



***Syndesmis echiniacuti* sp. nov.**
(Turbellaria: Neorhabdocoela: Umagillidae),
from the Mediterranean sea urchin *Echinus acutus*.

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Abstract: Specimens of the sea urchin *Echinus acutus*, collected in the vicinity of Banyuls-sur-Mer and Port Vendres, France, are parasitized by *Syndesmis echiniacuti* sp. nov. The testes of this umagillid are located farther posteriorly than in most other species of *Syndesmis*, and they are distinctive in having rather slender lobes that reach nearly to the lateral margins of the body. The seminal bursa, consisting mostly of fibrous tissue, appears to have only a small permanent cavity; much of the space occupied by sperm probably develops when sperm are introduced during copulation.

Résumé : L'oursin *Echinus acutus*, récolté au large de Banyuls-sur-Mer et Port Vendres, France, est parasité par *Syndesmis echiniacuti* sp. nov. Les testicules de cet umagillide sont plus postérieurs que ceux de la majorité des espèces de *Syndesmis*, et ils sont caractérisés par des lobes assez grêles qui s'étendent presque jusqu'au bord du corps. La bourse copulatrice, remplie de tissu fibreux, possède seulement une petite cavité permanente ; l'espace occupé par les spermatozoïdes se forme probablement quand les spermatozoïdes sont introduits pendant l'accouplement.

Keywords : Turbellaria, Neorhabdocoela, Umagillidae, *Syndesmis*, Mediterranean, taxonomy.

Introduction

When François (1886) described *Syndesmis echinorum*, the type species of the genus, he stated that his material came from the sea urchins *Paracentrotus lividus* and *Echinus acutus* collected at Banyuls-sur-Mer, on the Mediterranean coast of France. While the description touched on all major structures, it was not illustrated, and this made it difficult to compare umagillids found in other hosts with *S. echinorum*. Thus the name proposed by François was for many years applied more or less indiscriminately to similar worms found in various European urchins.

At Plymouth and Roscoff, I observed that *Echinus esculentus* was parasitized by two species of *Syndesmis*.

This convinced me that *S. echinorum* needed careful study, because at least one of the turbellarians in *E. esculentus* would have to be distinct from it. I therefore went to Banyuls and examined specimens of *P. lividus* and *E. acutus*, as well as *Sphaerechinus granularis*. In *P. lividus* I found two species of *Syndesmis*, both different from those in *E. esculentus*, and also what appeared to be abnormal individuals of still another species. In *E. acutus*, which is restricted to deep subtidal habitats, the only *Syndesmis* I encountered was unlike any I had seen in other urchins. It was comparatively fragile and deteriorated quickly after being removed from its host. If François really did study worms from *E. acutus*, it is strange that he did not perceive that they were unlike those in *P. lividus*.

One of the two well defined species inhabiting the gut of *P. lividus* at Banyuls was considerably more abundant than the other, and it seemed reasonable to assume that it was the

one on which François based his description of *S. echinorum*. Furthermore, the more common species agreed with François' description of *S. echinorum* in that its ejaculatory duct was long and extensively looped. It was therefore designated by Kozloff and Westervelt (1987) as *S. echinorum*, and its morphology was described thoroughly in order to define the type species, essential for making comparisons with closely related umagillids.

Because François did not mention *Sphaerechinus granularis*, easily obtained in shallow water at Banyuls, I have for a long time wondered if he temporarily confused this urchin with *E. acutus*. The umagillid in the intestine of *S. granularis* is, on average, slightly more robust than *S. echinorum* from *P. lividus*, but it is otherwise identical. It was correctly referred to *S. echinorum* by Russo (1895). The two species of *Syndesmis* from *E. esculentus* were described by Kozloff & Westervelt (1990) as *S. rubida* and *S. albida*. The less abundant of the two species in *P. lividus*, which has a relatively short and nearly straight ejaculatory duct, was named *S. aethopharynx* by Westervelt and Kozloff (1990). The *Syndesmis* parasitizing *E. acutus* is described in this paper.

Material and Methods

Twelve specimens of *Echinus acutus* were examined. All were collected by dragging at a depth of 105 meters in the vicinity of Banyuls and Port Vendres, France. Four were parasitized by a *Syndesmis*, the worms being restricted to the gut. The total number of individuals recovered was 28; the largest number taken from a single host was 10, the smallest number three. A few specimens were studied while alive, and the rest were fixed in Bouin's fluid, some with slight flattening. Flattened specimens were stained with borax carmine and mounted whole; the others were embedded in paraffin, sectioned serially at 6 µm, and stained with iron hematoxylin. My useful preparations consist of only four whole mounts and five sets of sections.

When removed from its host, this species is inclined to begin shedding its epidermis very quickly; it also exudes considerable mucus and has a tendency to curl. Furthermore, it is easily damaged when the gut contents of *E. acutus*, which include considerable sand, are sorted. Because *E. acutus* is a deep-water species, it is possible that its umagillid parasites begin to develop abnormalities soon after urchins have been collected and placed in holding tanks in which the temperature is considerably warmer than it is in the natural habitat.

Results

Syndesmis echiniacuti sp. nov.

Figs. 1-4

Type material. Holotype (US National Parasite Collection N° 87123); paratype (USNPC No. 87124); from

intestine of *Echinus acutus* (Echinodermata: Echinoidea) collected at depth of 105 meters near Banyuls-sur-Mer and Port Vendres, France.

Description. Largest living worms about 3.1 mm long, 1 mm wide, less conspicuously flattened than *S. echinorum* and *S. aethopharynx*. Distinctly reddish when viewed in reflected light, but gut region white. Dorsal epidermis ciliated, but ventral epidermis devoid of cilia.

Mouth, on ventral surface at end of first one-seventh of body length, opening into muscular pharynx (Figs. 1A, 2A). Intestine (Figs. 1A, 2A, 3A, B), located close to dorsal surface and with about 14 diverticula on both right and left sides, extending to beginning of last one-sixth of body length.

Testes (Figs. 1A, B, 2A), each with about 10 to 14 rather slender lobes reaching nearly to lateral margins, located in third one-sixth of body. Ejaculatory duct (Figs. 2A, 3A-D) close to midline (unless displaced by flattening of specimen), conspicuously looped for much of its length, and enclosed within a sheath; this at first consisting strictly of fibrous tissue, but posteriorly exhibiting well developed longitudinal muscle. Wall of ejaculatory duct similar to that of other species of *Syndesmis* in having a layer of closely spaced circular muscles; diameter of duct (measured to outside of muscle layer) about 25 µm over most of its length; much of first quarter of duct, however, may be dilated by sperm. Anterior tip of ejaculatory duct, where sperm ducts from testes presumably enter, narrowed, but sperm ducts not observed. Hard copulatory stylet (Figs. 2A, C, 3D), beginning at collarlike structure and projecting into male antrum, about 180 µm long. Male antrum (Fig. 2A, C, 3E), opening into common genital atrium, with outer layer of longitudinal muscle and inner layer of circular muscle, and enveloped by sheath continuous with that surrounding ejaculatory duct. Epithelial lining of male antrum appearing to consist of columnar cells whose apical portions are folded. Genital pore at posterior tip of the body.

Vitellaria (Figs. 1A, B, 2A, B), behind testes and not overlapping them appreciably, with six or seven primary branches, each divided again once or twice. Ovaries (Figs. 1A, 2A, B), posterior to vitellaria, usually with four primary lobes, one or more of which may be indistinctly lobed again. Vitellaria and ovaries uniting on entering right and left sides of nearly spherical anteriormost portion of seminal receptacle (Fig. 2B); this portion occupied by large cells, between which are narrow passages through which sperm may pass (Fig. 3A). Lumen of longer, saclike posterior portion of seminal receptacle (Figs. 2B, 3B), usually filled with sperm, narrowing gradually toward bursal valve, its terminal portion apparently not hardened. Anterior portion of vagina conspicuously hardened, and lumen of slender portion leading into bursal valve extremely narrow (Figs. 2A, B, 3C). Vagina becoming gradually wider until reaching

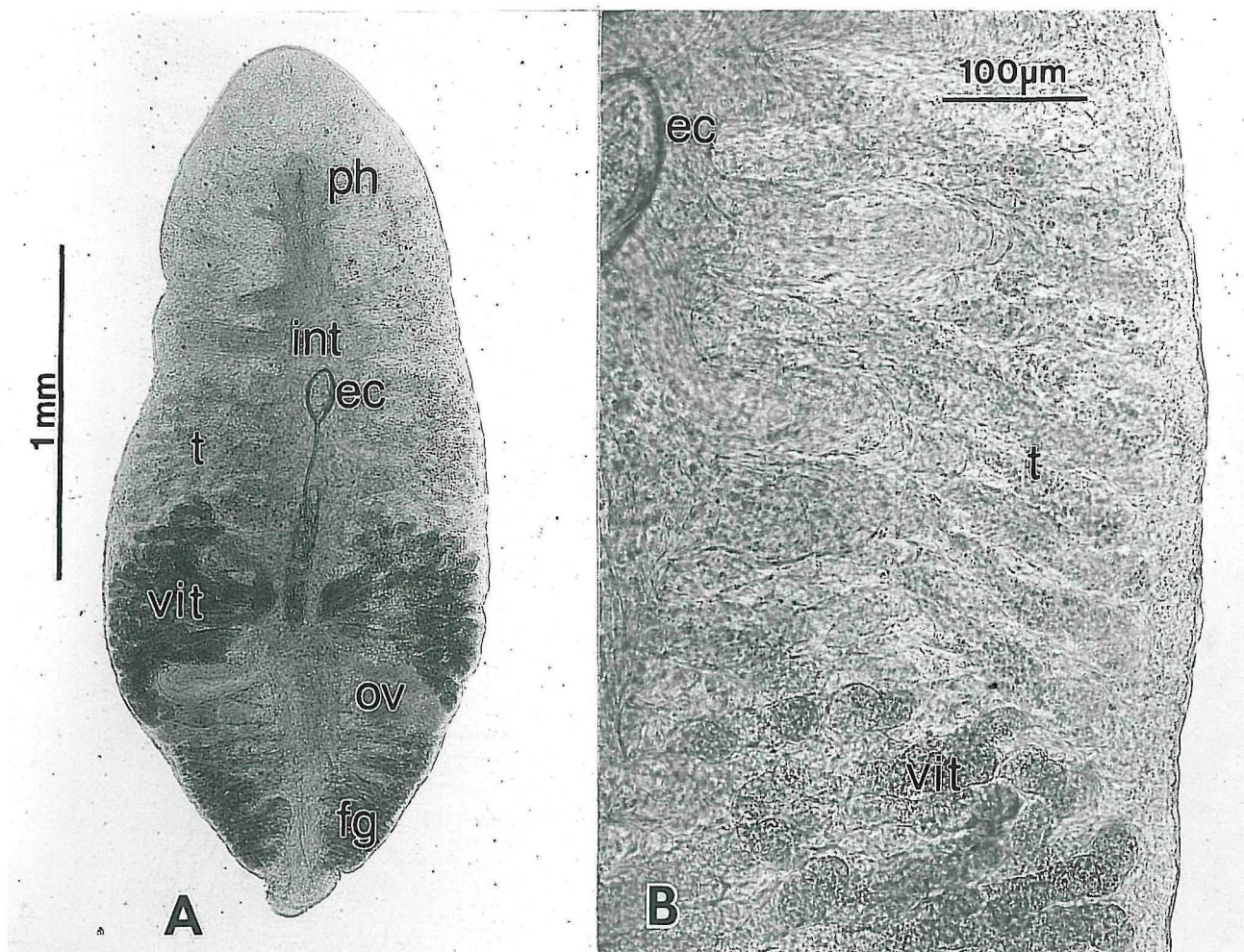


Figure 1. *Syndesmis echiniacuti* sp. nov.; holotype, stained with borax carmine. **A:** Dorsal view of entire specimen. *ec* egg capsule, *fg* filament glands, *int* intestine, *ov* ovary, *ph* pharynx, *t* testis, *vit* vitellarium. **B:** Right testis (*t*), anterior portion of right vitellarium (*vit*), and egg capsule (*ec*).

Figure 1. *Syndesmis echiniacuti* sp. nov. ; holotype, coloré au carmin boracique. **A :** Vue dorsale du spécimen entier. *ec* capsule ovigère, *fg* glandes sécrétant le filament de la capsule ovigère, *int* intestin, *ov* ovaire, *ph* pharynx, *t* testis, *vit* glande vitelloogène. **B :** Testicule droit (*t*), portion antérieure de la glande vitelloogène droite (*vit*), et capsule ovigère (*ec*).

common genital atrium. Vagina, like male antrum, with outer sheath of longitudinal muscles and inner sheath of circular muscles; much of vagina occupied by columnar epithelium (Fig. 2C). In some specimens, vagina slightly dilated near middle (Fig. 2A).

Seminal bursa (Figs. 2A, B, 3C) distinctive. Space containing sperm, lying within tissue appearing to consist mostly of fibrous components, joined to small cavity into which bursal valve protrudes. Base of valve not spreading out into substantial platelike flange typical of other species.

Uterus (Figs. 2A, C, 3A-E), lying close to ventral surface, about three-fifths as long as body. Entry of uterus into common genital atrium ventral to entrances of vagina and male antrum. Filament glands (Figs. 1A, 2A, 3D, E),

occupying much of posterior fifth of body, opening into uterus at level where ductus communis also enters. Ductus communis (Figs. 2B, 3A-D), as in other species, originating on ventral side of anterior portion of seminal receptacle. Egg capsule (Figs. 1A, B, 2A) ovoid, ranging in size from 157 by 112 μm to 170 by 121 μm . Two egg capsules observed in uterus of one living specimen.

Etymology. The species name is based on the genus and species names of the host, *Echinus acutus*.

Discussion

The most distinctive, easily observed features of *S. echiniacuti* are the form and position of the testes. These

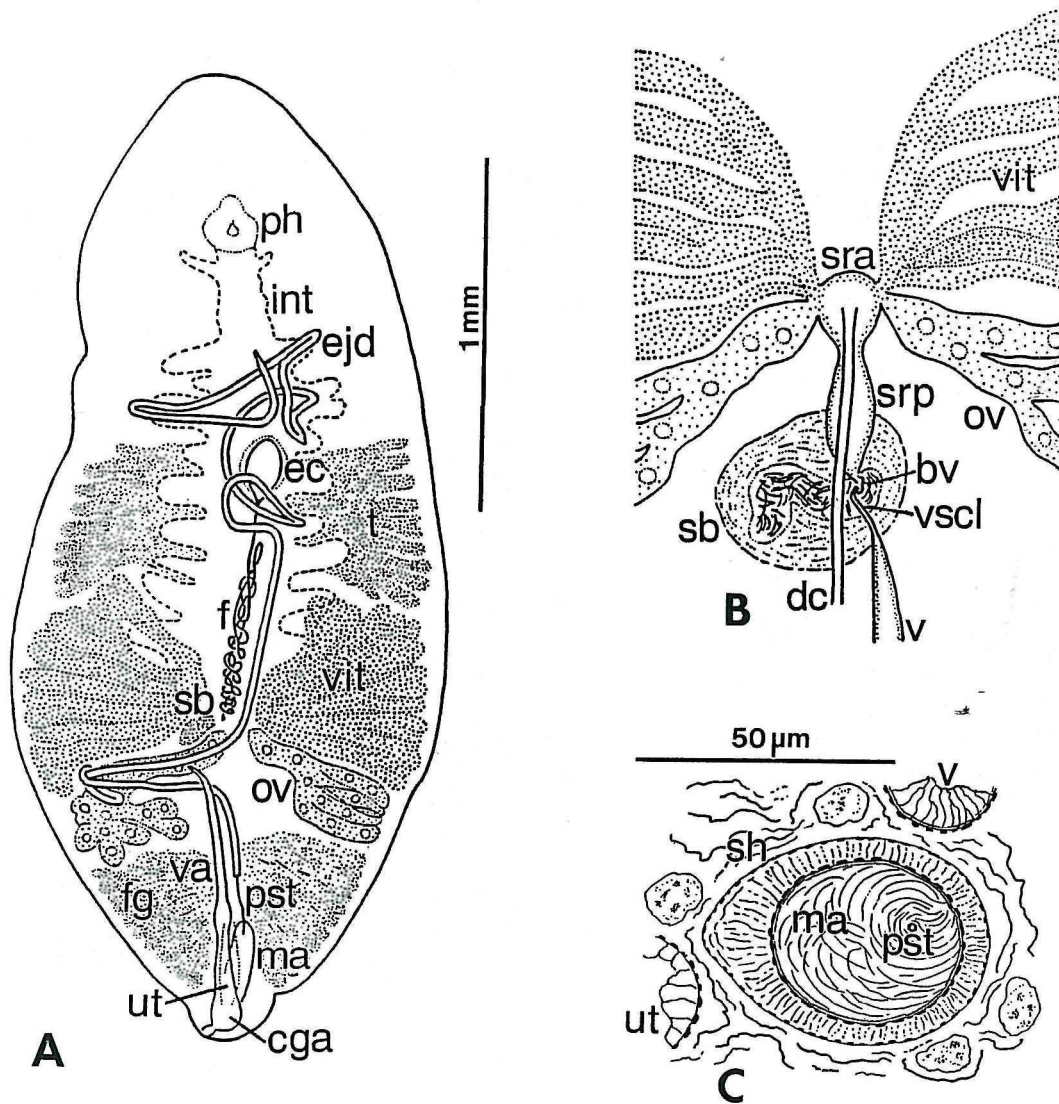


Figure 2. *Syndesmis echiniacuti* sp. nov.

A: Holotype, dorsal view (drawn with the aid of a camera lucida). Some structures (especially the ejaculatory duct, left ovary, and vagina) were distorted or displaced by compression during fixation. Ductus communis, seminal receptacle, and bursal valve omitted (see Fig. 2, B); extent of uterus evident from location of egg capsule. *cga* common genital atrium, *ec* egg capsule, *ejd* ejaculatory duct, *f* filament of egg capsule, *fg* filament glands, *int* intestine, *ma* male antrum, *ov* ovary, *ph* pharynx, *pst* copulatory stylet, *sb* seminal bursa, *t* testis, *ut* uterus, *va* vagina, *vit* vitellarium. **B:** Diagrammatic reconstruction of portion of the female reproductive apparatus; ventral view, based on a drawing of one specimen and on serial sections of another. *bv* bursal valve, *dc* ductus communis, *ov* ovary, *sb* seminal bursa, *sra* anterior portion of seminal receptacle, *srp* posterior portion of seminal receptacle, *v* vagina, *vscl* hardened portion of vagina, entering bursal valve, *vit* vitellarium. **C:** Drawing (camera lucida) of a portion of a transverse section stained with iron hematoxylin, showing hard copulatory stylet (*pst*) within male antrum (*ma*), sheath (*sh*) enclosing antrum, uterus (*ut*), and vagina (*v*).

Figure 2. *Syndesmis echiniacuti* sp. nov. **A:** Holotype, vue dorsale (dessiné à l'aide d'une chambre claire). Quelques structures (surtout le canal éjaculateur, l'ovaire gauche, et le vagin) ont été déformées par la compression pendant la fixation. L'oviducte commun, le réceptacle séminal, et la valvule de la bourse copulatrice ne sont pas dessinés (voir Fig. 2, B) ; l'emplacement de la capsule ovigère indique l'étendue de l'utérus. *cga* atrium génital commun, *ec* capsule ovigère, *ejd* canal éjaculateur, *f*, filament de la capsule ovigère, *fg* glandes qui sécrètent le filament de la capsule ovigère, *int* intestin, *ma* antrum mâle, *ov* ovaire, *ph* pharynx, *pst* stylet copulateur, *sb* bourse séminale, *t* testicule, *ut* utérus, *va* vagin, *vit* glande vitellogène. **B:** Reconstruction schématique d'une partie de l'appareil génital femelle ; vue ventrale, basée sur le dessin d'un spécimen entier et sur des coupes longitudinales en série. *bv* valvule de la bourse copulatrice, *dc* oviducte commun, *ov* ovaire, *sb* bourse séminale, *sra* partie antérieure du réceptacle séminal, *srp* partie postérieure du réceptacle séminal, *v* vagin, *vscl* partie durcie du vagin, à l'entrée de la bourse copulatrice, *vit* glande vitellogène. **C:** Dessin (chambre claire) d'une partie de coupe transversale (coloration : hématoxyline ferrique), montrant le stylet copulateur (*pst*) dans l'antrum mâle (*ma*), la gaine (*sh*) qui entoure l'antrum, utérus (*ut*), et vagin (*v*).

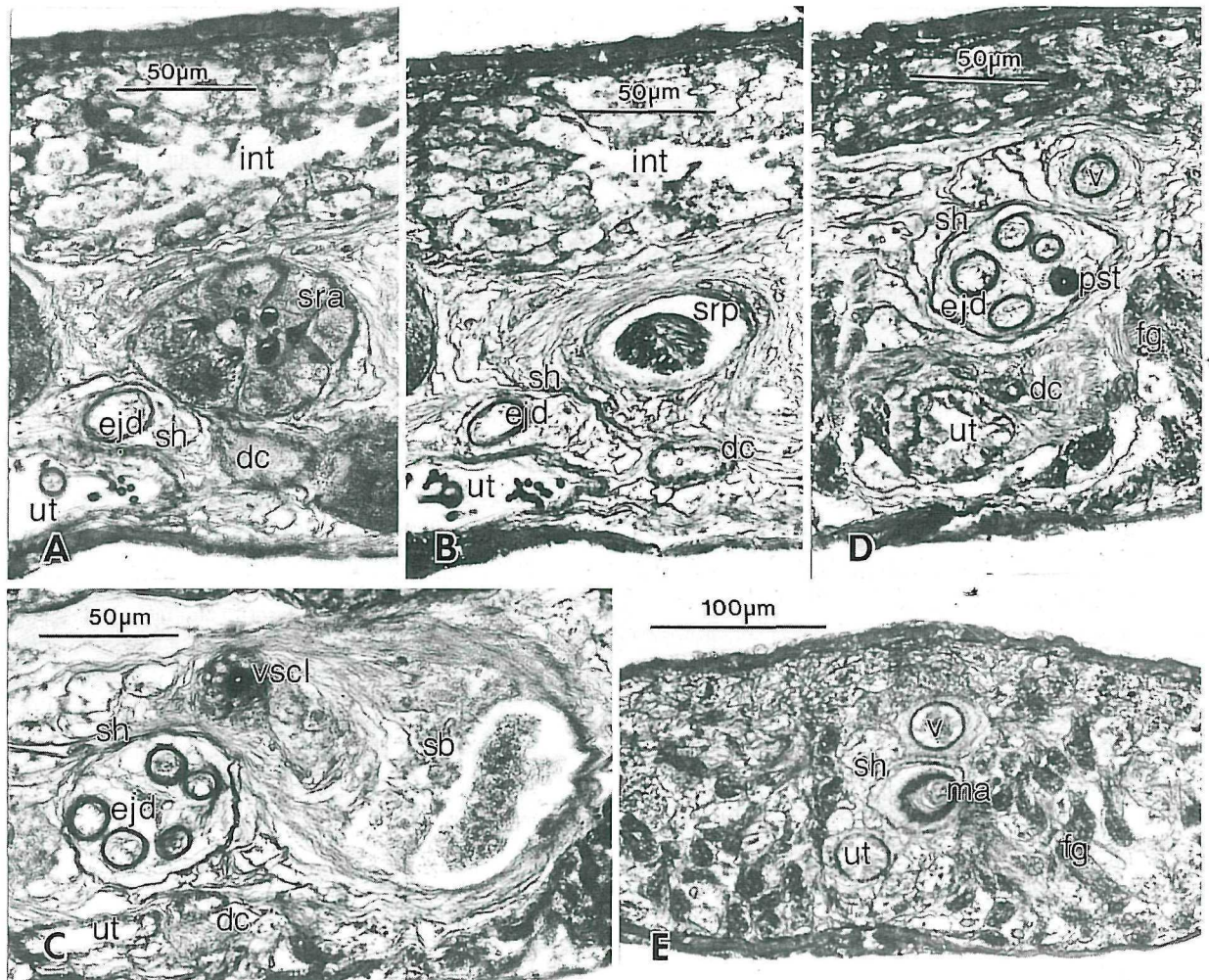


Figure 3. *Syndesmis echiniacuti* sp. nov.; photomicrographs of transverse serial sections of one specimen, stained with iron hematoxylin. **A:** Anterior portion of seminal receptacle (*sra*), posterior to origin of ductus communis (*dc*); *ejd* ejaculatory duct, *int* intestine, *sh* sheath enclosing ejaculatory duct, *ut* uterus. **B:** Saclike posterior portion of seminal receptacle (*srp*), ductus communis (*dc*), ejaculatory duct (*ejd*), intestine (*int*), sheath (*sh*) around ejaculatory duct, uterus (*ut*). **C:** Seminal bursa (*sb*) and hardened anterior portion of vagina (*vscl*) just posterior to bursal valve. *dc* ductus communis, *ejd* loops of ejaculatory duct, *sh* sheath around ejaculatory duct, *ut* uterus. **D:** Uterus (*ut*), slightly anterior to the level at which it is entered by the ductus communis (*dc*) and filament glands (*fg*). *ejd* loops of ejaculatory duct, *pst* collarlike thickening at proximal end of copulatory stylet, *sh* sheath around ejaculatory duct. **E:** Vagina (*v*), antrum male (*ma*), and uterus (*ut*) nearing their confluence at the common genital atrium. *fg* filament glands, *sh* sheath around male antrum.

Figure 3. *Syndesmis echiniacuti* sp. nov. ; photomicrographies de coupes transversales sériees, colorées par l'hématoxyline ferrique. **A :** Partie antérieure du réceptacle séminal (*sra*), en arrière de l'insertion de l'oviducte commun (*dc*). *ejd* canal éjaculateur, *int* intestin, *sh* gaine qui entoure le canal éjaculateur, *ut* utérus. **B :** Partie postérieure du réceptacle séminal (*srp*). *dc*, oviducte commun, *ejd* canal éjaculateur, *int* intestin, *sh* gaine qui entoure le canal éjaculateur, *ut* utérus. **C :** Bourse séminale (*sb*) et portion antérieure durcie du vagin (*vscl*), immédiatement en arrière de la valvule de la bourse copulatrice. *dc* oviducte commun, *ejd* replis du canal éjaculateur, *sh* gaine qui entoure le canal éjaculateur, *ut* utérus. **D :** Utérus (*ut*), légèrement en avant du niveau de l'entrée de l'oviducte commun (*dc*), et glandes (*fg*) qui sécrètent le filament de la capsule ovigère. *ejd* replis du canal éjaculateur, *pst* collerette proximale du stylet copulateur, *sh* gaine qui entoure le canal éjaculateur, *v* vagin. **E :** Vagin (*v*), antrum mâle (*ma*) et utérus (*ut*) près de leur débouché dans l'atrium génital commun. *fg* glandes sécrétant le filament de la capsule ovigère, *sh* gaine autour de l'antrum mâle.

gonads are situated more posteriorly than in most other species of the genus, and they have rather slender lobes that extend nearly to the lateral margins of the body. In *S. philippinensis* Komschlies and Vande Vusse (1980), the testes are at approximately the same transverse level as they are in *S. echiniacuti*, but they are compact. The general appearance of *S. philippinensis*, moreover, is decidedly different from that of *S. echiniacuti*. In the original description of *S. dendrastrorum* Stunkard and Corliss (1951), the testes are stated to be in the posterior portion of the anterior half of the body, and this is shown in a drawing. In an illustration of *S. dendrastrorum* provided by Smith (1973), however, the typically single testis of this species is considerably farther forward than claimed by Stunkard and Corliss. In any case, there is little similarity between *S. echiniacuti* and *S. dendrastrorum*.

The seminal bursa of *S. echiniacuti* also deviates from the usual form seen in the genus. Much of it consists of tissue that appears to have fibrous components, and except for a small cavity into which the bursal valve protrudes, the space occupied by sperm looks as if it had been formed when sperm were forced into the bursa. The absence of a substantial hard flange at the base of the bursal valve is another distinctive feature. I wish to emphasize, however, that my interpretation of the morphology of the bursa is provisional.

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