

# NOTES ON THE GENITALIA OF LYMNÆA.

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## INTRODUCTION.

WITH the exception of *Lymnæa megasoma* and *Lymnæa mighelsi*, nothing has been published on the genitalia of the American species of *Lymnæa*. Last fall the writer embraced the opportunity to dissect most of the common eastern *Lymnæas*, with some interesting results which are presented in the following paper.

In studying this subject it is eminently desirable that the material should be freshly killed and not alcoholic, as the latter condition causes portions of the genitalia to contract and otherwise lose their normal shape. Likewise in observing the male organ it is essential that it should be fully inverted, otherwise the form of the penis-sac and the length of the penis will be much modified, as shown by the accompanying cut (Fig. 1). The genitalia of the nine species examined are comparatively uniform, differing principally in the form of the prostate and in the length of the penis. The vagina and uterus also show some modifications.

The material dissected was obtained from the following sources:

*L. stagnalis appressa*, *stagnalis jugularis*, *elodes*, and *humilis* were collected in Braddock's Bay, Lake Ontario; *L. emarginata* and *catascopium* were collected

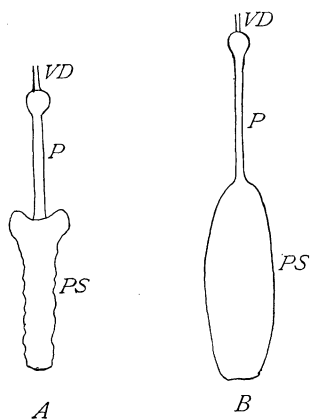


FIG. 1.—Male organs of *Lymnæa*. *a*, penis partly everted in penis-sac; *b*, fully inverted. Note the different shape of the penis-sac in the two conditions.

in Seneca Lake, N. Y.; *L. desidiosa* was obtained from Allen's Creek, N. Y.; *L. reflexa* was obtained from Long Lake, near Millers, Indiana, and *L. auricularia* was secured in the greenhouse in Lincoln Park, Chicago. All but the last two were dissected in September.

In the figures the different parts of the genitalia are designated by the following letters: *al*, albuminiparous gland; *cm*,

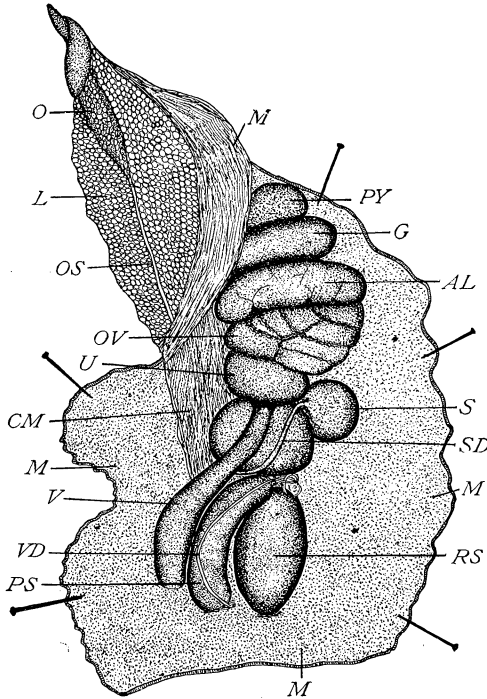


FIG. 2.—*Lynnaea stagnalis jugularis* opened from above, showing the reproductive organs in their natural position.

columella muscle; *fn*, nerves to female organs; *g*, gizzard; *l*, liver; *m*, mantle; *mn*, nerves to male organs; *o*, ovotestis; *ov*, oviduct; *os*, ovisperm or hemaphrodite duct; *p*, penis; *pd*, duct of prostate gland; *pr*, prostate gland; *ps*, penis-sac; *pmpr*, penis protractor muscles; *pmr*, penis retractor muscle; *py*, pylorus; *rs*, radula sac; *s*, spermatheca or receptaculum seminis; *sd*, duct of spermatheca; *u*, uterus; *v*, vagina; *vd*, vas deferens.

The position of the genitalia is the same in all of the species

examined, the male and female organs opening by separate orifices, that of the former being behind the right tentacle and that of the latter at the base of the neck, not far from the pulmonary opening. The genitalia occupy the median portion of the body cavity and are the most conspicuous organs when the animal is opened from the back (Fig. 2). The female organs closely embrace the alimentary tract, stomach, and esophagus, the ovotestis being imbedded in the liver near the posterior part of the animal. The male organs lie to the right of the buccal sac, the vas deferens being coiled up between these two organs. The relations of the different organs cannot be made out until they are spread out and separated from each other.

#### DISCUSSION OF SPECIES.

*Lymnæa stagnalis appressa* Say. (Figs. 3, 4.)

*Male Organs.*—Penis-sac very large, cylindrical, rather wide at the external opening and narrowing toward the distal end where the penis is attached. The penis is very short and rather thick, about one fourth the length of the penis-sac. There are three sets of protractor muscles on the penis-sac and two sets of retractor muscles. A large, thick muscle is inserted in the head of the penis at one end and is attached to one of the retractor muscles. The vas deferens is very long and extends from the penis to the base of the penis-sac where it is lost in the columella muscle, to appear again at the base of the vagina as the duct of the prostate gland, which is long and hair-like and enters the prostate in a rounded, bulbous-shaped organ, which gradually narrows until it enters the ovisperm duct.

*Female Organs.*—The vagina is a narrow, cylindrical organ about as long as the penis-sac. At the distal end it forms a large, rounded, more or less pyriform uterus, which narrows to form the oviduct, which is a tortuous, much folded organ, doubled upon itself several times. This organ narrows and unites with the ovisperm duct, which leads to the ovotestis or hermaphrodite gland, which is made up of rounded or lobulated follicles and is strongly attached to the liver. The albuminiparous gland

is very large. The receptaculum seminis is rather small, pyri-

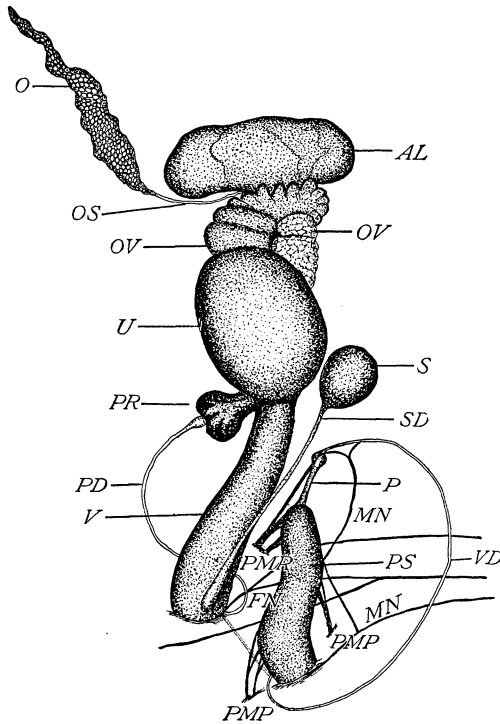


FIG. 3.—Genitalia of *Lymnæa palustris appressa*.

form, and is connected with the lower part of the vagina by a long, narrow duct. Both male and female genitalia are supplied

with nerves, the former from the cerebral ganglion and the latter from the right visceral ganglion.

The organs are very brightly colored, the albuminiparous gland, oviduct, uterus, and receptaculum seminis being orange, the prostate orange shading into black at its insertion, the vagina blackish white, and the penis-sac flesh-colored. The ovotestis is white, as are also the muscles, vas deferens, and ducts

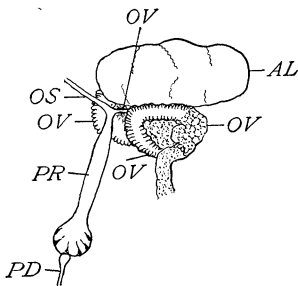


FIG. 4.—*Lymnæa palustris appressa*, showing position of oviduct, prostate, and ovisperm duct.

of the female organs. The ganglia are bright pink or orange.

The true relations of the hermaphrodite portions of the genitalia cannot be understood until the organs are separated and spread out, when it is seen that the ovisperm duct divides into two branches, one branch forming the prostate, which cares for the spermatozoa, and the other branch forming the oviduct which carries the ova.

*Lymnæa stagnalis jugularis* Say.

The genitalia of this variety are in all respects like those of variety *appressa* excepting in color, the prostate being brownish yellow, the receptaculum seminis yellowish white, and the rest of the female organs yellowish and flesh-colored.

Compared with the European *stagnalis*, the American varieties seem to be almost identical. The figures in Keferstein (Taf. 103, Fig. 8) differ only in the form of the uterus, which is represented as more pyriform, and the bulbous part of the prostate is larger. The penis is not clearly defined in the figure. The figure in Prash (Taf. 5, Fig. 7) is almost identical, the male organs being shown in much detail. The uterus is somewhat differently shaped but this may be due to a different point of view. There is nothing in the genitalia to separate the varieties of *stagnalis*.

*Lymnæa palustris* Müller (= *elodes* Say). (Fig. 5.)

*Male Organs.*—The penis is almost as long as the penis-sac and is very slender. The penis-sac is rather long, cylindrical, and of large diameter. There are two large, wide, ribbon-like retractors attached to the penis-sac and one muscle from the head of the penis to the posterior retractor muscle. Protractor muscles similar to those of *stagnalis*. Vas deferens long and thread-like. Prostate duct very fine; prostate thick, cylindrical, connected with the ovisperm duct as in *stagnalis*.

*Female Organs.*—Vagina long, cylindrical, of narrow diameter, enlarging to form a large, thick, pyriform uterus which narrows to form the much folded oviduct, which in turn narrows to form the ovisperm duct. Albuminiparous gland large. Receptacu-

lum seminis very large and globular, its duct very fine, enlarging somewhat at the point of insertion near the opening of the vagina. Ootestis and nerves as in *stagnalis*.

The colors of the organs are: albuminiparous gland and uterus bright yellow, receptaculum seminis and prostate yellow-

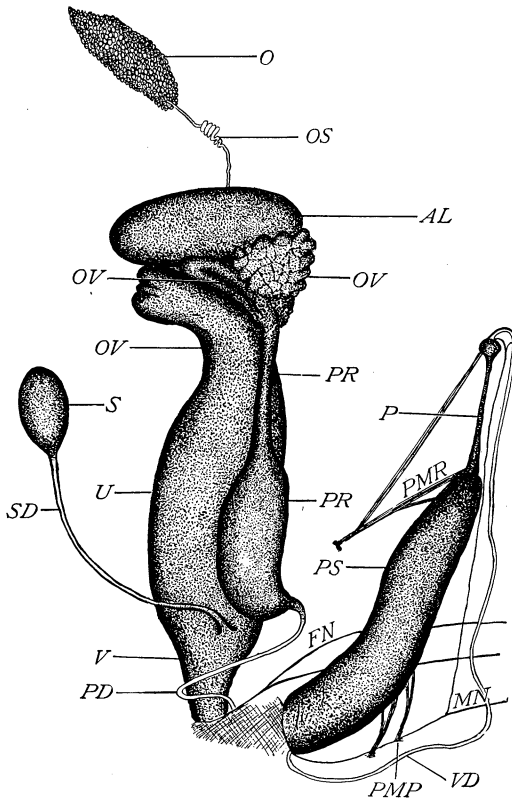


FIG. 5.—Genitalia of *Lymnaea palustris* (= *elodes*).

ish, penis-sac blackish, muscles, penis, vas deferens, and nerves whitish or flesh-colored.

*Palustris* differs from *stagnalis* in the greater length of the penis, has a larger receptaculum seminis, a more pear-shaped uterus, and the proximal end of the prostate is pyriform, not bulbous.

*Lymnæa reflexa* Say.

The genitalia of this species seem to agree in all essential characteristics with those of *palustris*. The penis-sac has but one retractor muscle while the penis has the long retractor inserted in this muscle as in *palustris*.

*Lymnæa emarginata* Say. (Figs. 6, 7.)

*Male Organs*.—Penis and penis-sac as in *palustris* and *reflexa*. A single penis-sac retractor muscle in which the penis retractor

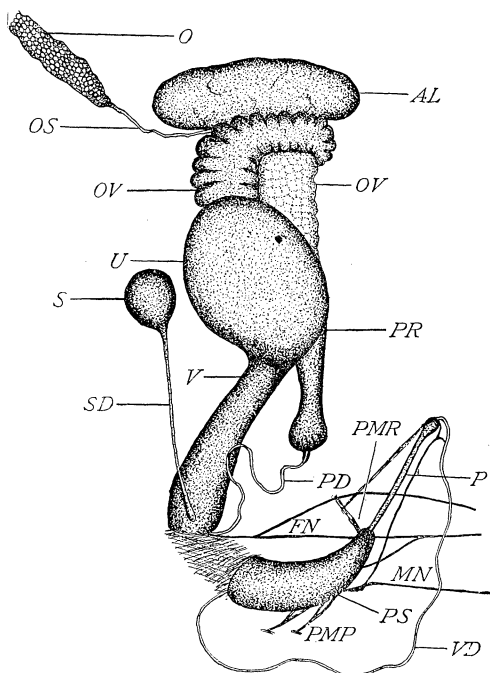


FIG. 6.—Genitalia of *Lymnæa emarginata*.

is inserted. Prostate cylindrical, of large diameter, with a somewhat bulbous proximal extremity, which narrows behind and then enlarges, to contract again before connecting with the ovisperm duct.

*Female Organs*.—The vagina is rather short and of large

diameter; the uterus is somewhat egg-shaped and very large;

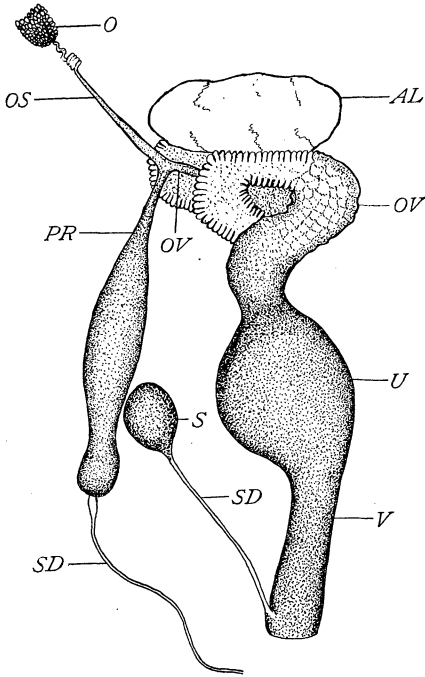


FIG. 7.—Genitalia of *Lynmnæa emarginata*, the organs separated to show their relations to each other. Note the division of the ovisperm duct to form the oviduct and prostate.

that of *stagnalis*. The muscles of the penis and penis-sac are like those of *palustris*.

*Lynmnæa desidiosa* Say. (Fig. 8.)

*Male Organs.*—Similar to those of *emarginata*. The prostate is whitish and is irregularly fusi-form, tapering at both extremities. Muscles and their insertions as in *emarginata* and *reflexa*.

*Female Organs.*—The vagina is very short and the uterus is large and long and pyriform in shape. The receptaculum seminis is globular in form and larger in proportion than that of *emarginata*.

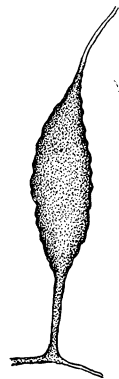


FIG. 8.—Prostate of *Lynmnæa desidiosa*.



*Lymnæa humilis* Say.

The genitalia of this small species appear in all respects like those of *desidiosa*. The receptaculum seminis is a rich salmon color, the prostate is whitish, and the rest of the organs are yellowish white.

*Lymnæa mighelsi* Binney.<sup>1</sup> (Fig. 9.)

*Male Organs*.— Penis-sac cylindrical, very long and of large diameter. Penis long and slender, half the length of the penis-

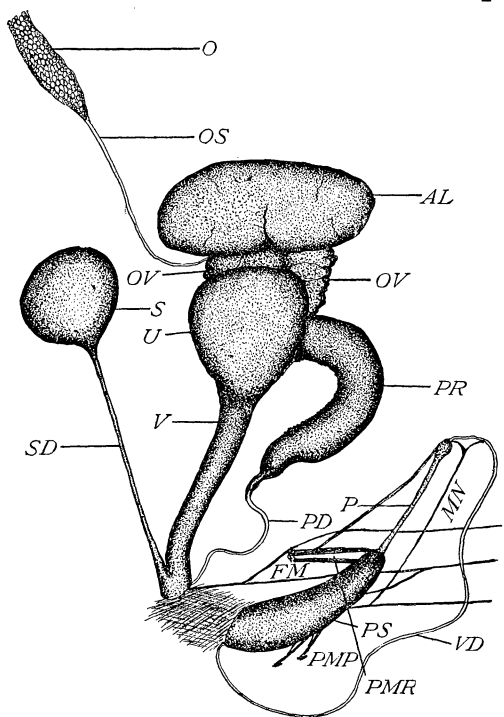


FIG. 9.—Genitalia of *Lymnæa mighelsi*. The male organs are drawn somewhat nearer the female organs than in nature.

sac. There is a single stout, ribbon-like retractor muscle attached

<sup>1</sup> The description of *mighelsi* is modified and corrected from that published in *Bull. Chicago Acad. Sci.*, vol. 2, no. 3, p. 202.

to the distal end of the penis-sac; and the penis muscle, which is attached to the head of the penis, is inserted in this muscle near its attachment to the columella muscle. Vas deferens and innervation as in the other species described. The prostate is large and cylindrical at its junction with the prostate duct, but becomes very long and narrow at its posterior portion and again narrows as it unites with the ovisperm duct.

*Female Organs.*—The ovotestis is made up of the usual lobulated follicles. The ovisperm duct is rather long; the oviduct is a much lobed organ, rather long and of large diameter; it enlarges to form a long, cylindrical uterus which suddenly contracts to form the vagina. The receptaculum seminis is small, elongate-ovate in form and connects with the vagina rather high up by a narrow duct. The albuminiparous gland is not large and is of the usual form. The innervation is as in the other species described.

The organs are colored as follows: penis and penis-sac yellowish, prostate yellowish or amber-colored, ovotestis yellowish, albuminiparous gland greenish, receptaculum seminis pearly white, and the other organs yellowish. The muscles are white in color.

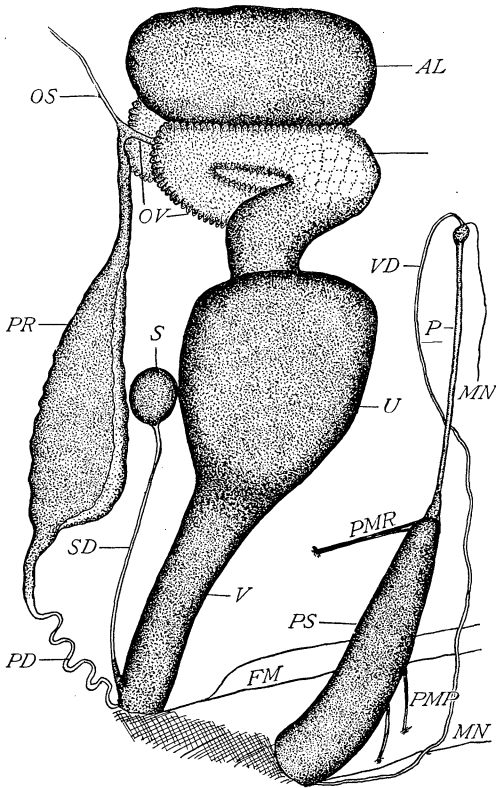
The genitalia of *mighelsi* differ from those of all the other species described in the form of the uterus, which is long and cylindrical while the vagina is short and wide. The prostate is also differently shaped. The penis-sac is very long and wide while the penis is about half its length. It is evident from a study of the genitalia of *mighelsi* and *emarginata* that the former is specifically distinct from the latter. The penis is shorter, the oviduct is differently shaped, as well as the prostate. The shells also exhibit differential characters.

*Lymnæa catascopium* Say.

*Male Organs.*—In all respects like those of *emarginata*. The prostate is also like that of *emarginata*. The receptaculum seminis is more pear-shaped. The uterus is not so swollen, the distinction between vagina and uterus not being very marked, and the two organs form a long, somewhat cylindrical sac.

*Lymnæa auricularia* Linné. (Fig. 10.)

*Male Organs*.— Penis-sac cylindrical, long, of large diameter. Penis very long and slender, exceeding the penis-sac in length. Penis retractor single, attached to the distal end of the penis-sac by a double connection. Prostate in the form of an elongated, inverted pear, narrowed at either end where it joins the

FIG. 10.— Genitalia of *Lymnæa auricularia*.

ovisperm duct and prostate duct. The prostate is dark gray in color with the exception of a narrow band of white on the border.

*Female Organs*.— The ovotestis is of the usual form. The ovisperm duct is of medium length. The oviduct is a much

lobed organ, rather long and wide; it abruptly enlarges to form a bulbous uterus, which narrows to form a rather long, wide vagina. The receptaculum seminis is small and spherical and connects with the vagina near its opening by a very long, narrow duct. The albuminiparous gland is very large. Nerves as in the other species. The uterus is yellowish, the albuminiparous gland is yellowish brown, the vagina is blackish white, the receptaculum is bright red and the other organs are flesh-colored.

The genitalia of *auricularia* do not resemble those of any other species very closely. The penis is longer than in any other species and the receptaculum is smaller. The uterus is more swollen and of a different shape. The prostate resembles that of both *elodes* and *mighelsi*.

Moquin-Tandon's figure in the *Histoire Naturelle des Mollusques Terrestres et Fluviatiles de France* shows the organs of different shape and position, but this may be due to viewing them in a different position and without separating the organs.

#### *Lymnæa megasoma* Say.

No specimens of this species have been obtainable for dissection. Wetherby's description and figure in *Jour. Cincinnati Soc. Nat. Hist.*, vol. 2, p. 95, show the penis to be rather wide and shorter than the penis-sac. The receptaculum seminis is ovate-pyriform. The other organs are not very clearly shown.

#### COMPARISONS.

The question has presented itself to the writer as to whether the genitalia of *Lymnæa* will afford sufficiently stable data upon which to base systematic groups or subgenera. In the land shells these organs furnish, in many cases, excellent characters for generic and even family divisions. It is possible that the examination of a large number of species might produce tangible

results, but the data presented in this paper seem hardly sufficient for this purpose, although some interesting features are brought out.

In the foregoing remarks, nine species and two varieties have been discussed. In comparing the genitalia of these eleven forms, several notable facts are at once apparent. The length of the penis as compared with the penis-sac is striking. The following table shows these relations (see Fig. 11):—

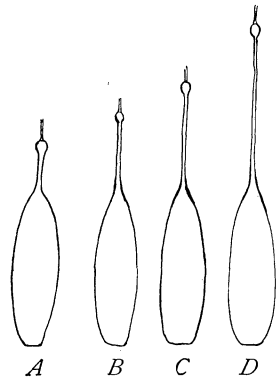


FIG. 11.—Comparison of the length of the penis with the penis-sac. *a*, *stagnalis*; *b*, *mighelsi*; *c*, *palustris*; *d*, *auricularia*.

*Comparative Length of Penis and Penis-sac.*

One fourth length.	One half length.	Three fourths length.	Longer.
<i>appressa</i>	<i>mighelsi</i>	<i>emarginata</i>	<i>auricularia</i>
<i>jugularis</i>		<i>palustris</i>	
		<i>reflexa</i>	
		<i>catascopium</i>	
		<i>desidiosa</i>	
		<i>humilis</i>	
		<i>megasoma?</i>	

There seems to be some difference in the number of penis retractor muscles attached to the penis-sac. In *stagnalis* and *palustris* there are two, with a muscle extending from these muscles to the penis. In *emarginata*, *mighelsi*, *auricularia*, *reflexa*, *desidiosa*, *humilis*, and *catascopium* there is but one retractor, in which is inserted the penis muscle. In *auricularia* there is but one penis-sac retractor and no muscle is attached to the penis. The prostate shows some differences, being fusiform in some species (*viz.*, *desidiosa*, *auricularia*, *mighelsi*, etc.) and cylindrical with an enlarged bulbous termination in the other species (*viz.*, *stagnalis*, *emarginata*). The uterus also varies from ovate to pyriform.

The colors of some of the organs, especially of the receptaculum, are striking. This latter organ is colored as follows in the different species :—

<i>appressa</i> , orange.	<i>desidiosa</i> , salmon.
<i>jugularis</i> , yellowish.	<i>mighelsi</i> , pearly white.
<i>reflexa</i> , yellowish.	<i>humilis</i> , salmon.
<i>emarginata</i> , flesh-colored.	<i>auricularia</i> , bright red.

The receptaculum seminis varies in several of the species, both in size and in shape. In *palustris* it is of extraordinary size while in *auricularia* it is very small.

While the characters of the genitalia do not seem to aid materially in the establishment of higher groups they do aid very largely in the separation of the species. The writer hopes to be able to examine all of the American species in the near future.

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