

*Syndesmis aethopharynx* sp. nov. (Turbellaria :  
Neorhabdoceola : Umagillidae), from the sea urchin  
*Paracentrotus lividus*, with notes on a probable  
third species from this host

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**Résumé :** A Banyuls-sur-Mer, l'oursin *Paracentrotus lividus* héberge deux umagillides distinctes : *Syndesmis echinorum* François, 1886 et *S. aethopharynx* sp. nov. La dernière est plus pâle et plus élancée que *S. echinorum*. Son pharynx est bipartite, avec une portion antérieure bulbeuse et une portion postérieure cylindrique. Une dilatation du canal séminal peut servir comme vésicule séminale. Le canal éjaculateur ne se replie pas. Le réceptacle séminal est exceptionnellement long, donc le vagin est très court. L'existence probable d'une troisième espèce de *Syndesmis* dans *P. lividus* est discutée brièvement.

**Abstract :** At Banyuls-sur-Mer, *Paracentrotus lividus* is host to *Syndesmis echinorum* François, 1886 and also to another umagillid, *S. aethopharynx* sp. nov. This worm is paler and more slender than *S. echinorum*. Its pharynx, moreover, is a bipartite structure, with a bulbous anterior portion and cylindrical posterior portion. A small part of the common sperm duct is dilated to form a seminal vesicle, and the ejaculatory duct is nearly straight, rather than coiled. The seminal receptacle is exceptionally long and the vagina is correspondingly short. What appears to be a third species of *Syndesmis* in *P. lividus* is discussed briefly.

## INTRODUCTION

In the original description of *Syndesmis echinorum*, the type species of the genus, François (1886) stated that the worms he observed were found in the sea urchins *Paracentrotus lividus* and *Echinus acutus* at Banyuls-sur-Mer, on the Mediterranean coast of France. Our studies on the umagillids from both of these urchins at Banyuls has shown that *P. lividus* is host to at least two species, one of which is much more common than the other, and that *E. acutus* is host to yet another species. Worms removed from the intestine of *E. acutus*, which lives in deep, cold water, deteriorate quickly, and it is not likely that François studied them as carefully as he did those from *P. lividus*.

Because François' description was brief and not supported by illustrations, and because a type specimen was not designated, we had to assume that the more common of the two distinct species of umagillids in *P. lividus* is the one that deserves to be called *S. echinorum*. Accordingly, our redescription of *S. echinorum* (Kozloff and Westervelt, 1987) was based on this worm.

In the present paper, we describe the second species of *Syndesmis* found in the intestine of *P. lividus*. We also briefly discuss, but do not formally describe or name, what is probably a third species in this host.

## MATERIALS AND METHODS

We have only six specimens of the new species, obtained from four of the 39 *P. lividus* examined at Banyuls. All of the worms were fixed in Bouin's fluid and prepared as whole mounts stained with borax carmine. Two were subsequently embedded in paraffin, serially sectioned at 8  $\mu\text{m}$ , and stained with iron hematoxylin.

## DESCRIPTION

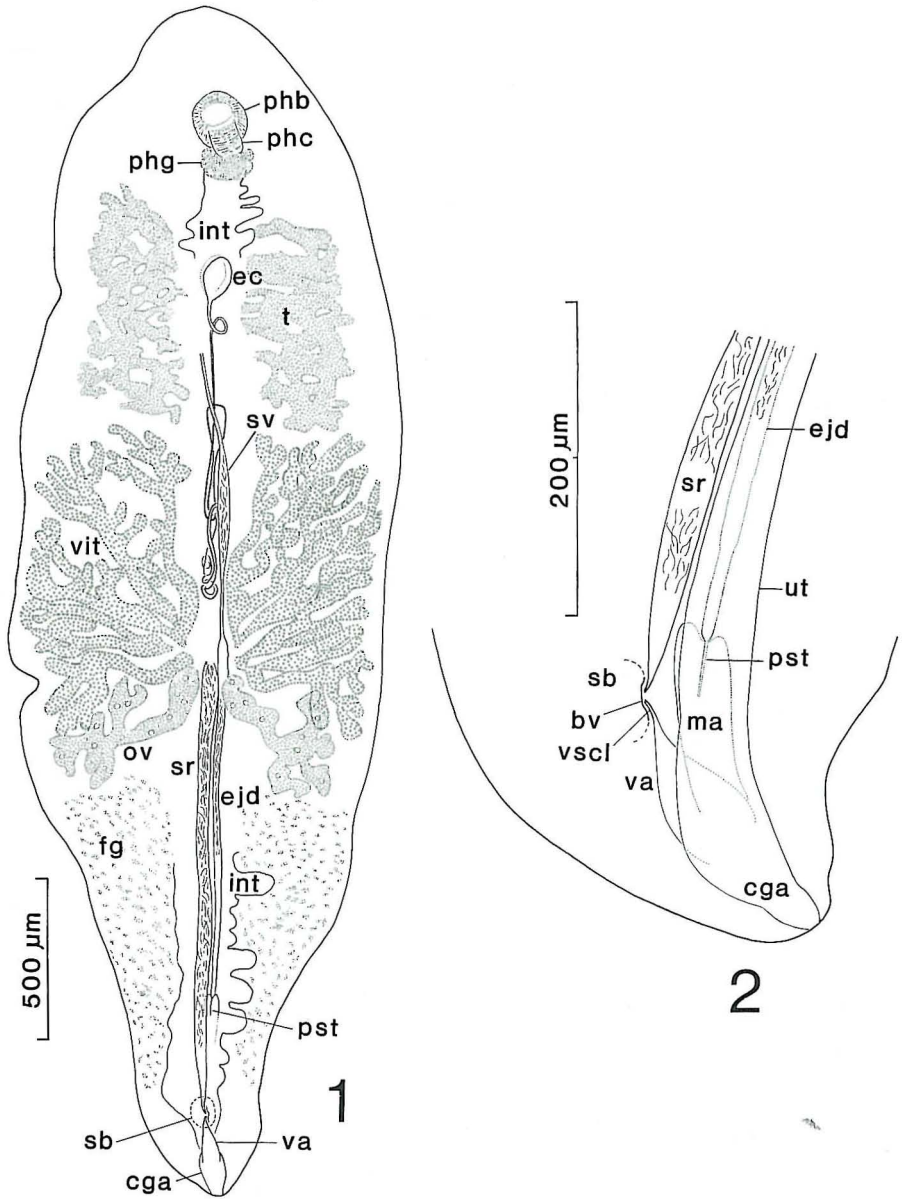
*Syndesmis aethopharynx* sp. nov. (Figs. 1-6)

In life, this species is more slender and less distinctly reddish than *S. echinorum*. Although not all of the worms observed by us were measured while alive, we believe that the largest specimen, while extended and actively gliding, was about 4 mm long and 1.2 mm wide. The epidermis is completely ciliated.

The mouth is about one-tenth of the body length from the anterior end. It is thus farther forward than in *S. echinorum*. The pharynx, moreover, is unusual in that it consists of two somewhat separate components: a bulbous portion next to the mouth, and a longer, cylindrical part (Figs. 1, 4, 5). The latter is succeeded by a short esophagus, which has a narrow lumen and which is surrounded by a conspicuous mass of glands that probably correspond to the pharyngeal glands described by Lehman (1946) for *Syndisyrinx franciscanus*. The intestinal portion of the gut, which has numerous diverticula of varying length, reaches nearly to the posterior end of the worm.

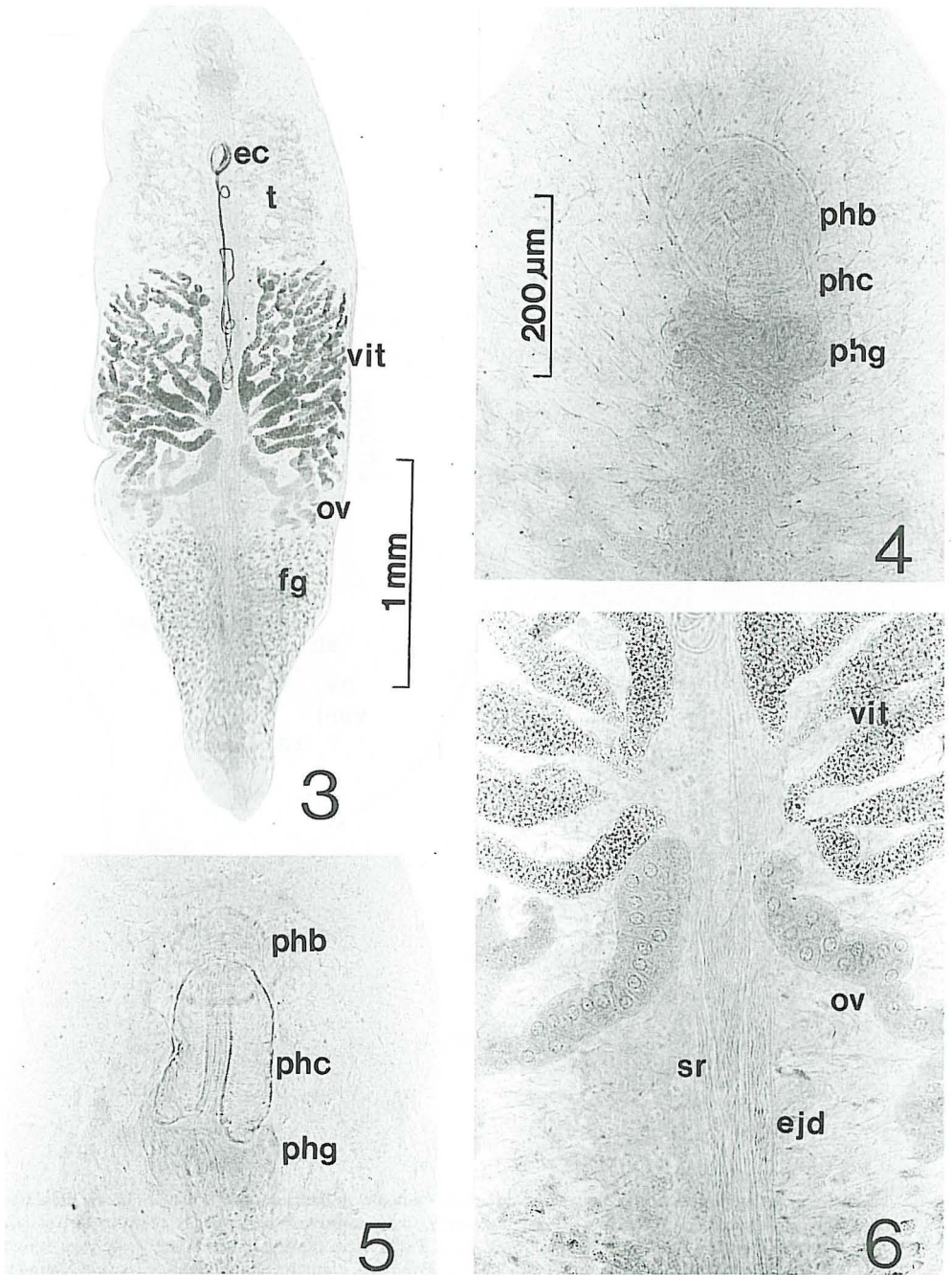
The testes, lateral to the intestine, begin at a level slightly behind the esophagus (Figs. 1, 3). They are not stained intensely by borax carmine, and appear to consist of a network of sperm-producing tissue. At least two channels, and sometimes as many as four, can be seen connecting each testis with its sperm duct. The two sperm ducts unite to form a common duct that is at first narrow, then becomes dilated into what we interpret to be a seminal vesicle (Fig. 1). Farther posteriorly, the duct narrows until it reaches the ejaculatory duct (Figs. 1, 2), characterized by prominent circular muscles external to less obvious longitudinal muscles. Over most of its length, the ejaculatory duct, including its muscular sheath, has a diameter of about 25  $\mu\text{m}$ . Unlike the ejaculatory duct of *S. echinorum*, it is not coiled, but follows a nearly straight course to the male antrum, into which the short penis stylet, only about 50  $\mu\text{m}$  long, protrudes.

Each of the vitellaria (Figs. 1, 3, 6) has six to eight primary lobes and numerous ultimate branches; the ovaries (Figs. 1, 3, 6) have three or four branches. The main trunks of the ovaries join the vitellaria to form short ovovitelline ducts that enter the ventral side of the anteriormost part of the seminal receptacle. This part of the seminal receptacle, as in other species, is filled with large cells, between which there are channels containing sperm. The seminal receptacle as a whole is exceptionally long, and the vagina, originating on the dor-



Figs. 1-2: *Syndesmis aethopharynx* sp. nov. ; whole mounts stained with borax carmine ; camera lucida drawings.

The seminal bursa is not visible in either specimen, so the approximate location of this structure is indicated by a broken line. 1. Holotype, dorsal view. 2. Paratype, portion of reproductive system, ventral view. Abbreviations (for all figures) : bv, bursal valve ; cga, common genital antrum ; ec, egg capsule ; ejd, ejaculatory duct ; fg, filament glands ; int, intestine ; ma, male antrum ; ov, ovary ; phb, bulbous portion of pharynx ; phc, cylindrical portion of pharynx ; phg, pharyngeal glands ; pst, penis stylet ; sb, seminal bursa ; sr, seminal receptacle ; sv, seminal vesicle ; t, testis ; ut, uterus ; va, vagina ; vit, vitellaria ; vscl, sclerotized portion of vagina.



Figs. 3-6: *Syndesmis aethopharynx* sp. nov. ; whole mounts stained with borax carmine ; photomicrographs. Figs. 5 and 6 are to the scale shown on Fig. 4. 3. Holotype, dorsal view. 4. Holotype, pharynx, dorsal view. 5. Another specimen, pharynx, ventral view. 6. Holotype, portion of the reproductive system.

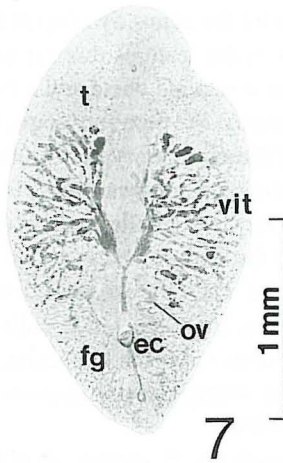


Fig. 7 : *Syndesmis* sp. ; a probable third species from *Paracentrotus lividus* ; whole mount, stained with borax carmine.

sal side of the common genital antrum, is correspondingly short (Figs. 1, 2). Where the vagina and seminal receptacle approach one another, narrow sclerotized ducts from both enter a seminal bursa through a sclerotized bursal valve similar to that of *S. echinorum* and all other species we have studied. The bursa is not obvious, however, unless it is filled with sperm, and this is the case in only one of our specimens. The uterus, whose entry into the common genital antrum is beneath that of the vagina, may reach as far forward as the anterior edges of the testes (Figs. 1, 3). The ductus communis is not visible in whole mounts, but in sections it is seen to extend from the ventral side of the anteriormost part of the seminal receptacle to the dorsal side of the uterus at the level where this is entered by the ducts of the filament glands. The filament glands, occupying much of the last quarter of the body (Figs. 1, 3), are not so crowded as those of *S. echinorum*.

This species, when alive, may be distinguished from *S. echinorum* by its pale color and more slender form. Its bipartite pharynx, seminal vesicle, nearly straight ejaculatory duct, unusually long seminal receptacle, and short vagina are other features that set it apart from *S. echinorum*.

Type specimens : the holotype of *S. aethopharynx*, a whole mount fixed in Bouin's fluid and stained with borax carmine, was taken from the intestine of *Paracentrotus lividus*, at Banyuls-sur-Mer, France. It has been deposited in the United States National Museum (Helminthological Collection N° 81036). A paratype, from the same host individual and prepared in the same way, has also been deposited in this collection (N° 81037).

## DISCUSSION

When Lehman (1946) proposed the genus *Syndisyrix*, he regarded the seminal bursa - bursal valve complex to be one of the features that separated it from *Syndesmis*. This distinction is not valid, however, for a seminal bursa and a bursal valve are present in *S. echinorum*, the type species of *Syndesmis*. We therefore suggested (Kozloff & Westervelt, 1987) that the form and proportions of the ejaculatory duct, male antrum, and penis stylet are better criteria for separating *Syndisyrix* from *Syndesmis*. In *S. franciscanus*, the type species of *Syndisyrix*, the ejaculatory duct is not coiled, the male antrum is long and narrow, and the penis stylet extends through the antrum nearly to the genital pore. The stylet is in fact commonly extruded from the pore when the worm is compressed. In *S. echinorum*, on the other hand, the ejaculatory duct is long and much coiled, the male antrum is broad and rather short, and the penis stylet does not reach the genital pore even in specimens that have been flattened. The same general arrangement is characteristic of *Syndesmis rubida* and *S. albida* (Kozloff & Westervelt, 1990).

*Syndesmis aethopharynx* is much like *S. echinorum* in having a broad male antrum and a penis stylet that apparently cannot be protruded. Its nearly straight ejaculatory duct and its seminal vesicle, however, suggest affinities with *Syndisyrix*. This species, more than any other we have studied, makes the separation of *Syndisyrix* from *Syndesmis* seem rather arbitrary. The presence or absence of a seminal vesicle on the sperm duct is perhaps a superficial distinction, for the vesicle is merely a dilation of the duct. The only really useful feature, then, may be the structure of the male antrum - penis stylet complex. Does the stylet slip freely up and down a narrow male antrum, as it does in *Syndisyrix franciscanus*, or is the male antrum broad and the position of the stylet within it so rigidly fixed that the stylet cannot reach the genital pore, as is the case in *Syndesmis echinorum*, *S. rubida*, *S. albida*, and *S. aethopharynx*?

As more species of sea urchins and sand dollars are examined for umagillids, many new worms of the *Syndesmis-Syndisyrix* complex will be discovered. Careful study of these will lead to a better understanding of the systematics of the group as a whole, and will enable us to decide whether retention of the genus *Syndisyrix* is warranted, and whether proposal of additional genera is desirable.

A PROBABLE THIRD SPECIES OF *SYNDESMIS* IN *PARACENTROTUS LIVIDUS*

In our whole-mount preparations of turbellarians from *Paracentrotus lividus*, there are four specimens of a *Syndesmis* that we believe is different from both *S. echinorum* and *S. aethopharynx*. These worms were found in only two of the 39 host urchins that were examined at Banyuls, and they were fixed and stained before their distinctive features were recognized. Because we have so little material, and because we are unable to work out certain morphological details to our satisfaction, we will not propose a name for this worm. We mention it so that other zoologists concerned with the systematics of umagillids, particularly those in *P. lividus*, will not confuse it with *S. echinorum* or *S. aethopharynx*. One specimen is illustrated in Fig. 7.

We estimate that the largest of the four specimens in our collection was about 3 mm long when it was alive and actively gliding, and that the general shape of this probably distinct species is more nearly similar to that of *S. echinorum* than to that of *S. aethopharynx*. The ejaculatory duct is coiled, but not so much so as in *S. echinorum*. Its course begins just behind the pharynx, considerably farther anteriorly than in either of the other two species from *P. lividus*. The penis stylet and relatively broad male antrum are similar, however, to those of *S. echinorum*. There is only one well developed testis, and this may be slightly to the left or right of the midline. What appears to be a rudimentary second testis is visible in one of the four specimens.

The vitellaria, with six to eight primary lobes and about 20 to 26 ultimate branches, are distinctive in that some of the branches extend considerably farther anteriorly than the testis. The two ovaries are unusual, each being sinuous and either unbranched or with only one or two short, stubby branches originating from the distal portion of the main stem. The proportions of the vagina and seminal receptacle are similar to those of *S. echinorum*. We have not observed the seminal bursa and bursal valve. The crowded filament glands occupy much of the posterior quarter of the body.

We have considered the possibility that the four worms in this series are abnormal individuals of *S. echinorum*, in which the testes and ovaries have undergone some resorption. Arguing against this idea is the fact that the ejaculatory duct begins so far anteriorly as it does, and also the fact that some branches of the vitellaria reach much farther anteriorly than they do in *S. echinorum*. It seems more likely that these worms belong to a species that ordinarily lives in some echinoid other than *P. lividus*, and that does not develop fully in the latter.

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