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CONTRIBUTIONS TO A KNOWLEDGE OF SOUTH
AFRICAN HIRUDINEA.

ON SOME POINTS IN THE ANATOMY OF *MARSUPI-*
OBDELLA AFRICANA.

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Pls. XV.-XVII.

MARSUPIOBDELLA AFRICANA.

Recently we described * the externals of this form, and laid down the diagnostic characters of the new genus.

We propose in this brief paper to deal with the more interesting of the internal structures which have been specially modified by the development of the brood pouch, which is so enormously developed and unique as an internal structure in the Hirudinea.

The chief modifications concern the digestive, reproductive, nervous, and muscle systems, and these are the result of displacement.

Preliminarily, we take this opportunity of rectifying an omission. In the previous description we omitted to mention the presence of a pair of eyes on the second annulus.

Body Wall and Brood Pouch.—The brood pouch occupies the greater portion of the body extending in a median longitudinal section through somites xv–xix inclusive. Transverse sections show clearly that both anteriorly and posteriorly horns are given off, and the importance of these varies according to the contents of the pouch, and these continue the pouch forwards into xiv and backwards into xx. Within the pouch we have found young in various stages of development from the segmenting egg to the fully developed young. The extensions and relations of the pouch to other body structures are clearly shown in the figures.

The body wall has the typical Glossiphonid appearance, and the same applies in regard to the general body structure and sinuses. The great

* "Annals of South African Museum," vol. xi., 1912, p. 309.

development of the brood pouch brings about a remarkable tenuity of the body wall and a displacement of the organs to the dorsal and dorso-lateral regions.

The musculature of the body wall is typically developed in the regions anterior and posterior to the brood pouch, but the ventral wall of the brood pouch has a much smaller development of muscles than the dorsal. However, this ventral wall is clearly seen to be the original, or rather primitive, ventral wall, the muscle fibres being continuous with those of the anterior and posterior regions. The dorsal and lateral walls of the pouch, however, are devoid of any musculature comparable with the transverse and longitudinal muscles of the body wall. The internal lining layer of the pouch consists of an irregular and generally indistinct epithelium which grades into a faint musculature in parts.

The greater portion of the dorsal and lateral regions of the body in the vicinity of the pouch is occupied by the digestive and sinus systems.

In the anterior and posterior parts of the body structures which agree in their disposition with the limits of the somites as mapped out from external studies are developed which apparently correspond to septa, and these give great assistance in mapping in the distribution of the various organs with reference to the somites, which would otherwise be impossible owing to displacement caused by the great development of the pouch.

It is clear that the pouch has not been formed by an intensification of the condition found in other Glossiphoniidae where a temporary pouch is formed by an inflection of the edges of the body ventrally, but is a specially developed structure, as is clearly shown by the nature of the dorsal and ventral walls, each of which shows no musculature other than that characteristic of their respective superficies in other Glossiphoniidae.

The pouch occupies the position which is taken, at least ventrally, by the large sac-like ovaries of other Glossiphoniidae, and it is highly probable that the dilated portions of these sacs have lost their germinal function and become united to serve as a brood pouch. This idea is supported not only by the position of the pouch, but also by the paired nature of the pouch as indicated by the anterior and posterior horns. This has led to a restriction of the germinal area to the anterior portion of the ovary as it is found in other Glossiphoniidae, and also to a displacement of the same forwards by the growth of the pouch.

Alimentary Canal.—This structure is divisible into the same regions as that of other Glossiphoniidae.

The proboscis extends backwards as far as somite xi, nearer the dorsal than the ventral side of the animal. The oesophagus then passes upwards and backwards over the vesicula seminalis and in somite xiii descends behind that structure to pass into the ovary. In the posterior region of xiii it emerges from the ovary and then again ascends obliquely backwards

in xiv. In xv it has reached the normal level and then passes into the crop, which extends along the middle line above the brood pouch. The crop gives off six pairs of caeca, which arise either in somites xiv-xix inclusive or in xv-xx inclusive.

The caeca of the crop, like the oesophagus, are very thin-walled, and there is some difficulty in tracing the structures of the middle portion of the canal. The caeca extend outwards along the sides of the brood pouch as far as the meeting-line of dorsal and ventral body surfaces.

The last pair of crop caeca arise at about the limit of posterior extension of the brood sac in the middle line.

The stomach gives off four pairs of diverticula, as it passes obliquely backwards and downwards behind the brood pouch.

The most marked features of the alimentary canal are the passage of the oesophagus through the ovary, and the exceedingly thin nature of the wall of the canal between the proboscis and the posterior portion of the crop.

As mentioned in the description of the female organs, the ovary is enclosed in a layer of flattened cells which become ellipsoidal at the points of entrance and exit of the oesophagus. The oesophageal wall consists of a single layer of flattened epithelial cells with elongate nuclei. This wall is in close apposition with the inner surface of the ovary and thus appears as an internal bounding layer. It is thus apparent that the ovary has invested the oesophagus.

Above the oesophagus is the dorsal sinus, which descends and ascends with the former in somites xiii and xiv. In xiii, however, it does not pierce the ovary, as can be understood, but rests on the dorsal surface of the latter, partly invested by the outer layer of cells of the ovary.

Reproductive Organs.—The male pore is situated between annuli 21 and 22 of the ventral surface, that is between somites xi and xii.

The female pore occurs between annuli 23 and 24, that is, between the second and third annuli of somite xii.

There are six pairs of testes, situated in somites xiv-xix, a position which corresponds with that in other Glossiphoniidae.

They are greatly drawn out in a dorso-ventral direction and stretch along each side of the body in a vertical direction in a crescentic fashion. The third and fourth pairs stretch along the outer sides of the brood pouch.

Masses of mature spermatozoa occur in sinuses in the dorsal portion of the brood pouch region of the body, and ventrally anterior and posterior to the pouch.

The male ducts are interesting in that the vas deferens communicates anteriorly with a loop which communicates with the vesicula seminalis. The formation of this loop is undoubtedly brought about by the displace-

ment due to the pouch. Otherwise the male ducts agree with those of other Glossiphoniidae.

The ovary is an unpaired hollow organ, and differs to a remarkable extent from the large sac-like ovaries of the other Glossiphoniidae, in which the ovaries occupy a large portion of the body. In many, for example, they stretch from somites xiii-xviii inclusive, and constitute a large portion of a transverse section in this region. In *Marsupiobdella* the ovary is limited to somite xiii, and would thus correspond to the anterior portions of the ovaries of other genera. It is enclosed in a layer of follicle cells which are ellipsoidal in places. The ovary is further peculiar in that the oesophagus pierces its dorsal wall, and passing through the cavity of the organ emerges through the posterior wall. The follicular cells of the ovary pass upwards for some distance around the oesophagus from its point of entrance into and exit from the ovary, and become ellipsoidal.

The external limiting layer is otherwise composed of flattened cells essentially similar to those limiting the brood pouch internally, and this may be taken to support the suggestion that the latter represents the posterior portion of the typical Glossiphonid ovary.

The tracing of the female ducts has been very difficult and unsatisfactory. The female pore, and two indistinct structures with convoluted walls which undoubtedly represents the oviducts were made out. The ducts pass from the ovary downwards towards the female aperture, but although there is every indication that they would communicate with the exterior, in a study of serial sections it is seen that the ducts turn near the pore upwards and backwards towards the antero-dorsal surface of the brood pouch. This portion directed upwards and backwards really represents part of the ovary of other Glossiphoniidae. No distinct opening into the brood pouch could be made out. There can be no doubt, however, that such communications do exist, and that the eggs pass directly into the brood pouch, and in all probability are fertilised in that sac.

The failure to find definite openings of the oviducts into the pouch is readily explained by the presence of well-advanced embryos or segmenting ova in the pouch, and by the small size and immature nature of the ova in the ovary. The specimens were all taken apparently after the breeding season, or, rather, towards the close of the same. Such a closure of the female ducts, in other Hirudinea has frequently been noted by one of us during the resting season.

The abundance of spermatozoa in the dorsal sinus and other parts of the body indicates that in all probability impregnation is hypodermic as in species of *Glossiphonia*, and this would be greatly facilitated by the delicate nature of the body wall in the brood pouch region.

Lastly, in specimens in which segmenting ova are present in the pouch, the ventral aperture of the pouch is closed, so that no other method of fertilisation seems possible. The sole function of the pore is to allow of the escape of the young.

Nervous System.—The course of this system will be readily understood from the diagrams. It passes backwards in the ventral median line as far as somite xv, and then ascends immediately in front of the anterior wall of the brood pouch to the dorsal side, between the two anterior horns of the brood pouch.

Transverse sections through the brood pouch region show the nerve cord in a median triangular projection of the dorsal body substance into the brood pouch.

The cord descends again behind the brood pouch, in close association with the posterior wall of the latter.

EXPLANATION OF FIGURES OF PLATES XV.-XVII.

- b.p.a* = aperture of brood pouch.
b.p.h.a = anterior horn of brood pouch.
br.p = brood pouch.
d.s = dorsal sinus.
caec = caecum of crop.
h = ejaculatory horn.
n. (*vide* figs. 4 and 10).
n.c = nerve cord.
oe = oesophagus.
oe.c = crop.
ov = ovary.
ov.d = oviduct passing downwards towards the obsolete female pore (this represents the true oviduct of other Glossiphoniidae).
p = proboscis.
p.s = proboscis sheath.
s. (*vide* figs. 2 and 10).
t = testis.
t3.4 = position of third or fourth pair of testes.
v.d = vas deferens.
v.s = vesicula seminalis.
x (*vide* figs. 2, 10, and 11).
y (*vide* figs. 3 and 10).
z (*vide* figs. 3 and 10).
ep = external epithelium of ovary, passing into muscular tissue (*ep.m*) comparable with lining layer of brood pouch.

FIGS.

- 1-9. Represent transverse sections through the more characteristic regions from the anterior end to the middle of the brood pouch.
10. Reconstruction of the male genital apparatus (compare with figs. 1, 2, 3, and 4).
11. Diagrammatic sagittal section to show the relations of the alimentary canal and female genital organs.
12. Reconstruction of brood pouch (in ground plan).
13. Transverse section through ovary, to show the relations of ovary, oesophagus, and dorsal sinus *inter se*.
14. Photograph of section showing segmenting eggs in brood pouch.
15. Photograph of transverse section through brood pouch containing fully developed young. Note the deeply stained crop caeca in the young and the testes and large sinuses in the lateral body wall of the adult.
16. Photograph of transverse section through the brood pouch, passing through the pore. Note the extrusion of a young individual through the pore and the testes (3rd or 4th pair) in the lateral body wall of the adult.

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