row they are abnormal raised, but slanting directly backwards. Similarly the cusp of the central tooth in fig 3 A is abnormally developed — here, too, the cusp is raised above the base of attachment, and turned towards the left, but, apart from this, it possesses two cutting points instead of one.

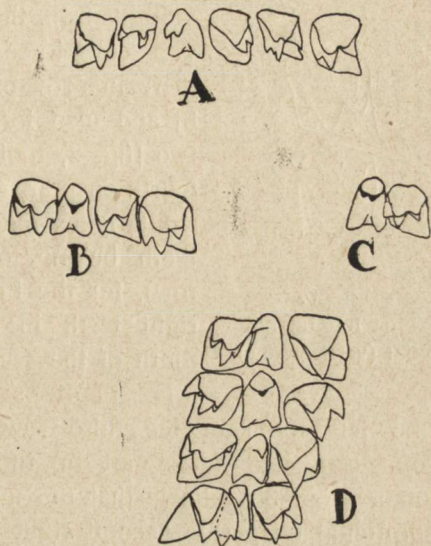


Fig. 3. Abnormalities of the teeth of the radula.

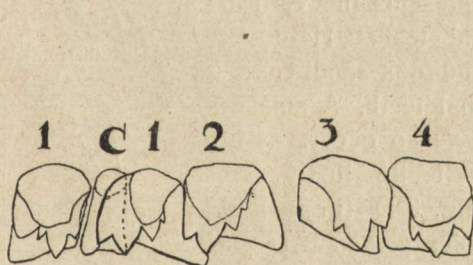


Fig. 4. Abnormal arrangement of the teeth of the radula.

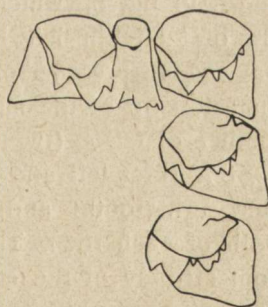


Fig. 5. Abnormal first lateral tooth of the radula.

The lateral teeth are usually tricuspid [fig. 2]. The longest and broadest is the mesocone, on both sides of which are placed the smaller and shorter, although also relatively broad, entocone and ectocone. Here, too, we often find deviations from the „normal“, as in fig. 2, where we see tetracuspid teeth scattered here and there in a row of tricuspids [fig. 2, tooth 5 and 8] and also forms intermediate between the two [fig. 2, tooth 6, 7, 9]. In each case, the fourth cusp arises from division of the ectocone, similarly as for the upper tooth in fig. 6 (these teeth belong to the left half of a horizontal row), for the first left and the first and second right teeth in fig. 4, and for the first left tooth of the second row from the top in fig. 3 D.



Fig. 6.  
First left lateral  
tooth (vertical row).

In the same figure we see from the first left tooth of the third row from the top that the entocone can also take part in the formation of a tetracuspid tooth. Fig. 3 A shows that the mesocone may also possess an additional cusp (the second right tooth). Occasionally in individual teeth of the lateral series we encounter even greater numbers of cusps, as can be seen in the first right lateral teeth in fig. 5, where the ectocone has divided into 3—4 cusps. Sometimes the lateral tooth assume the shape of marginal, although after them follow entirely normal lateral tooth—such a tooth is shown in fig. 8, which represents the vertical row of the tenth left lateral teeth. Here we may see the presence of numerous small cusps, characteristic of the marginal teeth. A smaller number of cusps (two) may also occur, as in fig. 3 A (first left and right teeth), in fig. 3 B (first right tooth) and in fig. 3 D (first right tooth of each row). This bicuspid state arises from atrophy of the entocone.

Deviations from the normal in the lateral teeth may exist not only in the number of cusps, but also in their direction. Normally,



Fig. 7. Variability  
of the number of cusps  
of the central tooth  
(vertical row).

the cutting portion of the lateral teeth only very slightly covers the base of attachment of the neighbouring tooth, but, in some cases, the cusps are to such an extent twisted to one side that a considerable portion of the neighbouring tooth is covered. On figs. 4 and 3 D we see two such cases of the covering of the central tooth by the cutting portion of the first lateral tooth [fig. 4, first right, fig. 3 D first left tooth of the lower row]. The cusps of the lateral teeth are, however, normally slightly inclined towards the median line of the radula, i. e., towards the central tooth, so that on the left side of the radula they are directed to the right, and on the right side to the left. The above described abnormality is therefore merely an exaggeration of the normal inclination of the cusps. Cases may, however, be encountered in which the inclination of the cusps is in the opposite direction to the normal. Thus, on the right-hand side of fig. 4 we see four lateral teeth, of which the first is mentioned above, and covers the central tooth, the second is normally directed, while the cusps of the third and fourth teeth are contrarily directed towards the right instead of to the left. As a result of this, a gap exists between the second and the third teeth (on this figure the teeth are represented in their normal position, without displacing them, as was done in fig. 2). We see the same in fig. 3 D, where on the right side the cusps of all the first teeth are directed abnormally to the right, and on the left side the three first upper teeth to the left, as also in fig. 3 A (first left and right teeth).

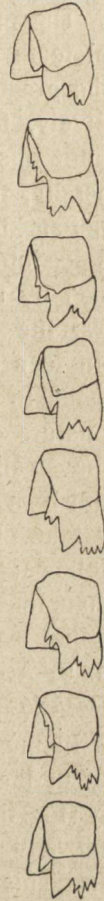


Fig. 8.  
10-th left lateral  
tooth (vertical  
row).

In *Pseudosuccinea peregrina* the most characteristic are the marginal teeth, which, on the whole, possess the characteristic shape of the teeth of the *Lymnaeidae* family, namely, elongated plates with numerous small cusps. Here, however, the number of cusps is on the average greater than in the European representatives of this family; it is increased by the formation of nu-

merous small cusps on the external edge of the cutting portion. Thus in European species we see in this place 1 — 3 cusps, whilst here we have from 3 to 8 [fig. 2, tooth 15 — 34].

The presence of these numerous small cusps on the marginal teeth may be considered to be a primitive feature, pointing to the greater antiquity of the species *Pseudosuccinea peregrina*, relatively, for example, to the European *Lymnaeidae* (Baker did not observe a greater number of cusps in *Ps. columella*; 2). Generally, the most primitive forms of Gastropods possess very numerous but small teeth, which in younger forms appear to coalesce into larger units, of course, in smaller number. Such a tooth, formed by the coalescence of a certain number of smaller teeth, shows the traces of its composite origin in the cusps, which retain to a certain extent the primitive individuality of its components. In still younger forms, and probably in connexion with the nature of their food, a further weakening of the individuality of the small primitive teeth occurs, i. e., the cusps disappear or diminish in number in the composite teeth. Such modifications may take place according to the law formulated by Pilsbry as follows: „All modifications in the teeth proceed from the median line of the radula outwards toward the edges, the outer marginal teeth being the last to be modified“ (cited from Baker, 2, p. 9) According to the above rule we find primitive features in *Pseudosuccinea peregrina* in the row of marginal teeth.

In my previous papers I drew attention to the great variability of the radula in the *Lymnaeidae*, and hence to its unreliability for the classification of species. I could not, therefore, attach any great philogenetic importance to the shape of the teeth. This view was, however, much more emphatically stated by Heidemanns (6) in a recently published paper, where he makes the following statement: „Man ist stets geneigt gewesen dem Bau der Radula hohen phylogenetischen Wert beizulegen, d. h. sie für geeignet zu einer natürlichen Einteilung der Arten zu erachten. Es dürfte aber zu denken geben, ob nicht gerade die vielfach veränderten Lebensbedingungen einen weitgehenden Einfluss auf ihre Umgestaltung gewonnen haben, wodurch ihre ursprüngliche Form so sehr geändert wurde, dass sie zu phylogenetischen Spekulationen viel an Wert verloren hat, wie ja überhaupt alle Organe des Darmsystems jenen Einflüssen sehr

leicht unterliegen“ (6, p. 347 — 348). Whilst Heidemans' view is undoubtedly to a large extent justified, yet I cannot entirely admit that the study of the radula (abstracting, of course, from such small details as vary from individual to individual) is entirely destitute of value for the philogenetics of this family. The shape of the radula, as, indeed, of any organ, is determined by the resultant of two opposed tendencies — that tending to conserve the typical, hereditarily fixed form, inherited from the ancestors, and that expressing the influences of a given environment at a given time, modifying the external shape of the radula during its development. Which features of a given individual radula are acquired and would be lost with the disappearance of modifying agencies, and which are hereditarily fixed and passed on from generation to generation, it is difficult to decide for each particular case — long years of research and study would be necessary to solve this question<sup>1)</sup>.

<sup>1)</sup> Heidemans did not, unfortunately, acquaint himself with the literature of this subject; among others, he does not know the papers by F. C. Baker, Wł. Dybowski and of the author of this paper. His conclusions as to the radulae of this family he bases only on his own observations, probably made upon only a small number of individuals; indeed, I have the impression that he limited himself only to single individuals of each species. Heidemans comes to the conclusion that the shape of the teeth of the radula depends exclusively upon the nature of the food consumed, adding that: „Schlamm- und Detritusfresser Schaufelzähne besitzen, Algenvertilger Bürstenzähne und Blätterstörer Dolchzähne“ (6, p. 347). The author classifies adult *Lymnaeidae* in the category „Blätterstörer“, and accordingly shows the presence of „Dolchzähne“ in the lateral series of teeth. This is quite correct as far as concerns *Lymnaea stagnalis*, which does, in reality, feed above all upon higher plants. It cannot, however, be applied to *Radix auricularia*, which, as in general European Radices, feeds above all upon algae. One might, therefore, expect to find in *Radix* at least a certain approach of the lateral teeth to the „Bürstenzähne“ shape, i. e., a certain increase in number of cusps relatively to *Lymnaea stagnalis*. This author, however, unexpectedly shows quite the contrary: according to him *L. stagnalis* possesses tricuspid lateral teeth and *Radix auricularia* bicuspid. Had the author, however, read the literature dealing with this subject, he would have found that *Lymnaea stagnalis* is characterised by its bicuspid lateral teeth, and that the specimen examined by him deviated, therefore, individually from the normal shape, since *R. auricularia* possesses usually (at least, in Europe) tricuspid lateral teeth. In the given case, therefore, the results obtained by other authors to a certain extent confirm the views of this author, in spite of conflicting facts given by him. If, however, the shape of

I would not, in this case, attach any greater importance than in my previous papers to the detail of the existence of an increased number of cusps on the marginal teeth, did this detail not entirely agree with the hypothesis of the primitive nature of the genus *Pseudosuccinea*, based upon the structure of entirely different organs, namely, of the reproductive system (see below).

Finally, I must emphasise another fact concerning the variability of the teeth. It is generally accepted that if one encounters in one horizontal row any deviation from the normal shape, this deviation will be repeated in the corresponding teeth of all the succeeding rows. This is often indeed the case, but not always, as is illustrated by fig. 7, in which the central tooth of one and the same radula possesses in succeeding rows 4, 1, 4, 2 and 3 cusps. A similar condition may be seen in fig. 8, representing the tenth left lateral tooth of rows directly succeeding one another. It is true that general type of the deviation (approach to the marginal type) is in every case apparent, but the number of cusps is different in the individual teeth. Considerable differences are shown in fig. 3 D, both in the shape of the central tooth and in that of the 1-st lateral, particularly the left tooth. The first right lateral teeth in fig. 5 also differ among themselves in their details, although they too retain the general type of the deviation.

**The Alimentary Canal.** The course of the alimentary canal and the number of coils it possesses are apparently different for different genera of *Lymnaeidae*. So far, no comparative researches on this subject have been published, and as my own observations in this connexion on European *Lymnaeidae* will be published later, I shall here confine myself to a description of the alimentary tract of *Pseudosuccinea peregrina*.

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the teeth of the radula depends to so large an extent upon the nature of the food eaten as Heidemanns supposes, then the abyssal *Lymnaeidae* of Lake Léman, consuming only mud from the lake-bottom, together with, of course, the minute organisms contained therein, should exhibit at least a tendency towards the modification of their teeth to the „Schaufelzähne“ type. Meanwhile, not even a trace of such a modification is visible, and the abyssal forms retain the shape of lateral teeth characteristic of the given species from the littoral fauna (Roszkowski, 9).

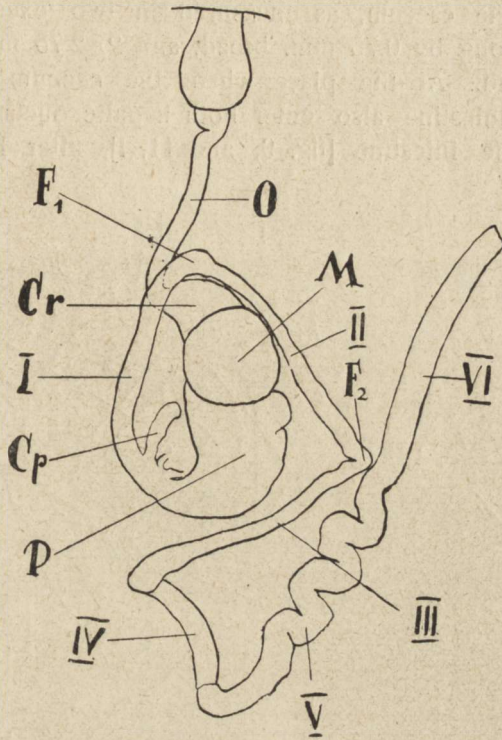


Fig. 9. Alimentary canal. Cp is the *caecum pyloricum*, Cr, the first portion of the stomach (crop), F<sub>1</sub> and F<sub>2</sub> the first and second intestinal flexures, M the second muscular portion of the stomach (gizzard), O the oesophagus, P the third posterior portion of stomach (pyloric-portion), I—VI the intestinal sectors.

The comparatively short oesophagus, directed posteriorly and to the left, dilates towards its termination, thus forming the first thin-walled portion of the stomach (crop) [fig. 9 Cr.]. The stomach itself lies in the visceral sac on the left side. It is placed sideways, so that only half of the muscular portion (gizzard), [fig. 9, M] is visible from the dorsal side, the other half being directed below. The concave *curvatura minor* is directed to the left and the larger convex *curvatura* to the right. The intestine leaves the stomach at the terminal constricted pyloric portion of the latter [fig. 9, P], turning to the left, and here, at the boundary between the stomach and the intestine is the *caecum pyloricum* [fig. 9 Cp, fig. 10], embedded in the liver. The di-

mensions of the caecum, as measured in two exemplars, are 1) 2.5 mm. long by 0.75 mm. broad; and 2) 2.75 mm. long by 0.9 mm. broad. At the place where the caecum enters the stomach or intestine also enter both hepatic ducts. The first section of the intestine [fig. 9, and 11, I], after leaving the

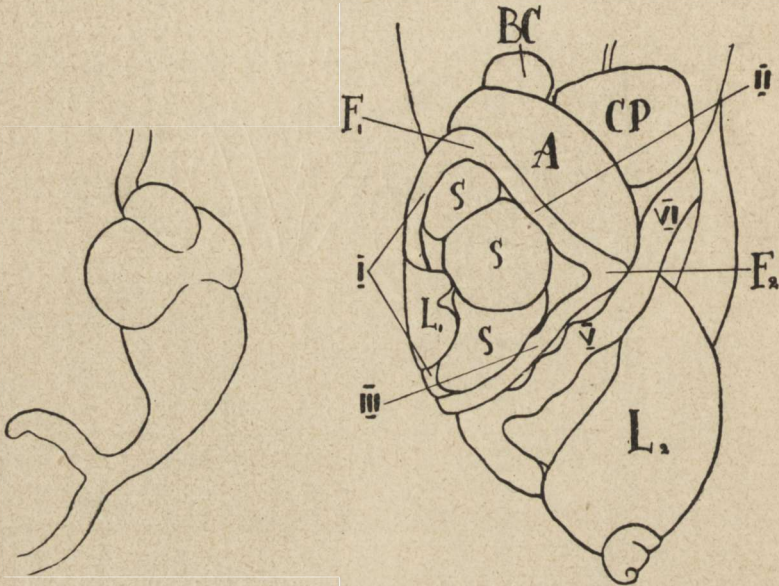


Fig. 10. Stomach and *caecum pyloricum*.

Fig. 11. Alimentary tract in situ, from the dorsal side (exemplar shrunk in alcohol). A is the albuminiparous gland, BC the *bursa copulatrix*, CP the *corpus pyriforme*, F<sub>1</sub> and F<sub>2</sub> the 1-st and 2-nd intestinal flexures, L<sub>1</sub> and L<sub>2</sub> the anterior and posterior livers, S the three parts of the stomach, I—VI the intestinal sectors.

stomach, proceeds along the left side of the latter to the front, reaching the place where the *oesophagus* dilates to form the fore stomach or crop. Here it forms the first flexure [fig. 9, and 11, F<sub>1</sub>], bending backwards over the *oesophagus* and to the right. The next, second section of the intestine runs obliquely along the right side of the stomach, i. e., along its *curvatura major*, running to the rear and to the right. Posteriorly, approximately either between the muscular and the posterior portion of the stomach [fig. 11, F<sub>2</sub>], or else midway to the end of the latter



[fig. 9,  $F_2$ ], the intestine makes the second flexure, bending at right-angles to the left and rear. After this flexure, the third section of the intestine [fig. 9 and 11, III] proceeds to the left along the posterior margin of the stomach, at first running slightly obliquely to the rear, and then down to the ventral surface. Here it passes in a gentle arc [fig. 12, representing this part of the intestine viewed from the left side] into the fourth section [fig. 12, IV], likewise bent into an arc and directed mainly to the rear. The fifth section [fig. 9, 11 and 12, V] also proceeds smoothly and with the same arc curvature from the fourth section, at the beginning ascending, and then bending over to the right and slightly forward on the dorsal side — the terminal portion of the fifth sector is sometimes quite parallel to and side by side with a considerable portion of the third section [fig. 11], and sometimes is removed from it, being in contact only with the second flexure [fig. 9]. This section is usually more or less undulated. Together, therefore, the hind portion of the third sector, the whole of the fourth, and the fifth sector form a large loof, lying on the left and ventral side of the visceral sac [fig. 12]. From the point of contact of the fifth section with the second flexure proceeds the sixth and last section of the intestine [fig. 9 and 11, VI], namely, the *rectum*, running obliquely forwards and to the right to the *anus*.

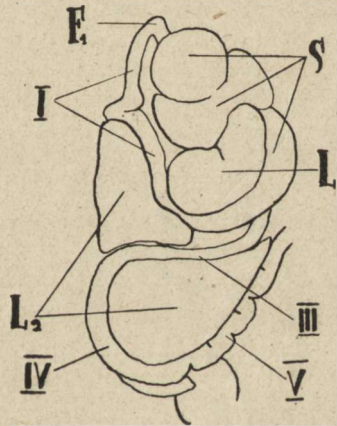


Fig. 12. Part of the alimentary canal, viewed from the left side;  $F_1$  is the 1-st intestinal flexure,  $L_1$  and  $L_2$  the anterior and posterior livers, I—V the intestinal sectors.

The ducts of both livers, of the small, right or anterior liver, [fig. 11 and 12,  $L_1$ ] and of the large left or posterior liver [fig. 11 and 12,  $L_2$ ] open just next to the opening of the *caecum pyloricum*, at the boundary of the intestine and the

stomach. Both hepatic ducts enter through a common opening, which is illustrated in a series of sections [fig. 13 and 14] on which the intestine and stomach as well as those parts of the hepatic ducts

non possessing glandular epithelium (they are lined with cylindrical epithelial cells, such as line the stomach and intestines) are shown in black, while the liver walls formed of glandular epithelium are shaded. The series of sections begins from be-

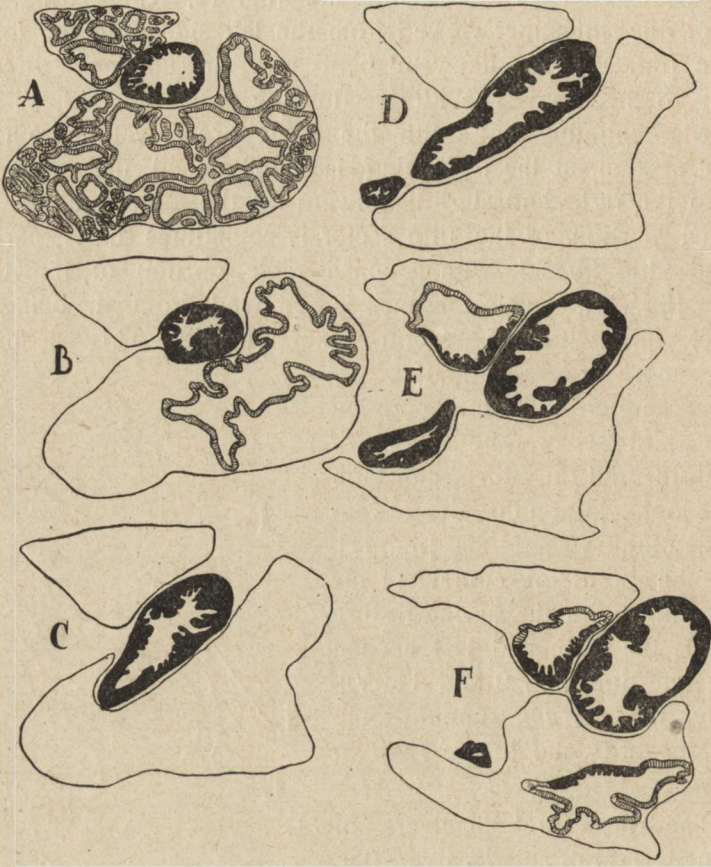


Fig. 13.

hind, i. e., from the intestine, and proceeds to the front, that is, in the direction of the hind part of the stomach. Fig. A represents a section through the intestine (black outlines) above which is a lobe of the right anterior liver, and below a much larger lobe of the left posterior liver. Within the outline of the liver we see numerous liver follicles (contours shaded) of various sizes. On the

next section, B, only one large follicle has been drawn, the rest being omitted in this and in the succeeding sections. On fig. C we see a considerable elongation of the section of the intesti-

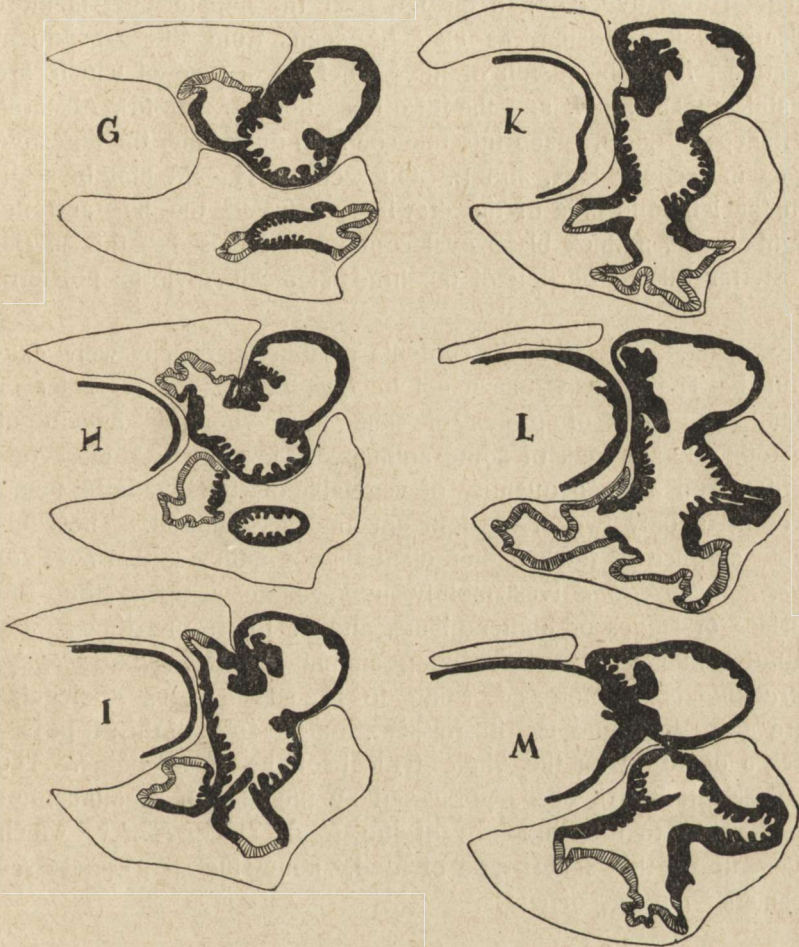


Fig 13 and 14. Schemes of cross sections trough the liver, intestinum, *caecum pyloricum* and posterior part of the stomach.

ne; this is the *caecum pyloricum*, whose further section we see again in fig. D, where the section also passes through the bent *apex caeci*, similarly as in figs. E and F. On fig. E we may notice that part of the wall of one of the follicles of the left

liver is lined with cylindrical non-glandular epithelial cells (shown black) — this is not a hepatic follicle, but part of a hepatic duct, and the same may be seen in the left liver in fig. F. In the next section, G, the hepatic duct of the right liver enters the general digestive tract; in the left liver the hepatic duct is more clearly visible, arising, as may be seen, from the subsequent sections, from the fusion of three chief ducts (two of which are visible in section I, and the third in sections L and M). All three left hepatic ducts, fused into one common duct, enter the digestive tract in sections I, K, and L. On sections H — M may be seen, on the left-hand side of the drawings, between the left and the right livers, a thick black oval contour, not closed — this is the posterior dilated portion of the hind stomach (pyloric portion).

**Food.** The stomach contents of four specimens were examined. They consist, as usual in *Lymnaeidae*, of a greater or smaller number of grains of sand<sup>1)</sup>, an enormous amount of diatoms, algae, eggs of some animals, a few nematodes, a few rotifers and a small quantity of vegetable detritus, the latter being present in only two of the four specimens examined. The complete absence of fresh higher plant tissues indicates that *Pseudosuccinea peregrina* lives mainly upon algae scraped from the surface of stones or higher plants, and at the same time upon minute animal organisms living among algae. *Pseudosuccinea peregrina* is therefore, according to Heidemanns nomenclature an „Algen-und Detritusfresser“, but in spite of this, it possesses a dentition on the whole typical of the *Lymnaeidae*. The greater number of cusps possessed by the marginal teeth cannot be ascribed to the influence of the food, since *Radix*, which lives upon the same type of food, none the less possesses a smaller number of cusps.

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<sup>1)</sup> I found in the specimens of *Radix ovata* forma A from the Murman Coast (Kola Peninsula) the stomach and intestine completely filled with sand, containing very little organic material. In view of the lack of algae, these animals, in order to obtain a sufficient amount of food, were forced to swallow fairly large quantities of sand, together with the particles of organic matter contained therein. They did not, however, attack higher plants, which grow fairly abundantly in this locality. This is further evidence that *Radix* does not belong to the „Blätterstörer“ group of Heidemanns.

**Genitalia.** The ovotestis, embedded in the upper coil of the left liver, is fairly short and comparatively broad. Its shape is variable: oval [Pl. I, fig. 3 A], more cylindrical [Pl. I, fig. 3 B] or more or less definitely branched [Pl. I, fig. 3 C]. The surface of this gland is not smooth, since rounded follicles appear

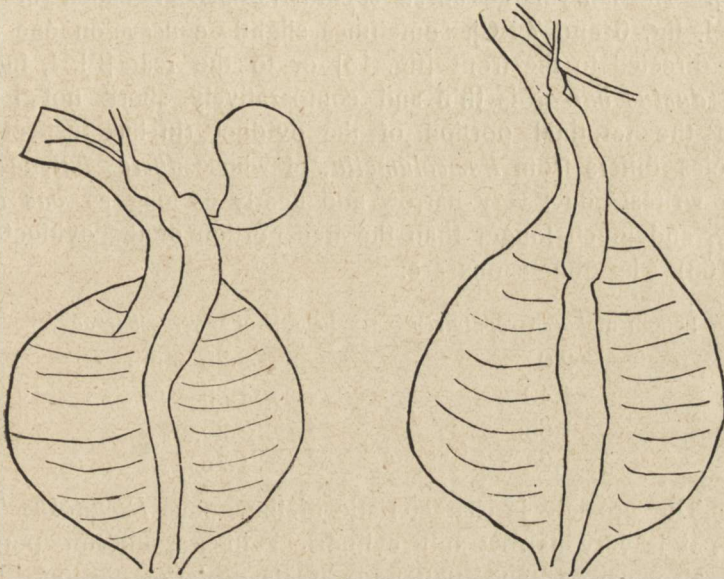


Fig. 15 and 16. *Corpus pyriforme*, bursa copulatrix and prostate from ventral side.

partly on the surface, giving it a rough appearance. The dimensions of the ovotestis are: 1) 2.25 by 1.15 mm., 2) 3.25 × 1.60 mm., 3) 2.80 × 1.45 mm., 4) 2.85 × 1.60 mm. I would draw special attention to this fairly short and broad ovotestis, since it proves that shortening and broadening of this organ is not confined exclusively to the genus *Myxas* = *Amphipeplea* (11). The albuminiparous gland has the usual „boat“-shape [Pl. I, fig. 7 A]; sometimes, probably through the strong contraction of the whole body in alcohol, this shape undergoes deformation [Pl. I, fig. 6 A]. The fairly large nidamental gland is oval in shape [Pl. I, fig. 6 NG]; in this case, too, for the above reasons, it may become somewhat irregular [Pl. I, fig. 7 NG]. The

pear-shaped *corpus pyriforme* [is short and broad [Pl. I, fig. 6 C P]; its ventral surface is somewhat flattened, and along its median line runs the narrow prostate [fig. 15 and 16]. Occasionally, evidently from strong contraction of the body, and from the consequent forward displacement of the entire *corpus pyriforme*, the latter assumes a more spherical shape [Pl. I, fig. 7 C P]. The fairly large *bursa copulatrix* is pear-shaped [or oval [Pl. I, fig. 6 and 7 BC], sometimes slightly concave on one side, and directed to the front [fig. 15] or to the rear [Pl. I, fig. 5]. The *ductus bursae* is thin and comparatively short, not longer than the terminal portion of the oviduct (in this respect this species differs from *Ps. columella*, of whose *ductus bursae* Baker writes: „duct very narrow and nearly as long as *vas deferens*, and much longer than the free portion of the oviduct“ (2, p. 168). Its dimensions are:

Length of <i>bursa copulatrix</i>	Length of <i>ductus bursae</i>
2.0	2.25 mm.
1.40	1.85 „
1.85	2.25 „
1.25	1.75 „

The prostate is characteristic of the genus *Pseudosuccinea*, i. e., it is very narrow and cylindrical in its [anterior portion, and also narrow and flattened in its posterior portion. Both portions may be more or less distinctly separated by a constriction [fig. 16] or may pass smoothly one into the other [fig. 15]. The head of the prostate, from which issues the *vas deferens* is either slightly dilated [fig. 15] and separated from its further cylindrical portion by a slight constriction, or else slightly elongated than the remainder of the prostate [fig. 16]. The shape of the flattened portion may also vary; usually it is wider than the cylindrical portion [fig. 16] but it may also be narrower [fig. 15].

The characteristic bulbous dilatation of the *vas deferens* at its origin, where it leaves the prostate, described by Baker for *Ps. columella*, exists also in *Ps. peregrina*. This dilatation is pear-shaped [fig. 16], sometimes elongated [fig. 15], and its walls are thin and translucent, distinctly differing in colour from the prostate and from the further portions of the *vas deferens*, which are darker.

The penis-sacs (= sheath of the penis) are unusually small, weak and thin, as is also the terminal portion of the *vas deferens*. In order to demonstrate how small are the penis-sacs of this species I give below the lengths of the 1-st and 2-nd penis-sacs of four specimens of *Ps. peregrina* and five of *Radix ovata* forma *B*, taking the latter measurements from a previous paper (10). In order that these measurements should be comparable, the specimens of *Radix* selected were of about the same size as the Brazilian animals. The following table gives only the length of the penis-sacs, but the thickness of the 1-st sac is also proportionately smaller in *Ps. peregrina*, while the 2-nd sac, although thicker relatively to its length, is likewise absolutely smaller:

*Pseudosuccinea peregrina*:

Length of shell	Length of 1-st penis-sac	Length of 2-nd penis-sac
18.5	2.10	1.20 mm.
16.75	1.85	1.0 "
17.90	2.0	1.0 "
16.0	1.75	0.85 "

*Radix ovata* forma *B*:

18.0	6.50	7.50 "
18.0	6.50	8.50 "
16.0	6.0	6.25 "
17.0	6.0	6.25 "
17.75	6.25	7.0 "

The above figures show clearly that a great difference exists between the dimensions of the male copulative apparatus of the above two species. Of those *Lymnaeidae* which I have studied *Pseudosuccinea peregrina* possesses the smallest copulative apparatus (of course, relatively to the size of its shell). Its small size is, indeed, so striking that in dissecting the first specimen I thought that the copulative organs were undeveloped, and only the examination of further individuals showed that all had similar dimensions. The measurements given by Baker (2, p. 169) show that *Ps. columella* has a similarly small penis-sacs, in spite of which he states in the text: „The characteristic features of the genitalia of *columella* are..... the larger size of

the penis", etc. (the author means by the term „penis“, the 2-nd penis-sac). This statement appears to me to be incomprehensible as I can find no support for it in the values given by this author. The 1-st penis-sac of *Ps. peregrina* is more or less cylindrical in shape [Pl. I, fig. 4]; the head is not demarcated by a constriction from the remaining part of the sac, and is often, on the contrary, narrower. The second penis-sac, narrow at its anterior end, which enters the second-sac, widens into a club-like form at its other end [Pl. I, fig. 4]. The ratio of the 1-st penis-sac to the 2-nd is, on the basis of the above measurements, 1.90 : 1.0; measurements made, however, on preserved material must always give slightly smaller values for the 1-st sac than this would have been obtained from fresh specimens, since the thick muscular walls of this sac contract more than those of the second sac. One may thus suppose that the ratio of the two sacs, had measurements been taken from fresh individuals, would not greatly differ from that obtained by Baker for *Ps. columella*, namely, that the 1-st sac would be twice, or slightly more than twice as long as the second.

The musculature of the penis sacs was studied only for one individual [Pl. I, fig. 4].

As to the histological structure of the penis sacs, as also of the prostate, this could not be studied, as specimens preserved in alcohol are unsuitable for histological examination.

**Internal structure of the prostate.** In a previous part of these „Contributions“ (12) I showed that European *Lymnaeidae* exhibit three types of prostate. The most complex type characterises the genus *Lymnaea*, *Galba* possessing a simpler type, whilst the simplest is found in *Radix* and *Myxas* (= *Amphipeplea*), who possess only one large internal fold. Even if one might consider the *Lymnaea* type to be a result of further evolution and complication of the *Galba* type, the *Radix-Myxas* type appears to be too distinct and separate to enable one to relate it to either of the above types. In writing the above paper, I suspected, without, however, stating it, that a primitive form must exist or have existed, constituting a link between the above forms. Such a form would possess a simpler prostate, possibly



entirely destitute of folds, and, to my great gratification, I found that *Ps. peregrina* appears to be such a primitive form.

Fig. 17 represents a series of cross-sections through the prostate of *Ps. peregrina*. The first three (A — C) do not properly belong to the prostate but to the bulbous dilatation of the *vas deferens*, where it leaves the prostate. Section D passes through the head of the prostate characterised by the thick walls and relatively narrow lumen of the gland. The further sections, E to H, are through the anterior cylindrical part of the gland; the rather irregular contour, and shape of the lumen, may be ascribed to the pressure exerted on the prostate by the contraction of the animal in alcohol. The walls of the gland are thick, and lumen is oval in section, the folds characterising European genera of *Lymnaeidae* being absent. The section J is of the narrowed portion of the prostate at its transition to the posterior

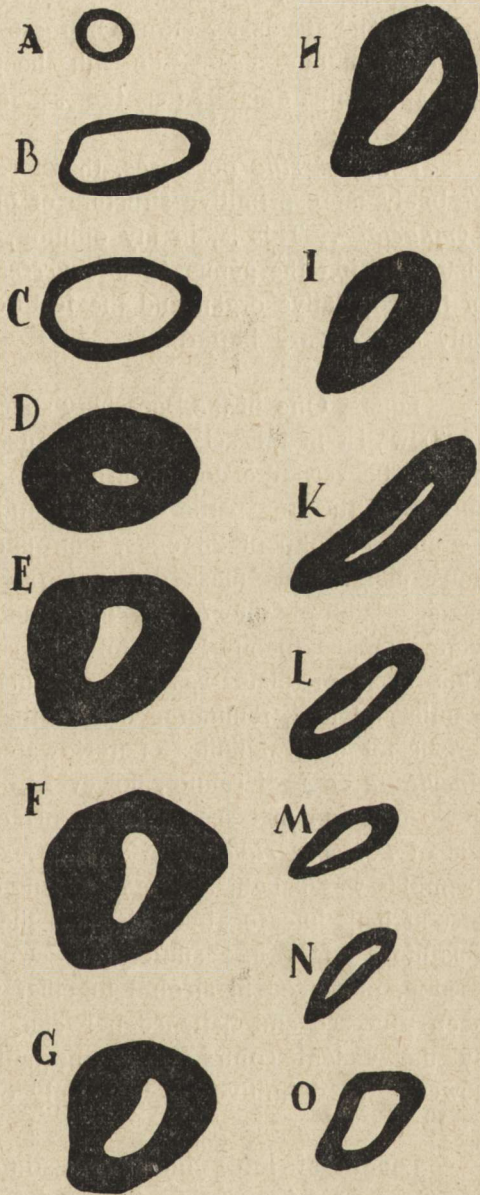


Fig. 17. A — C Cross sections trough the bulbous part of the *vas deferens*, D — O cross sections trough the prostate.

flattened part. The succeeding sections (K to N) are of this flattened portion, and the last section O, possessing again a more nearly circular contour, passes through the posterior portion, near the hermaphrodite duct. After the section O the prostate rapidly narrows.

*Ps. peregrina* possesses, therefore, a different, simpler and probably more primitive structure of prostate than the European *Lymnaeidae*. This is, in my opinion, the most important feature characterising the genus *Pseudosuccinea*, the weak development of the copulative organ and the features of its shell possessing only a secondary importance.

**Eggs.** One of the Bacachery specimens was caught (15 VIII 1923) whilst in the act of laying eggs. Near the female genital orifice, between the dorsal surface of the foot and the ventral surface of the free partle of the mantle, overhanging the foot, I found a group of 28 eggs, surrounded by a common gelatinous mass. This mass did not possess the elongated shape characteristic of the *Lymnaeidae*, and the eggs contained in it were arranged in one layer forming a thin and irregular plate. This mass or plate was bent irregularly by the pressure of the mantle and foot, reminding one of the gelatinous plates characteristic for many families of fresh-water Gastropoda (*Planorbidae*, *Ancylidae* etc.). I cannot, however, draw from the above fact the conclusion that such a shape of cocoon is really characteristic of *Ps. peregrina*, since another explanation is possible. This exemplar was caught at the moment of oviposition, before the cocoon had time to attach itself to the substrate, and before the gelatinous mass had sufficiently swollen and hardened. The cocoon, immersed in alcohol together with the animal, may have been squeezed and flattened between the mantle and the foot by the violent contraction of the animal. This question can, however, be definitively settled only on the spot.

**Length of Life.** Infallible estimates of the longevity of any species of Lymnaeids may be based only on breeding experiments. In the given case, therefore, where we have to deal with alcohol preserved specimens, analysis of this material allows one only to make hypotheses, but not to draw positive conclusions.

My conclusions as to the longevity of *Ps. peregrina* are based upon the following reasoning.

The shells of those exemplars collected on the 13 VIII 23 between Curityba and Affonso Penna measured:

8 specimens 12.0—16.0 mm. in length  
1 specimen 10.0 " " "

The shells of the Bacachery individuals, caught on the following dates, measured:

15 VIII 1923	13 specimens	11.75 — 18.5 mm. length.		
	3	8.01 — 10.0	"	"
	7	6.01 — 8.0	"	"
	18	4.01 — 6.0	"	"
	4	2.0 — 4.0	"	"
7 X 1923	4	10.1 — 14.75	"	"
	26	8.01 — 10.0	"	"
	59	6.01 — 8.0	"	"
	89	4.01 — 6.0	"	"
	5	2.0 — 4.0	"	"
21 X 1923	1	10.70 —	"	"
	8	8.01 — 10.0	"	"
	45	6.01 — 8.0	"	"
	63	4.01 — 6.0	"	"
	6	2.0 — 4.0	"	"

and 5 empty shells.

Dec. 1923	1	8.5	"	"
	1	8.0	"	"
	1	6.60	"	"
	1	5.23	"	"

and 6 empty shells.

13 I 1924	1	8.70	"	"
	2	7.0	"	"
	1	6.60	"	"
	1	6.0	"	"

If we were to plot a curve of the size of the shells of the specimens caught at the beginning of spring, in August 1923 (collections of Mr. Sz. Tenenbaum and Dr. T. Jaczewski

together) we would obtain a curve with two summits, one which would correspond to the largest individuals, above 11.75 mm. in length (21 exemplars) and the second to those between 4.01 to 6.0 mm. (18-exemplars). The occurrence of these two summits is undoubtedly due to the presence of individuals belonging to two different generations. The material obtained at the beginning of summer (7-th and 21-st October, 1923) gives a strikingly different curve, possessing only one summit, also for lengths of from 4.01 to 6.0 mm. (152 specimens). Here, further, one may notice the small number of adult individuals, over 10 mm., namely only 5, of which 4 were caught on the 7-th, and the remaining one on the 21-st October. Thus we see that the number of adult individuals has enormously decreased from early spring to the beginning of summer, which might give rise to the supposition that adult individuals die after laying their eggs in the spring. We have, unfortunately, insufficient material from the height of summer, i. e.; from December and January, but no individual caught at this period exceeds 8.70 mm. in shell-length. The absence of small animals shows that the period of proliferation has already passed, and the small number of animals caught shows, in view of the fact that Dr. Jaczewski took all those he could find, that the struggle for existence had already eliminated the vast majority of younger individuals; this being further supported by the number of empty shells found on the 21 October and in December.

The analysis of the material at my disposal would therefore indicate that *Ps. peregrina* lives probably only one year, and that adult individuals die in spring and at the beginning of summer. Sexual maturity is attained probably within the first few months of life, as I have found individuals whose shells measured only 8.50 mm., and whose *bursa copulatrix* was full of sperm, showing that copulation had already occurred. It is impossible to state, on the basis of the available material, when these animals begin to lay eggs, but the presence of small exemplars in the early spring collections would, however, point to this taking place in winter or autumn.

On the whole, the *Lymnaeidae* live longer, about two or more years, but species of this family are known which live only one year, as, for example, *Myxas glutinosa*. This species,

as my breeding experiments showed, attains sexual maturity and begins to multiply three months after leaving the egg.

I would desire, however, once again to emphasise that I do not consider the above conclusions, as to the life of *Ps. peregrina* being one year, as being certain, but only probable.

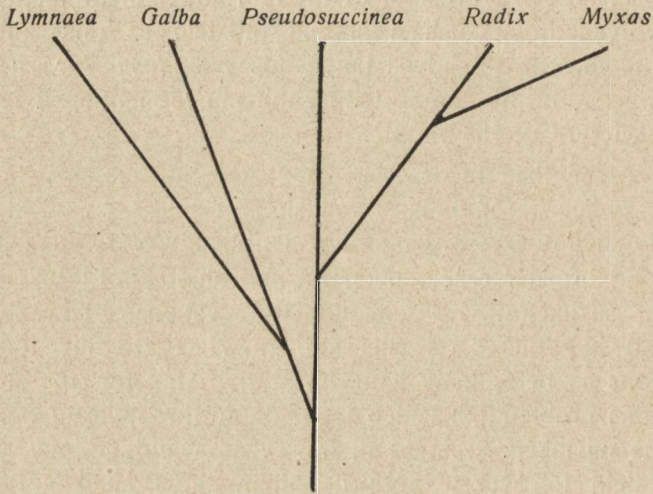
**The relation of the genus *Pseudosuccinea* to other genera of *Lymnaeidae*.** In the above description of the structure of the prostate of *Ps. peregrina*, I showed that it is less complex than that of other genera of *Lymnaeidae* with which I am acquainted (*Galba*, *Radix*, *Myxas* and *Lymnaea*). In my opinion, the more complex types of prostate of the four above mentioned genera have evolved from such a simple prostate as this, and this peculiarity of structure gives the genus *Pseudosuccinea* a primitive character, further supported by the above-mentioned features of the structure of the radula.

It is true that, in assessing the genetic relations between various groups of animals, conclusions cannot be based upon the study of any one organ only. Until, however, more fundamental and broader research on the morphology of these animals has been carried out, I would like to advance certain suppositions and hypotheses on this subject. I regard the following conclusions as being only a first tentative step towards the solution of this problem; this step may, on further investigation, turn out to be mistaken. Should it, however, encourage any worker in this field to seek a more certain path, I shall not regret having made it.

*Galba* possesses straight, unbranched folds on the internal surface of the dilated portion of its prostate; in this part only can they be found. The *Lymnaea* type is obtained by the greater development of these folds, by their branching into smaller secondary folds and by their apparition in the posterior portion of the prostate. This type may thus be regarded as a product of the further development and complication of the *Galba* type, which itself probably developed from the *Pseudosuccinea* form by the formation of folds on the originally smooth inner wall of the prostate, in order to increase its surface. The *Radix-Myxas* form probably developed independently of *Galba* directly from

this primitive *Pseudosuccinea* type, by the formation of one fold only on the dorsal side of the prostate.

Viewed in this light, the genus *Pseudosuccinea*, being the most primitive, would be the nearest form to the prototype from which all *Lymnaeidae* developed, being a direct continuation of the ancestral trunk. *Galba* probably developed very early as a branch from this trunk, and from *Galba*, likewise fairly early, branched *Lymnaea*. Later, *Radix* branched from the main stem, and, probably quite recently, from *Radix* branched *Myxas*. These relationships are shown diagrammatically as follows:



From the conchological standpoint the above view appears to be quite sound. The close resemblance between the shells of *Radix* and *Pseudosuccinea* is shown by the fact that up till 1908 the majority of conchologists did not differentiate two genera. Similarly Annandale and Rao (1) in 1925 included in the *Pseudosuccinea* „group“ the European *Radix peregra*, as well as a whole series of Indian species, also in all probability belonging to *Radix*. I have discussed the close relationship between the genera *Myxas* (= *Amphipeplea*) and *Radix* in one of my previous papers (11). The relationship between the shells of

*Galba* and *Pseudosuccinea* is undoubtedly smaller, and for this reason only Dall (5) included the latter in the former genus.

The weakest point in the above argument is the direct connection of the genera *Lymnaea* and *Galba*; here, above all, further investigation may lead to modification of this scheme.

The fact that no fossil forms of *Pseudosuccinea* are known (apart from the Pleistocene) cannot constitute an objection to the above scheme, as, in the first place, the thin, fragile and brittle shell of this genus has not the same chances of preservation in deposits as the thick, strong shells of *Galba*, for example, which is the most often met with. Secondly, certain fossil forms, included into one or another genus, strongly remind one of the conchological form of *Radix*, thus approaching the *Pseudosuccinea* form (as, for example, the American *Galba consortis*, from the lower Cretaceous), and, if we could by some miracle examine such a form anatomically, it is quite conceivable that it would be similar to *Pseudosuccinea*. In the third place, we have no reason to believe that the hypothetical prototype or ancestral form of *Lymnaeidae* had necessarily the same shaped shell as *Pseudosuccinea* — this shape would become fixed only after *Galba* had branched off, and as this would take place only very gradually, it is possible that the main stem leading to the modern *Pseudosuccinea* retained for a long time a conchological form of a mixed type.

In the above scheme, I have considered only those genera studied by myself, since our knowledge of the others is insufficient. A very little is known of European and North American *Lymnaeidae*, but, as there are no comparative studies upon the majority of organs, this knowledge is quite inadequate. As to Indian *Lymnaeidae* we know even less, while as to South American (with the exception of *Ps. peregrina*), African, Australasian and Asiatic (with the exception of Indian) forms practically nothing is known. With the advance of our knowledge of this subject, therefore, the above scheme will probably undergo considerable modification.

I would wish to express my sincere gratitude to the Curators of the Polish Museum of Natural History for placing

this valuable material at my disposal and to Prof. Dr. K. Łopatyński for the photographs of shells shown on the plate <sup>1)</sup>.

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<sup>1)</sup> In the previous (seventh) part of these „Contributions“ (12) for reasons beyond the control of the author a number of misprints have entered, the more important of which we now take opportunity of correcting:

- Page 1, in the 1-st line of the footnote substitute for „1916“ — 1918“.
- |   |             |                |               |
|---|-------------|----------------|---------------|
| „ 2 „ „ 11-th „                                 | from bottom | „ „ „shall“    | „would“       |
| „ 5 „ „ 5-th „                                  | „ top       | „ „C“          | „D“           |
| „ 5 „ „ 9-th „                                  | „ „         | „ „F“          | „I“           |
| „ 5 „ „ 9-th „                                  | „ bottom    | „ „portion“    | „portion“     |
| „ 7 „ „ 18-th „                                 | „ top       | „ „is dealing“ | „deals“       |
| „ 7 „ „ 4-th „                                  | „ bottom    | „ „scarsely“   | „sparsely“    |
| „ 8, last line of explanation of fig. 4         |             | „ „cell“       | „gland“       |
| „ 9, in the 12-th line from top insert after    | „divide“    | „the internal  |               |
| surface of the prostate“.                       |             |                |               |
| „ 11, in the 14-th line from top substitute for |             | „drown“        | „drawn“       |
| „ 12 „ „ 1-st „                                 | „ „         | „ „staded“     | „shaded“      |
| „ 12 „ „ 8-th „                                 | „ bottom „  | „ „untranchéd“ | „unbranched“. |



11. — Z badań nad Otułką (*Amphipeplea* Nilss.) Rozpr. Uniw. Warsz, № 1, 1925. (Études sur l'*Amphipeplea*. Disput. Univers. Varsoviensis № 1. 1925).
12. — Contributions to the study of the Family Lymnaeidae. VII. The structure of the prostata of the Lymnaeidae. Ann. Zool. Mus. Polon. Hist. Nat., V, 1926.

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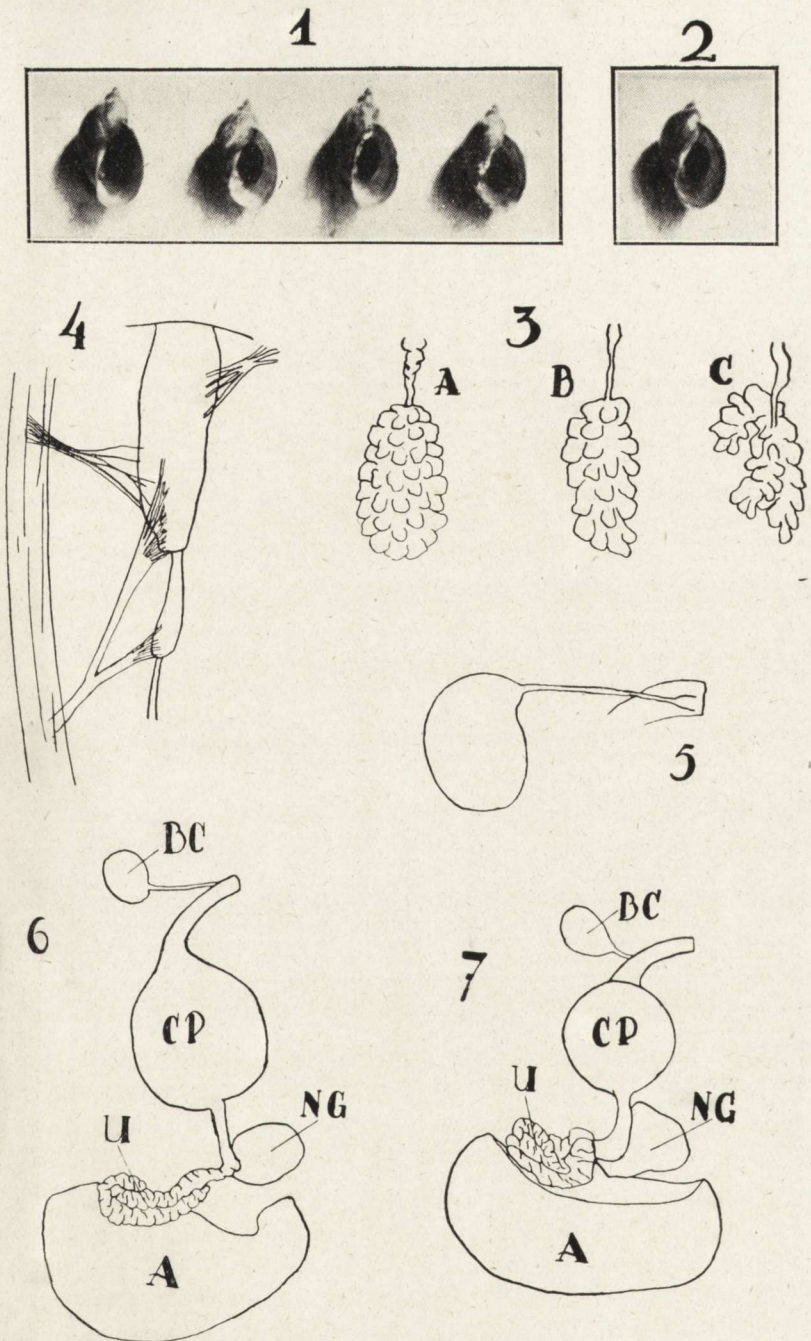
#### EXPLANATION OF PLATE.

- Fig. 1. Shells from Bacachery (15 VIII 1923).  
 Fig. 2. Shell from marsh between Curityba and Affonso Penna.  
 Fig. 3. Hermaphrodite gland (*Ovotestis*).  
 Fig. 4. 1-st and 2-nd penis-sac with musculature.  
 Fig. 5. *Bursa copulatrix* and its duct.  
 Fig. 6 and 7. Female genitalia, from the dorsal side. A is the albuminiparous gland, B C — the *bursa copulatrix*, CP — the *corpus pyriforme*, N G — the nidamental gland and U the *uterus*.

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#### STRESZCZENIE.

Autor po zbadaniu kolekcji błotniarek *Pseudosuccinea peregrina* (Parana, Brazylja) omawia w pracy powyższej muszlę, szczękę, tarkę, przewód pokarmowy, narządy rozrodcze, pokarm i długość życia powyższego gatunku. Na podstawie pewnych cech prymitywnych, znalezionych w budowie tarki i gruczołu przyprątnego, autor uważa *Ps. peregrina* za gatunek pierwotniejszy niż inne błotniarki, oraz stara się prowizorycznie naszkicować hipotetyczne stosunki pokrewieństwa pomiędzy niektórymi rodzajami rodziny błotniarek.



*Dr. W. Roszkowski.*