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ON A NEW SIPHONARIA FROM NEW GUINEA,
ON SIPHONARIA NORMALIS GOULD
AND ON THE STRUCTURE OF THE EPIPHALLUS
GLAND IN SIPHONARIIDAE,

by BENGT HUBENDICK (Uppsala).

A NEW *Siphonaria* FROM NEW GUINEA.

In their large account on the molluscs of the Netherlands East Indies ADAM and LELOUP (1939) mentioned two species of *Siphonaria*, *S. sipho* SOWERBY and « *S. funiculata* REEVE ». In my systematic monograph of Patelliformia (1946) I stated that the correct name for *S. sipho* SOWERBY should be *S. laciniosa* LINNÉ. [In this Monograph I referred to ADAM and LELOUP's discussion of this species. But I did so wrongly in connection with *S. stellata* (§ 70). The correct position of the reference should be in § 69.] On the species preliminarily determined as *S. funiculata*, ADAM and LELOUP wrote: « Faute de matériel de comparaison, nous ne pouvons pas décider définitivement de l'identité de notre matériel. » Owing to the great obligingness of Dr. W. ADAM in Bruxelles I had the opportunity of examining twelve specimens of the species in question.

Siphonaria funiculata REEVE lacks the so-called muscular sheath (cf. fig. 16 in HUBENDICK 1946), as well as the flagellum and has an extremely muscular epiphallus duct. Thus it must belong to the subgenus *Liriola*. Still more features confirm this position. But the species dealt with by ADAM and LELOUP has, according to my own investigation, a well developed muscular

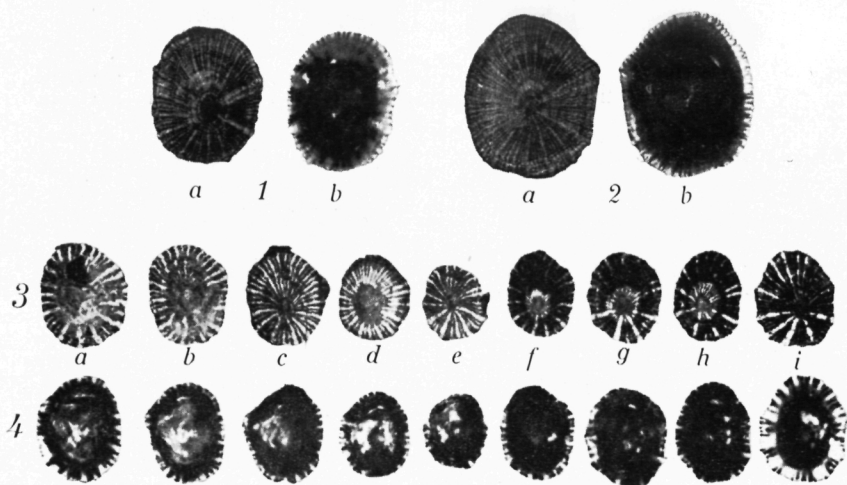


Fig. 1-4.

Fig. 1-2. — Shells of *Siphonaria pisangensis* n. sp. from the Isle of Pisang, New Guinea ($\times 1,8$). a, dorsal side; b, ventral side.

Fig. 3-4. — Shells of *Siphonaria normalis* GOULD from Hanouma Bay, Oahu, Hawaii ($\times 1,8$; fig. 3, dorsal side; fig. 4, ventral side). a, specimen which, except for its size, agrees with *S. nuttalli* HANLEY; a-i, typical specimen of *S. normalis*; b-e, intermediate forms.

sheath and flagellum and an epiphallus duct but containing a thin muscular layer. Thus this species must belong to the subgenus *Siphonaria* and more exactly to the section *Siphonaria* (*Siphonaria* s. str.). As most species in this section show a high degree of similarity in their anatomical features, the radula included, the specific characters are only to be found in the shells. The shell of the species in question shows a slight resemblance to that of *S. laciniosa* (L.) (= *S. siphon* SOWERBY Auct.). But there are considerable differences in sculpture, colour and shape between the two species. Many species of *Siphonaria* are rather variant, and therefore it may be conceivable that the form in question represents a geographical race of *S. laciniosa*. But this last-mentioned species also occurs in the same locality where it is distinctly separated from the other species by its shell features. Actually the shell of *S. laciniosa* from that locality shows its ordinary form and sculpture. Owing to these facts it is necessary to describe

the species mentioned by ADAM and LELOUP as a new one under the name *Siphonaria funiculata*.

For this new species I propose the name *Siphonaria (Siphonaria) pisangensis*.

MATERIAL EXAMINED : Twelve specimens from the Isle of Pisang, New Guinea, Coll. 18/3 1929 by the « voyage aux Indes Orientales Néerlandaises de LL. AA. RR. le Prince et la Princesse Léopold de Belgique ». (Cf. fig. 1-2 and ADAM et LELOUP, 1932, pl. II, fig. 2.)

DESCRIPTION : The length of the shell ranges around 20 mm., the breadth around 13 mm., the height being about a third of the length of the shell. The circumference is almost symmetrical, but at the right margin the siphon sometimes is protruding. The apex is situated in the median line but a little behind the middle. On the upper side, about 80 ridges in the full-grown shell; most of them, however, are extremely slender. Every third or fourth ridge is a little coarser, and in young shells these ridges constitute the whole sculpture. On the siphon, two ridges are still more coarse as well as about five to eight ridges on the caudal half of the shell. Very weak concentric growth-lines usually occur, at least on the peripheral part of the shell. On the ridges the colour is paler than in the interspaces. The latter are pale brown or grayish. Usually this colour is a little darker on the central half of the shell. The very apex is still darker. The under side is dark brown inside (or centrally to) the muscle impression and white outside (or peripherally to) this impression. Very fine brown spots or radii, corresponding to the interspaces on the upper side, may occur at the under side of the margin. The central brown colour may, in peripheral direction sometimes almost reach the margin. In these cases the brown colour is arranged in radial sections corresponding to the interspaces between the coarser ridges on the upper side.

DIFFERENCES FROM RELATED SPECIES : Species at least typologically nearly related to *S. pisangensis* are *S. laciniosa* (L.) and *S. parvicostata* DESHAYES. The form *exigua* of *S. laciniosa* is distinctly separated by its very coarse sculpture. The form *sipho* may however show resemblance to *S. pisangensis*. But in this form the ridges normally are more different in size than in *S. pisangensis*. When occasionally all ribs in the form *sipho* are of equal size, they are considerably coarser than those in *S. pisangensis*. Considerable differences also occur in the co-

louring. *S. parvicostata* differs from *S. pisangensis* by the broader, smooth and rounded dominating ribs. Their colour is clear white.

TYPE SPECIMENS: The type specimen of *Siphonaria pisangensis* belongs to Musée Royal d'Histoire Naturelle de Belgique in Brussels. Five paratypes are kept in the Swedish State Museum (Naturhistoriska Riksmuseum) in Stockholm, the remaining paratypes in Brussels.

ON *Siphonaria normalis* GOULD.

When writing my systematic monograph on the Patelliformia, I had no access to any material of *Siphonaria normalis* GOULD. Hence I was compelled to place this species among those of unknown systematic position. Thanks to the great obligingness of the officials of the Bernice P. Bishop Museum in Honolulu, I have received 22 specimens of this species from Oahu, north end of Hanauma Bay (coll. 11/1 1947 by D. ROGERS and Y. KONDO. Mus. number: BBM — 201080).

My anatomical investigation of *Siphonaria normalis* showed clearly that the species belongs to *Siphonaria s. str.* The copulatory organ has a well developed muscular sheath as well as a distinct, rather long and slender flagellum (fig. 5). The epiphallus duct has only a thin muscular layer peripherally, otherwise it is constituted by epithelium, connective tissue and glandular tissue.

On the basis of shell features I have previously (1946, p. 51) assumed that *Siphonaria nuttalli* HANLEY from the Hawaiian Islands must belong to *Siphonaria s. str.* After having examined shells of *S. normalis* I must believe that *S. nuttalli* is only a form of *S. normalis*. The shell of the latter varies in a high degree (fig. 3-4). Certain specimens (fig. 3-4, b-c) seem to be transitional forms between *S. normalis* and *S. nuttalli*. The latter is mainly separated from the former by its larger size and its paler colour inside. Fig. 3-4 a is a *nuttalli*-resembling specimen of *normalis*-size.

ON THE STRUCTURE OF THE EPIPHALLUS GLAND IN *Siphonariidae*.

In my previous investigations on *Siphonariidae* (1945, 1946) I made no detailed examination of the epiphallus gland. In this connection I shall now make some complementary remarks on that structure.

There are three of epiphallus in Siphonariidae. In *Williamia* the epiphallus duct and the epiphallus gland proper are not distinctly separated. There is no flagellum. The glandular tissue of special type, which constitutes the proximal gland, reaches down through almost the entire duct (fig. 6). This tissue is an epithelium consisting of very large glandular cells forming one single layer and surrounding one single lumen. The glandular cells sometimes seem to be polynuclear as in *Siphonaria gigas*. The subepithelial layer only consists of a thin, peripheral sheath of connective tissue (cf. fig. 7 c. t. and HUBENDICK 1945, p. 32). The second type of epiphallus occurs in the subgenus *Liriola*. Its duct is characterized by an extremely thick muscular layer in which circular muscles dominate (cf. HUBENDICK 1946, fig. 1). In the gland proper there are mazy folds and processi. There is no flagellum. In species belonging to subgenus *Liriola* I have not seen such large glandular cells, as occur in other Siphonariidae. The third epiphallus type, occurring in the subgenus *Siphonaria*, is characterized by a duct in which the muscular tissue is limited to a thin peripheral circular muscle (cf. HUBENDICK 1946, fig. 2). For the rest, the duct consists of epithelium containing glandular cells. These reach into and partly constitute the subepithelial tissue. A flagellum is present (fig. 5). In the latter there are also connective cells. The structure of the epiphallus gland in this third epiphallus type will be discussed in the following.

Where the epiphallus duct enters the epiphallus gland proper, or the duct begins to form the latter, and proximad (1) to the branching off of the flagellum, its lumen is connected with that of the epiphallus gland (fig. 10 a). The flagellum is the direct continuation of the epiphallus duct. The lumen of the epiphallus gland belongs to three main lobes. The first one (I) is connected with the lumen of the epiphallus duct at the entrance of the latter in the gland (fig. 10 a-b). Proximad its lumen rapidly increases and from one of its walls a large process extends through the whole lumen (fig. 10 b). By a deviation of the process and certain coalescences (observe the signs on fig. 10 b) the lumen of lobe I further proximad is divided into lumina I and II (fig. 10 c). The latter is still connected with the continuation of the epiphallus duct. Lobe I continues in proximal direction and ends blindly (fig. 10 c). From lobe II, but in

(1) The flagellum is the most proximal part of the epiphallus and its connection with the genital atrium the most distal one.

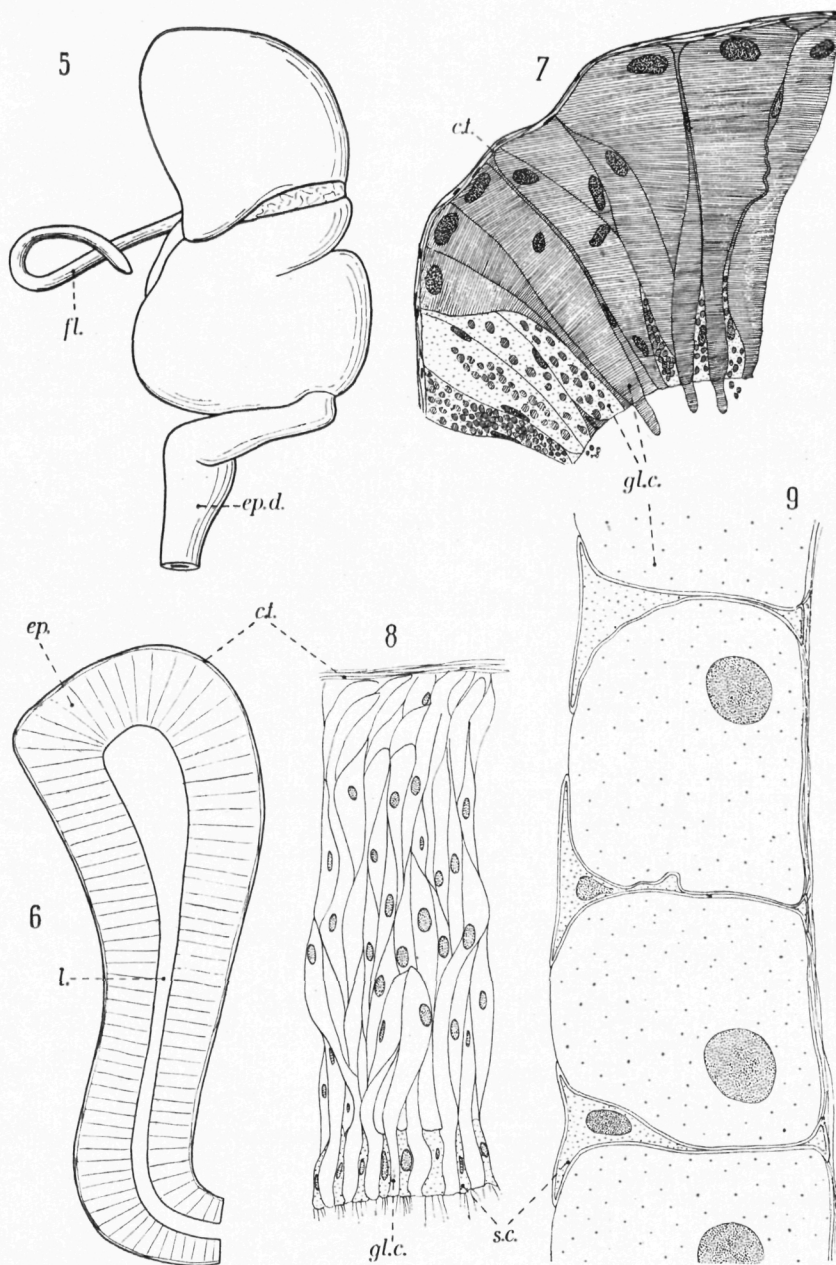
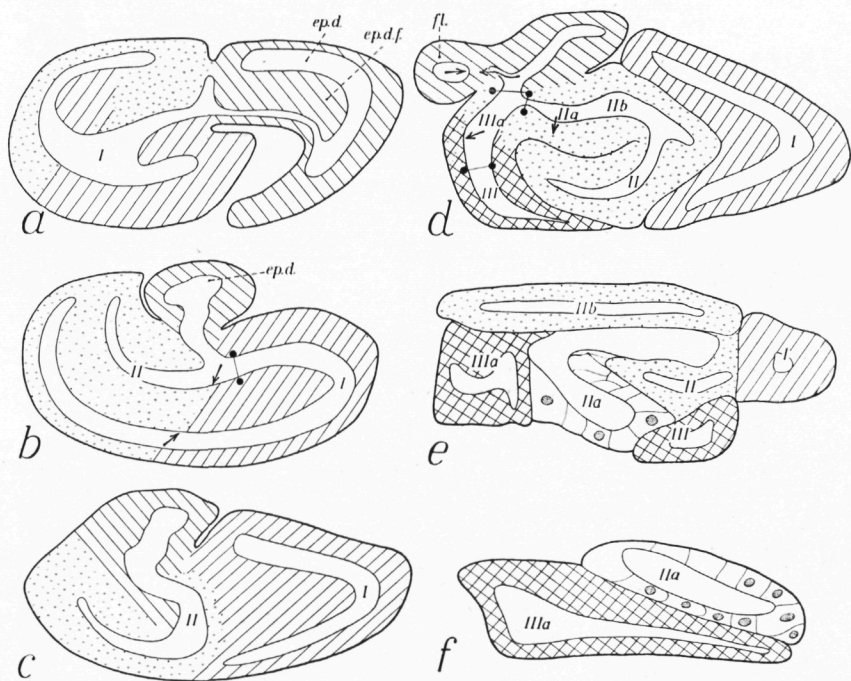


Fig. 5. — *Siphonaria normalis* GOULD. Epiphallus. $\times 30$ (approx.) *ep. d.*, epiphallus duct; *fl.*, flagellum. — Fig. 6. — *Williamia vernalis* (DALL). Scheme of a longitudinal section through the epiphallus. $\times 60$ (approx.). — Fig. 7. — *Williamia vernalis* (DALL). Cross section through the epiphallus gland. $\times 540$. *c.t.*, layer of connective tissue; *gl. c.*, glandular cells. — Fig. 8. — *Siphonaria normalis* GOULD. Cross section through lobe II of the epiphallus gland $\times 1100$ (approx.); *gl. c.*, glandular cells; *s.c.*, supporting cells. — Fig. 9. — *Siphonaria normalis* GOULD. Cross section through lobe IIa of the epiphallus gland, $\times 540$. *gl. c.*, glandular cells; *s. c.*, supporting cell.

direct connection with the continuation of the epiphallus duct, the lumen of lobe *III* is branched off (fig. 10 *d*). Further proximad the latter becomes divided into two lobes. One of them (*III*) is rather narrow and it runs half way round the periphery of the gland in oblique direction, ending blindly (fig. 10 *e*). The other (*III a*) increases in proximal direction, forming the main proximal part of the gland (fig. 10 *f*). Lobe *II* is bifurcated proximad into three lobes, two of which taper off a little more proximad (cf. the signs in fig. 10 *d*). The third (*II a*), which is characterized by extremely large glandular epithelial cells, together with lobe *IIIa* forms the most proximal part of the gland (fig. 10 *f*). The description here given of the structure of the epiphallus gland is simplified. Still more lobes occur, but



Epiphallus duct-flagellum; // lobe I; ••••• lobe II;
 x x x x lobe III; ••• coalescence proximad; → invagination proximad;
 ep.d. epiphallus duct; ep.d.f. epiphallus duct fold; fl. flagellum.

Fig. 10. — *Siphonaria normalis* GOULD. Cross sections through the epiphallus gland arranged from distal (*a*) to proximal (*f*)
 × 65 (approx.).

they are small and of little importance. The different lobes are kept together by connective tissue.

Histologically the different lobes show certain characteristics. Only the main features of the histological structure will be discussed here. Generally the epithelia are constituted by cylindrical ciliated supporting cells and the distal ends by large glandular cells. The main part of the latter is situated below the epithelium (fig. 8). In other cases the epithelium is cubical or flattened, with the subepithelial glands arranged in groups separated by connective tissue. In certain cases there seem to be no glandular cells but only large swollen and rather small-nucleated connective cells.

As already mentioned, lobe *Ila* is characterized by very large glandular cells (fig. 9). In the section *Siphonaria s. str.* they are separated by slender cells with thick membranes, perhaps functioning as supporting cells. Probably the large glandular cells in the epiphallus of *Siphonaria* are homologous with those forming almost the entire epiphallus in *Williamia*. The comparative morphological sense of this I have already discussed (HUBENDICK 1945, p. 53-54).

SUMMARY.

The *Siphonaria*, which ADAM and LELOUP (1939, p. 9) mentioned under the name *funiculata* is a new species. I describe it under the name *S. pisangensis*. It belongs to the section *Siphonaria s. str.*

An anatomical investigation shows that *S. normalis* GOULD belongs to *Siphonaria s. str.* *S. nuttalli* HANLEY seems not to be specifically distinct from *S. normalis*. Thus it is confirmed that the form *nuttalli* belongs to *Siphonaria s. str.*

The structure of the epiphallus gland in Siphonariidae, especially in *Siphonaria s. str.* is examined and described.

ZOOLOGICAL INSTITUTION, UNIVERSITY OF UPPSALA.

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