

ON THE LINGUAL DENTITION, JAW, AND GENITALIA OF CARELIA,
ONCHIDELLA, AND OTHER PULMONATA.

BY W. G. BINNEY.

Macrocyclus sportella, Gld.

Oregon. Mr. O. B. Johnson.

Jaw and lingual membrane as usual in the genus. (See Proc. Acad. Nat. Sci. Phila., 1875.)

Teeth 22—1—22. The 6th tooth is the largest. The peculiar side spur noticed on the inner laterals of *Macr. Vancouverensis* is present in this species also. The central tooth is of same type as that of the last-named species, to which *sportella* is most nearly allied by its shell. Pl. VI., fig. AA.

Zonites inornatus, Say.

Pl. VI., fig. c, represents the dentition of this species, showing both planes of the cusps and cutting points. The dotted lines show the lower plane, *i. e.*, the part which rests on the base of attachment. This is what I have hitherto shown in my plates. From this lower plane the cusp and cutting point bulge out laterally as they round upwards. The most outward margin is the other plane shown, giving the widest extension of the cutting point.

Zonites fuliginosus, Griff.

On pl. VI., fig. d, is a lateral tooth of this species showing the two planes described under *Z. inornatus*.

Zonites(?) Bermudensis, Pfr.

Bermuda. Mr. J. Matthew Jones to Mr. Bland.

The specimens were living, enabling me to study advantageously the external characters of the animal. There is a distinct locomotive disk to the foot, but no caudal mucus pore, and no longitudinal furrows above the margin of the foot, so that the species cannot be placed in *Zonites*, which has the last two characters. The external orifice of generation is quite under the mantle, not behind the right eye-peduncle.

The jaw and dentition I have already described. (Ann. Lyc. Nat. Hist. of N. Y., X., 221.)

The genitalia present the following peculiarities. The genital bladder is small, globular, on a long duct. The penis sac is long,

tapering to its apex, where it receives the vas deferens and the retractor muscle. There is a long, stout, dart sac, containing a delicate, arrow-like dart of the same form as figured by Leidy for *Zonites ligerus* (Terr. Moll., U. S. I.).

The absence of the caudal mucuspore removes the species from *Zonites*, nor can it be placed in any recognized genus.

Limax Hewstoni, J. G. Coop.

California. Dr. Cooper.

Pl. VI., fig. F, represents the genitalia of this species, which I have recently drawn from specimens kindly furnished by Dr. Cooper. For description, see Ann. Lyc. Nat. Hist. of N. Y., XI., p. 22.

Limax campestris, Binney, var. *occidentalis*.

California. Dr. J. G. Cooper. (See Proc. Acad. Nat. Sci. of Phila., 1872, 146, pl. III., fig. c.)

In outward appearance, in genitalia and in jaw, this form cannot be distinguished from the eastern form. Its lingual membrane has 35—1—35 teeth, 13 being laterals. On some of both the inner and outer marginals I can detect the side spur which in the eastern form I have only observed in the outer marginals. In this particular, *occidentalis* is more nearly allied to *L. montanus*, Ingersoll,¹ but when the value of differences in such slight details becomes known, I believe all three species will be found identical.

Pl. VI., fig. x, b, gives two inner marginals.

Onchidella borealis, Dall.

Alaska. Dr. W. H. Dall.

In three specimens examined I found a jaw (pl. VI., fig. BB), low, wide, slightly arcuate, ends scarcely attenuated, blunt, anterior surface ribless.

Lingual membrane (pl. VI., fig. EE) long and wide. Teeth about 61—1—61, arranged strongly en chevron. The central tooth is large, longer than wide, truncated above, expanded below its middle, and incurved at the basal margin. The reflection is large, tricuspid, each cusp bearing a decided cutting point. The side teeth have a long, narrow base of attachment, a small portion of its upper portion thrown outwards, the balance curving inwards, giving an irregular bow-shape to the whole base of attachment—

¹ This is the species indicated by me as *L. Ingersolli*, in Proc. Acad. Nat. Sci. Phila., 1875, 176.

whose upper and lower edges are abruptly truncated. The reflection is near the base, and consists of a very small, inner cusp, bearing a small conical cutting point, and another, outer, larger cusp, bearing an extraordinarily developed, wide, expanding, bluntly truncated cutting point. As the teeth pass outwards towards the outer margin of the membrane, they at first increase and then decrease in size, but retain the same shape quite to the edge.

An outer lateral tooth is figured in *c*, an inner lateral in *b*.

Fig. E, of plate VI., gives a view of the lower surface of the animal and also one of the head, showing the short, stout eye peduncles and curious oral appendages.

The *Onchidiidæ* are described as agnathous, but I am confident of having observed the jaw figured.

Ariolimax Columbianus, Gld.

From Mr. O. B. Johnson, of Forest Grove, Oregon, I have received specimens of this species. On examining the genitalia, I find them to agree perfectly with what I have already figured in Proc. Acad. Nat. Sci. of Phila., 1874, pl. XI., fig. c. I am convinced, therefore, of the identity of the specimens there figured, of which some doubt then existed.

Binneya notabilis, W. G. B.

Sta. Barbara Island, California, Mr. Henry Hemphill.

Pl. VI., fig. v, represents almost the whole of the genital system. The penis sac is long, narrow, tapering at its apex, where it receives the vas deferens: the retractor muscle is inserted below the entrance of the latter. The genital bladder is oval, on a long, narrow duct. There is a small, saclike, accessory organ, probably a dart sac.

Carelia bicolor, Jay.

Dr. W. H. Dall.

Through the kindness of Dr. Dall, I have been able to examine this species, formerly known as *Achatina bicolor*. Thus I have increased the list of subgenera or groups of *Achatinella* of Gulick's arrangement, whose jaw and lingual dentition is known, leaving still to be examined *Newcombia* only of the same arrangement.

It will be seen from my description, that while *Carelia* (or at least this species) differs utterly in jaw and dentition from Gulick's *Achatinella s. s.*, *Bulimella*, *Apex*, *Partulina*, *Auriculella*, it agrees

in dentition with his *Laminella*, *Amastra*, *Leptachatina*, but differs in having a costate jaw. *Carelia*, therefore, must stand distinct from any of the other groups of *Achatinella*.

My description and figures should be studied in connection with my former papers on *Achatinella* in *Annals of Lyceum of Natural History of New York*, Vol. X., p. 331, pl. xv., and Vol. XI., p. 190, pl. xiv., in the preparation of which I was assisted by Mr. Bland.

The animal is obtuse before, pointed behind. The mantle appears subcentral in the single individual examined, which is preserved in alcohol. The orifice of respiration and anal orifice are as usual in the heliciform genera. The genital orifice as far as I can judge is somewhat removed from behind the right eye peduncle, rather under the mantle edge, but it is difficult to say what is its position in the living animal. There is no sign of a distinct locomotive disk or of a caudal mucus pore.

The jaw (pl. VI., fig. g) is low, slightly arcuate, with but little attenuated, blunt ends: anterior surface with ten stout ribs, denticulating either margin.

Lingual membrane (pl. VI., fig. cc) long and narrow. Teeth 37—1—37 of same type as I have formerly described (l. c.) for species of *Laminella*, *Amastra*, and *Leptachatina*, the marginals being irregularly and obliquely pectinate as in *Achlla. obesa* (l. c.).

The digestive system, as would be anticipated from the shape of the shell, is characterized by the extreme length of the œsophagus. The salivary ducts are comparatively short. The salivary glands are small and in a globular mass around the œsophagus. The buccal mass with its pouch of the lingual membrane is as usual: its retractor muscle is attached to the retractor of the head.

The genitalia are here figured (pl. VI., fig. o). It will be seen that there is in the specimen examined a decided external swelling of both male and female (the former, female (*f. o.*), large and horn-shaped, the latter, male (*m. o.*), small and globular) organs; owing, perhaps, to the sudden immersion of the individuals in alcohol. The gravid state of the uterus precludes the possibility of these swellings being preparatory to accouplement. This condition of the external orifices accounts for the wide separation of the genital bladder from the vagina, and of the accessory organ (*pr.*) from the penis sac. The figure is of life size, all the organs having been accurately measured. The testicle (*t.*) is composed of short cœca grouped in a globular mass. The epididymis (*ep.*) is short and

greatly convoluted. The ovary (*o.*) is obtusely tongue-shaped and lobate. The oviduct is sacciform and contained two well-developed embryonic shells, showing the species to be viviparous, as well as four masses, probably consisting of less mature embryos. The genital bladder is small, suboval, on a short duct. The penis sac (*p. s.*) is long, cylindrical, with a developed, extended median constriction. The vas deferens (*v. d.*) enters the apex of the penis sac: the retractor muscle (*r. p.*) of the penis is inserted just above the entrance. There is a long, narrow, accessory organ (*pr.*) with an extended median constriction to the penis sac, perhaps a dart sac or prostate gland. There is a stout retractor muscle (*r.*) to the external horn-shaped swelling of the male orifice.

***Microphysa incrustata*, Poey.**

Corpus Christi, Texas. A dried specimen collected over thirty years ago by Mr. Bartlett.

Jaw low, wide, slightly arcuate, ends blunt, but little attenuated: anterior surface with numerous, crowded ribs, bluntly denticulating the lower margin.

Lingual membrane (pl. VI., fig. *r*) with 13—1—13 teeth, 5 perfect laterals. The teeth are of same type as in other species of *Microphysa*, as *Ingersolli* (Ann. Lyc. of N. H. of N. Y., XI., pl. xviii., fig. *c*). The jaw also resembles that of *Microphysa* rather than *Patula*, to which I formerly referred the species. Von Martens places it in *Microphysa*. Fig. *b* shows marginal teeth.

***Triodopsis inflecta*, Say.**

Indiana. Mr. F. Stein.

Genitalia as in *T. Rugeli*. See Ann. Lyc. Nat. Hist. of N. Y., XI., pl. xvi., fig. 18.

***Turricula tuberculosa*, Conr.**

Palestine. A dried specimen in Mr. Bland's collection.

Lingual membrane (pl. VI., fig. *r*) long and narrow. Teeth 28—1—28. Centrals and laterals without decided side cusps or cutting points, but the central cutting point has a decided lateral bulge. Marginals low, wide, with one inner, oblique, large bifid cutting point, and two outer smaller cutting points. A marginal is shown in *f*.

Jaw with numerous, crowded, broad, flat ribs, denticulating either margin.

Helix monodon, Rackett.

Indiana. Mr. F. Stein.

Genitalia (pl. VI., fig. q) characterized especially by a very unproportionally large penis sac, which is long, club-shaped, greatly enlarged above, where it receives the vas deferens and retractor muscle. The genital bladder is elongate-oval, small, on a short, delicate duct. The epididymis is convoluted throughout its length.

Polygyra Postelliana, Bland.

Charleston, S. C. Mr. W. G. Mazyck.

Genitalia as in *P. auriculata*. (See Leidy in Binney's Terr. Moll. U. S. I.)

Jaw as usual in the genus: over 12 ribs. Lingual membrane (pl. VI., fig. z) as in *P. Hazardi*. (See Proc. Acad. Nat. Sci. Phila., 1875, pl. viii., fig. 5.) The change from laterals to marginals is very gradual, and formed without the splitting of the inner cutting point. There are 21—1—21 teeth with about 7 laterals. Extreme marginals are shown in *b*.

Polygyra Dorfeuilleana, Lea.

A dried specimen long preserved in my cabinet furnished the lingual membrane here described.

Teeth (pl. VI., fig. v) 20—1—20, with 9 laterals, the tenth tooth having its inner cutting point bifid. Base of attachment subequilateral of central and lateral teeth. All the teeth of same type as in *P. auriculata*. (See Ann. Lyc. of Nat. of N. Y., XI., pl. xviii., fig. E.)

Polygyra avara, Say.

Banks of St. John's River, Florida. Mr. Chas. Dury.

It is with peculiar satisfaction that I give these details, as it is one of our rarest species.

Jaw as usual in the genus, with over 12 ribs. (See Proc. Acad. Nat. Sci. Phila., 1875, p. 201.)

Lingual membrane as usual in the genus (see same, p. 202). The change from laterals into marginals is shown in the 9th tooth, which is the first having a bifid inner cutting point. There are 17—1—17 teeth. Pl. VI., fig. y.

Caracolus sagemon, Beck.

Gonave Island. Prof. Linden to Mr. Bland.

On pl. B, fig. gg, I figure the dentition of the specimens described in full by Mr. Bland in Ann. Lyc. Nat. Hist. of N. Y., XI., 197 (1875).

Mesodon major, Binn.

This species (or form of *albolabris*) was found by me near Aiken, S. C., but still larger specimens, at Macon, Ga., in the City Cemetery, by Mr. H. S. Crooke. The form seems to inhabit a narrow strip of territory east of the mountains from Abbeville, S. C., to the Gulf of Mexico. The largest specimen I have ever seen is 48 mill. in its greater diameter.

The jaw, lingual dentition, and genitalia agree with those of *albolabris*. Fig. I, of plate VI., represents the genital system of one individual examined, in which the ovary is very small, and the genital bladder unequally divided, both points differing from those of other individuals examined. This shows us we should allow some latitude of variation in the details of the genital system of any given species.

Aglaja fidelis, Gray.

Oregon. Mr. O. B. Johnson.

On pl. VI., fig. p, I give a more satisfactory figure of the genitalia of this species than formerly published by me. The organ *x* in the specimens recently examined was greatly developed. The organ is a dart sac, which contained a dart of the type described below under *Arionta Mormonum*.

Arionta Mormonum, Pfr.

Tulumne Co., California. Mr. A. W. Crawford.

Pl. VI., fig. s, represents the genitalia. The general appearance is that of *A. fidelis*, as formerly described by me (see below), but there is an additional accessory organ (*q.*), of use unknown to me. The organ, *r*, is a dart sac. The dart is short, stout, straight, swollen at its base, and with an enlarged acutely pointed apex (pl. VI., fig. k). Upon the vagina, above the insertion of the penis sac, is a ridge-like process (*s.*) containing in three individuals examined one round, and one oblong calcareous nodule (pl. VI., fig. j). I suspect the organ 14, noticed in *fidelis* (Proc. Acad. Nat. Sci. Phila., 1873, pl. I., fig. 5) corresponds with this process.

Jaw as usual in *Arionta*: 7 ribs.

Lingual membrane (pl. VI., fig. b) as usual in *Arionta*. Teeth 50—1—50, with 15 laterals, the 16th tooth having its inner cutting point bifid.

Arionta sequoicola, J. G. Coop.

Santa Cruz, California. Mr. H. Hemphill.

The genital system (pl. VI., fig. r) is like that of *Arionta Traski*.

(See Ann. Lyc. of Nat. Hist. of N. Y., XI., pl. VI., fig. IV.) The accessory bulb upon the vaginal prostate is somewhat differently situated in this species. The extreme length of the genital system is eighty-seven millimetres.

Jaw and lingual membrane already described. (See Proc. Acad. Nat. Sci. Phila., 1874, pl. XIV., fig. 5.)

Arionta Californiensis, Lea.

Monterey. Mr. H. Hemphill.

Jaw already described.

Lingual membrane with 53—1—53. Teeth as usual in the genus (see above). The side cusp and cutting point appears on the 9th tooth. The inner cutting point of the 25th is bifid, so that there are about 24 laterals (pl. VI., fig. w).

The genitalia are as in *A. Nickliniana* already described.

Arionta Dupetithouarsi, Desh.

Monterey. Mr. H. Hemphill.

Jaw as usual in the genus, with four, separated, stout ribs.

Lingual membrane with 50—1—50 teeth. There are no distinct side cusps or cutting points on the centrals or first laterals, though there is a lateral bulge on the large cutting point. The distinct side cusp and cutting point appears on the ninth tooth. There are about nineteen laterals, the twentieth tooth having its inner cutting point bifid. The marginals are as usual in the genus (pl. VI., fig. u).

Genitalia as in *A. Traski* (l. c.). The penis sac is more slender and has no retractor muscle in the single individual examined by me. The oviduct is greatly convoluted.

Glyptostoma Newberryanum, W. G. B.

San Diego, Cal. Henry Hemphill.

Genitalia (pl. VI., fig. h). *x* is a dart sac or prostate gland.

Bulimulus Dormani, W. G. B.

Port Orange, Florida. Mr. Chas. Dury.

Jaw (pl. VI., fig. m, the central portion only) as usual in the genus, arcuate, thin, transparent, ends acuminate, anterior surface with about 54 plait-like ribs. The figure gives only a portion of the jaw. The upper median ribs are very oblique.

Lingual membrane as in *B. laticinctus*, *primularis*, *papyraceus*, etc. Teeth 79—1—79. Pl. VI., fig. hh. This is the first species of

Bulimulus noticed within the United States having this peculiar type of dentition.

Genitalia figured on pl. VI., fig. n. Penis sac very long and narrow, ending in a flagellum: vas deferens entering at about the anterior fourth of its length. Genital bladder oval, on a long, narrow duct. No accessory organs.

Bulimulus Edwardsi, Mor.

Lake Titicaca. Prof. Alex. Agassiz.

Jaw low, arcuate, ends rapidly acuminate, blunt: anterior surface with over ten distant ribs, some of the usual *Helix* type, others like the plait-like processes, common in *Cylindrella*, *Bulimulus*, *Gæotis*, *Amphibulima*, etc.

Lingual membrane (pl. VI., fig. dd) with 44—1—44 teeth. Centrals of the usual *Helicinæ* type, tricuspid: laterals like centrals, unsymmetrical, and consequently bicuspid. The change to marginals very gradual, and formed by the simple modification of the laterals, without any splitting of the inner cutting point.

Succinea ovalis, Gould, not Say.

Burlington, New Jersey.

Teeth over 60—1—60. Fig. b represents extreme marginals (pl. VI., fig. A).

Jaw with smooth anterior surface and prominent median projection to the cutting edge.

EXPLANATION OF PLATE VI.

- Fig. A. Lingual dentition of *Succinea ovalis*.
 Fig. B. " " *Arionta Mormonum*.
 Fig. C. " " *Zonites inornatus*.
 Fig. D. " " " *fuliginosus*.
 Fig. E. *Onchidella borealis*.
 Fig. F. Genitalia of *Limax Hewstoni*.
 Fig. G. Jaw of *Carelia bicolor*.
 Fig. H. Genitalia of *Glyptostoma Newberryanum*.
 Fig. I. " *Mesodon major*.
 Fig. J. Lingual dentition of *Turricula tuberculosa*.
 Fig. K. Dart of B.
 Fig. L. Calcareous concretions of B.
 Fig. M. Jaw of *Bulimulus Dormani*, central portion.

Fig. N. Genitalia of M.

Fig. O. " Carelia bicolor.

t. Testicle.

ep. Epididymis.

o. Ovary.

ovid. Oviduct.

g. b. Genital bladder.

p. s. Penis sac.

r. p. Retractor penis.

r. Retractor.

pr. Prostate gland?.

v. d. Vas deferens.

m. o. Male orifice.

f. o. Female orifice.

e. t. External tegument.

Fig. P. Genitalia of Aglaja fidelis.

Fig. Q. " Stenotrema monodon.

Fig. R. " Arionta sequoicola.

Fig. S. " B.

Fig. T. Lingual dentition of Microphysa incrustata.

b. Marginals.

Fig. U. Lingual dentition of Arionta Dupetithouarsi.

Fig. V. Genitalia of Binneya notabilis.

Fig. W. " Arionta Californiensis.

Fig. X. " Limax occidentalis.

b. Inner marginals.

Fig. Y. Lingual dentition of Polygyra avara.

Fig. Z. " " " Postelliana.

Fig. AA. " " Macrocyclus sportella.

Fig. BB. Jaw of E.

Fig. CC. Lingual dentition of G.

Fig. DD. " " Bulimulus Edwardsi.

Fig. EE. " " E.

b. Inner marginals.

c. Outer marginals.

Fig. FF. Lingual dentition of Polygyra Derfeuilleana.

Fig. GG. " " Caraculus sagemon.

Fig. HH. " " M.



Binney, W. G. 1876. "On the Lingual Dentition, Jaw, and Genitalia of Carelia, Onchidella, and Other Pulmonata." *Proceedings of the Academy of Natural Sciences of Philadelphia* 28, 183–192.

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