NOTES ON THE ANATOMY OF SOUTH AFRICAN APLYSIIDÆ,
WITH DESCRIPTIONS OF TWO NEW SPECIES.

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RATHER more than a year ago, a small collection of Aplysiidæ, collected in South Africa by Mr. Henry Burnup, was entrusted to me, through the kindness of Mr. J. H. Ponsonby, for dissection and description. To both of these gentlemen I wish to express my thanks for the opportunity thus afforded me of adding somewhat to the relatively scanty records of the anatomy of members of this group of molluscs.

The collection comprised eight specimens belonging to four species, two of which are apparently new.

TETHYS OPERTA, n.sp.

The four specimens of this species (three from Isipingo and one from Scottsburg) closely resemble each other except in size, and in their most important external features are so closely similar to *Tethys dactylomela* (Rang) and its varieties (especially var. *æquorea*, Heilprin) that, were it not for the complete closure of the shell-sac, it would be unnecessary to consider them as anything but varieties of *dactylomela*.

FIG. 1.

The least distorted of the four specimens (Fig. 1) had the following measurements:—Total length, 68 mm.; breadth in front of the parapodia, 21 mm.; height in the middle of the visceral sac, 28 mm.; length of posterior extremity of the foot behind the parapodia, 9 mm.; length of the attachment of the parapodia to the body, 28 mm.; greatest depth of the parapodia, 14 mm.; breadth between the anterior ends of the parapodia, 12 mm.; distance from the anterior end of the parapodia to the rhinophores, 22 mm.; distance between the rhinophores and anterior tentacles, 12 mm.; breadth between the rhinophores, 5 mm.

The surface of the animal is slightly crinkled, but otherwise smooth. The parapodia are moderately developed, but do not cover the mantle; posteriorly they are united where they meet the foot, the depth of the union being about 3 mm. The mantle is large; its free right-hand border is turned down for about 4 mm., and posteriorly is suddenly bent to the left to form a short wide siphon 5 mm. in length. The shell-sac is completely closed, but a minute hollow papilla, near its centre, indicates the position where the opening should be.

The rhinophores are short, cylindrical, and blunt. Their apices are hollowed out, the margins of the cavity being irregular. The anterior tentacles are small, and, as usual, are formed by scrolled projections of the buccal lobes. The latter are large and of circular form.

The eyes lie 2.5 mm. in front of, and slightly lateral to, the rhinophores.

The anal orifice lies as usual in the siphon. The genital opening is situated beneath the mantle on a level with the anterior limit of the gill, at a distance of 12 mm. from the anterior ends of the parapodia, and 4 mm. in front of the large single opening of the opaline gland. The genital groove takes the usual course to the penis beneath the right anterior tentacle.

FIG. 2.

FIG. 3.

FIG. 4.

The animal is greenish grey, covered with a network of fine irregular black reticulations, which in places run together to form blotches, or more frequently somewhat vague ring-like markings. These are sharply circumscribed, as a rule, towards the centre, but outwardly fade off into the general reticulation. The rings are scattered chiefly upon the sides of the body and upon the outer surface of the parapodia, the blotches being mainly situated near the margin of the foot, a specially definite one marking the upper surface of its posterior free extremity. The inner surface of the parapodia is marbled with large confluent black blotches. The surface of the mantle is also marbled, but very delicately, the depressed free edge being somewhat specially pigmented. The sole of the foot is yellower than the rest of the body-surface, and is sparingly flecked with small blotches of black or brown.

The shell (Figs. 2, 3) is rather long, narrow, and flat (24 by 16 by 2.5 mm.). It is slightly calcified, showing internally traces of nacre.

The beak is strongly incurved, and upwardly reflexed. The sinus is deeply excavated, and extends barely a third the length of the shell. The colour of the shell is yellowish, owing to the strong periostracum which extends from 1 to 2.5 mm. beyond the anterior border of the calcified part.

Alimentary canal: The jaws, which have an elongated quadrilateral shape, are lateral brush-like developments of a continuous delicate sheet of chitin that encircles the buccal cavity just inside the mouth. They are covered with slender, rod-like, chitinous processes (Fig. 4), about .2 mm. in length, that slightly swell distally, and terminate in a rounded end.

The radula is of the type common to the family, with a formula of 28 : 1 : 28, the outer lateral teeth being, as usual, more or less rudimentary. The median tooth is broad and has three cusps, a median which is irregularly denticulate along its edge, and on either side a smaller smooth cusp. The first lateral has one large smooth cusp; the other teeth, except those quite at the side, have a large internal denticulate cusp, and lateral to it a smaller smooth cusp.

The buccal mass is nearly globular (9 mm. long by 8 mm. broad). The œsophagus measures 9 by 2 mm., and is longitudinally pleated internally. It leads into a voluminous crop measuring roughly 30 by 12 mm., and making one complete spiral twist to the right before opening into the muscular gizzard. This latter region is, as usual, very clearly defined externally by the abrupt anterior and posterior margins of the thick layer of circular muscle fibres of which its walls are composed. Internally it is armed with two or three irregular rows of pyramidal horny teeth of different sizes. The gizzard passes without constriction into the stomach, which in turn gradually narrows to form the intestine. Two large bile ducts and a narrow cæcum open into the intestinal end of the stomach.

The arrangement of the gut-coils, a character that seems to differ in different species, resembles very closely that figured for *T. leporina* in Bronn's *Thierreich*, Bd. iii, Abth. 2, pl. lxx, fig. 7. The salivary glands and hepato-pancreas call for no remark.

The opaline gland is of very large size, and is composed of long transparent conical lobules, which measure about 1 mm. in diameter at their outer ends, and gradually narrow towards a common duct that opens by a large aperture, as stated previously.

The nervous system has the form normally present in the genus.

The gill and heart are also of the normal type. The first portion of the aorta is provided with a leaf-like enlargement (*crista aortæ*) closely attached to the anterior wall of the pericardium. The aorta occupies the central line of this enlargement, and on either side is a wing-like expansion.

The reproductive organs are in no way specially remarkable, but it may be mentioned that the hermaphrodite gland, which is buried as usual in the right side of the apex of the visceral mass, is rounded, and the albumen gland is small and sausage-shaped. Otherwise they very closely resemble the published figures of European species such as *T. leporina*.

TETHYS BURNUPI, n.sp.

Of this species (Fig. 5), which I have taken the liberty to name after Mr. Burnup, there was one specimen only, from Durban. It had the following measurements: total length, 42 mm.; greatest breadth, 15 mm.; distance from the mouth to the anterior end of the parapodia, 11 mm.; length of the parapodia, 30 mm.; greatest depth of parapodia, 9 mm.; distance from anterior end of the parapodia to the rhinophores, 3 mm.; distance between the anterior ends of the parapodia, 6 mm.; breadth of foot, 7 mm.

FIG. 5.

The animal has an oval form, with very long but not particularly deep parapodia. The latter unite where they meet the foot at a point only 1 mm. from its extremity.

The mantle is large; its anterior limit nearly coincides with the mid transverse plane of the animal. The shell-sac is completely closed, without any indication of the position where the opening should be. The siphon is small.

The rhinophores, which lie remarkably close in front of the parapodia, are short, cylindrical, and blunt; their apices are excavated, the border of the hollow being irregular. The anterior tentacles, which are formed by foldings of the buccal lobes, are large and flat, and, together with the buccal lobes, project laterally in the horizontal plane.

The genital opening lies on a level with the anterior limit of the mantle, 3 mm. in front of the gill. The opaline gland opens by numerous minute pores. The anus is in the usual position within the siphon.

The genital groove has the normal position and appearance. The eyes lie 1 mm. in front of the rhinophores.

In colour the animal is dusky grey green, flecked with small elongated blotches of whitish green, directed for the most part longitudinally. The inner surface of the parapodia is dusky green, marked near the margin by radially disposed patches of whitish green. The mantle is for the most part transparent, but clouded along its left side and around the siphon with dusky green.

The shell (Figs. 6, 7): Unfortunately the calcareous part was broken to pieces, but the general shape can be recognised from the stout periostracum. It is of elongated oval form, moderately convex, with the beak strongly incurved, and with an upstanding reflected hood. The sinus is short and moderately concave.

FIG. 6.

FIG. 7.

FIG. 8.

The alimentary canal: The jaws lie on either side just within the mouth. They have an irregularly oval form measuring 3 by 2 mm., and are covered by chitinous hair-like rods .08 millim. in length, with a pointed and slightly hooked free extremity (Fig. 8).

The radula has the formula 22 : 1 : 22. The median tooth has a central blunt cusp with denticulate edges, and two pairs of lateral cusps. The lateral teeth have a long denticulate cusp towards the median side, and upon the lateral side two smaller smooth cusps. The teeth are relatively large, being about equal in size to those of *T. aperta*, although the animal is much smaller.

The alimentary canal otherwise closely resembles that of *T. aperta*, but the intestine is longer with similar though more pronounced coils. The following measurements of the different parts may be noted:—Œsophagus, 7 mm. long by 1.5 mm. diameter; crop, 17 mm. long by 7 mm. diameter; gizzard, 4 mm. long, with two rows of thorn-like chitinous teeth upon its inner surface.

The opaline gland consists of a number of isolated follicles covering an area of the body-wall below, and slightly posterior to, the genital opening. It measures 6 mm. long. by 4 mm. broad, and is more pointed behind than in front.

Reproductive organs: The only remarkable feature about these organs is the absence of the seminal vesicle. The albumen gland also is extremely small.

The gill, mantle-cavity, kidney, pericardium, and heart show no special features worthy of mention. The aortic appendage (*crista aorta*) is large and leaf-like.

This specimen is of somewhat exceptional interest, for in its general configuration, in the arrangement of the parapodia and mantle, and in the position of the external openings, in fact, in nearly all its most important external characters, it resembles the genus *Paraplysia* of

Gilchrist¹ so closely that I should have unhesitatingly placed it in that genus, had it not differed slightly from it in the leading feature upon which the genus was founded, namely, the position of the rhinophores with regard to the parapodia. In *Paraplysia* the rhinophores lie actually between the anterior ends of the parapodia, whilst in this specimen they are 3 mm. in advance of them. On this account alone it must, I think, be placed in the genus *Tethys*, and having regard to its general similarity in other characters to the genus *Paraplysia*, it becomes a question, as suspected by Gilchrist himself,² whether in reality any hard and fast line can be drawn between the genera *Tethys* and *Paraplysia*.

TETHYS NIGROCINCTA (Martens).

Of this species there was one specimen from Scottsburg, Natal. It is larger than the type described by Martens, and also differs from it in being of a pale yellow colour instead of light brown.

The specimen had the following measurements: total length, 28 mm.; height, (through the visceral sac) 13 mm., (in front of the parapodia) 6 mm.; distance from the mouth to the anterior limit of the parapodia, 10 mm., the rhinophores being situated midway between these two points. The parapodia are united behind to a depth of 2 mm., and are separated in front by a distance of 6 mm. Their greatest height is 6 mm.

The general form of the body is long and slender, with the visceral sac strongly humped up. The rhinophores and tentacles are slender and ear-like. The sole of the foot is narrow (5 mm.) and very clearly defined. The mantle orifice is peculiarly large (7 by 6 mm.) and somewhat egg-shaped, with the narrower end directed backwards. The siphon is short and wide.

The genital opening lies in front of the anterior edge of the mantle, some 2 mm. in advance of the gill. The opaline gland opens by numerous minute pores.

The colour of the animal is a delicate fulvous yellow, with very faint indications of small lighter spots upon the outer surface of the parapodia and down the centre of the back. The edges of the parapodia, of the mantle orifice, and of the siphon are bordered by an interrupted delicate black line. Black pigment also occurs within the cavities of the rhinophores and tentacles, and upon the anterior and posterior margins of the foot. The eyes, which are plainly visible, lie just in front of the rhinophores.

The shell: The calcareous part of the shell was unfortunately broken. The uninjured beak and the periostracal layer, however, give the following particulars: length, 10 mm.; breadth, 8 mm.; height, 3 mm. The beak is strongly inturned, and is not reflexed. The sinus is slightly concave, and occupies a little more than the posterior third.

¹ Gilchrist, "The genus *Paraplysia*, with description of a new species": Trans. S. Af. Phil. Soc., vol. xi (1902), p. 121.

² Gilchrist: loc. cit., p. 124.

Digestive organs: The radula is small, and has the formula 10 : 1 : 10. The individual teeth, though few in number, are relatively large, and are strongly cusped, the cusps being similar in number and arrangement to those of *T. Burnupi*. The jaws are covered with short hooked rods very similar to those of *T. Burnupi*.

The buccal mass, salivary glands, crop, and stomach are quite normal but for a dilatation of the œsophagus, about its middle. This may, however, be an individual peculiarity, or possibly a pathological condition. The intestine is remarkably short and very simply coiled (Fig. 9). The point of the cæcum projects from the hepato-pancreas

FIG. 9.

further and more abruptly than in the other species examined, although in the usual place, where the intestine begins to run forward upon the left side of the hepato-pancreas.

Organs of circulation: The intra-pericardial part of the aorta has no expansion (*crista aortæ*).

Reproductive organs: These have the usual characters, but (in this specimen) are of large size. The complex of organs that lies between the hermaphrodite duct and the external opening measure 7 mm. in length. The seminal vesicle and spermatheca are also very conspicuous. The albumen gland is nearly circular.

The opaline gland is small (3 by 2 mm.), and consists of an aggregation of separate follicles.

TETHYS ELONGATA (Pease).

Of this species there were two specimens from Port Shepstone. They had the following dimensions: total length, 21 mm.; height, (through the visceral sac) 11 mm., (in front of the parapodia) 7 mm.; distance from the mouth to the anterior end of the parapodia, 7 mm., the rhinophores being situated about midway between these two points. The parapodia are united behind, 2 mm. in front of the extremity of the foot, to a depth of 4 mm., and are separated in front by a distance of 6 mm. Their greatest depth is 4 mm.

The rhinophores and tentacles have the same shape as in *T. nigrocincta*. The mantle orifice measures 8 by 6 mm. The siphon is small and broad. The external openings are as in *T. nigrocincta*.

The colour of the animal is dullish olive green, tending to yellowish brown. The concavities of the rhinophores and tentacles are black.

The eyes lie external to the bases of the rhinophores.

The shell, which is remarkably stout, is brownish in colour, and measures 13·5 mm. in length by 9·5 in breadth by 5 in height. The beak is strongly inturned, and is reflexed upward. The periostracum extends considerably beyond the anterior margin of the calcareous part of the shell.

In its internal anatomy this species so closely resembles *T. nigrocincta* that a detailed description is unnecessary, but attention must be drawn to the following special points of resemblance: the arrangement of the gut-coils; the absence of a crista aortæ upon the intrapericardial part of the aorta; the large size of the reproductive ducts and accessory glands—these are, in fact, even larger than in *T. nigrocincta*, although the animal itself is considerably smaller. The relative size of the several parts differs, however. The albumen gland is larger in *T. elongata*, but the seminal vesicle and spermatheca are smaller. Much importance should not, I suppose, be attached to the size of these organs, for, no doubt, they vary considerably in this respect according to the time of year, as in other animals.