

***Salmoneus sketi*, a new species of alpheid shrimp (Crustacea:
Decapoda: Caridea) from a submarine cave in the Adriatic**

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Key words: Decapoda; Caridea; Alpheidae; *Salmoneus*; new species; Mediterranean Sea.

A new species of Alpheidae, *Salmoneus sketi*, is described and figured. Two specimens of the species were found in a submarine cave in the Adriatic.

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Introduction

In 1988/89 Dr B. Sket from the Ljubljana University in Yugoslavia sent two specimens of an alpheid shrimp from a submarine cave in the Adriatic for identification to the NNM. The specimens proved to belong to a new species which is described here.

Abbreviations used are: pocl. for postorbital carapace length, and RMNH for Rijksmuseum van Natuurlijke Historie, Leiden.

***Salmoneus sketi* spec. nov.**

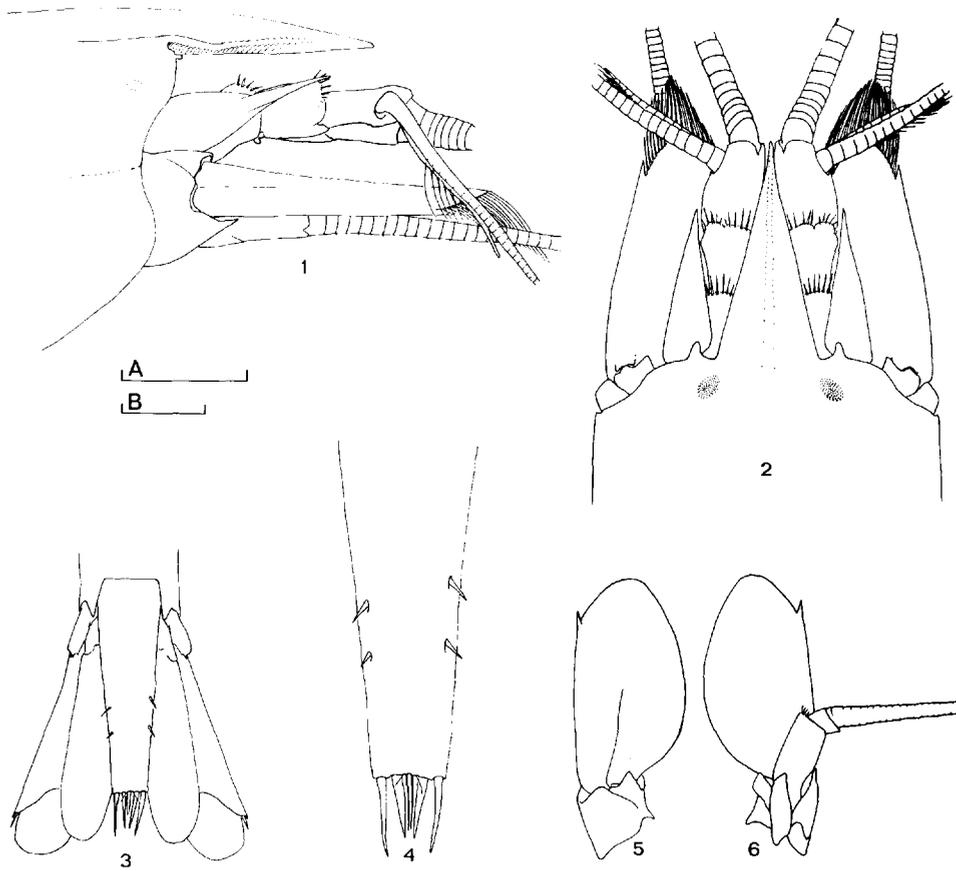
(figs. 1-29)

Material.— Holotype, 1 ovigerous ♀, pocl. 5.8 mm (RMNH D 38494, dissected); paratype, 1 ovigerous ♀, pocl. 6.9 mm (Biology Department University of Ljubljana, Yugoslavia). Both from underwater cave off the N coast of the small Island Lavernaka in the Kornati Archipelago, Middle Dalmatia, Adriatic, August 1988, caught by "Sket bottle".

Description of ovigerous female holotype.— Rostrum elongate, about half as long as pocl., reaching end of antennular peduncle, indistinctly carinate dorsally, without dentation (fig. 1). Tip of rostrum sharp, straight. Dorsal aspect of rostrum triangular (fig. 2). Lateral eaves completely concealing eyes in dorsal view. Orbital teeth small and lobate.

Carapace with anterior margin excavate above and behind antennal peduncle.

Pleura of anterior two abdominal somites broadly rounded, of third somite subrectangular, of fourth somite rectangular with acute posterior angle, of fifth somite with produced acute posterior angle. Sixth somite about 1.5 times longer than fifth somite, with traces of articulation posterolaterally. Telson (fig. 3) three times longer than proximal width; distal margin half as wide as proximal margin. Distal margin (fig. 4) straight, with two pairs of terminal spines, lateral pair somewhat longer than mesial pair. Between mesial pair two long setae directing distally, and two short setae directed obliquely outwards. Two pairs of dorsal spines present on 0.55 and



Figs. 1-6. *Salmoneus sketi* spec. nov., ♀ holotype, pod. 5.8 mm. 1, anterior region, lateral aspect; 2, anterior region, dorsal aspect; 3, telson and uropods, dorsal aspect; 4, distal part telson, dorsal aspect; 5, scaphocerite, dorsal aspect; 6, scaphocerite and antennal peduncle, ventral aspect. (Scale A: 1, 2, 4 = 1 mm; 3 = 2 mm. Scale B: 5, 6 = 1 mm).

0.70 of telson length.

Eyes small, reduced, composed of few rather large facets. Eystalks very short.

Antennular peduncle reaching tip of rostrum. Stylocerite just overreaching second antennular segment, triangular, with an acute distal point. Basal segment with ventral longitudinal carina, with distal tooth. Basal, second and third antennular segment of about the same length, all slightly longer than broad. Basal and second segment with a row of distal dorsal spines. Outer antennular flagellum biramous; first five segments fused. Shorter ramus of five segments with aesthetascs.

Scaphocerite (figs. 5, 6) about two times as long as wide, reaching tip of rostrum. Outer margin straight with distal tooth. Blade medially broadest, extending far beyond tooth anteriorly. Antennal peduncle about 0.6 times length of antennal scale; basal segment with ventral longitudinal carina with distal tooth.

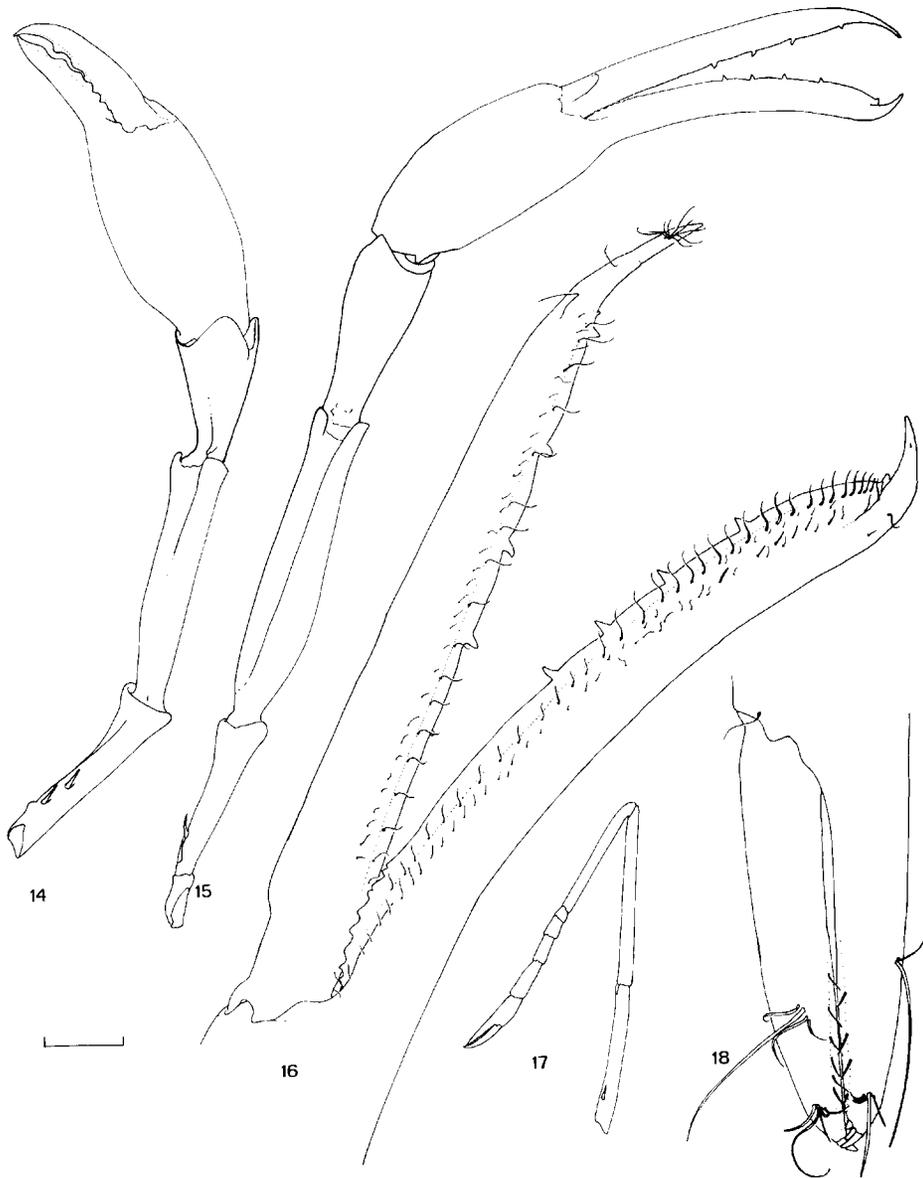
Branchial formula as in table 1.

Table 1. Branchial formula in *Salmoneus sketi* spec. nov.

	maxillipeds			pereiopods				
	1	2	3	1	2	3	4	5
pleurobranchs	-	-	-	1	1	1	1	1
arthrobranchs	-	-	1	-	-	-	-	-
podobranchs	-	-	-	-	-	-	-	-
setobranchs	-	-	-	1	1	1	1	1
epipods	1	1	1	1	1	1	1	-
exopods	1	1	1	-	-	-	-	-

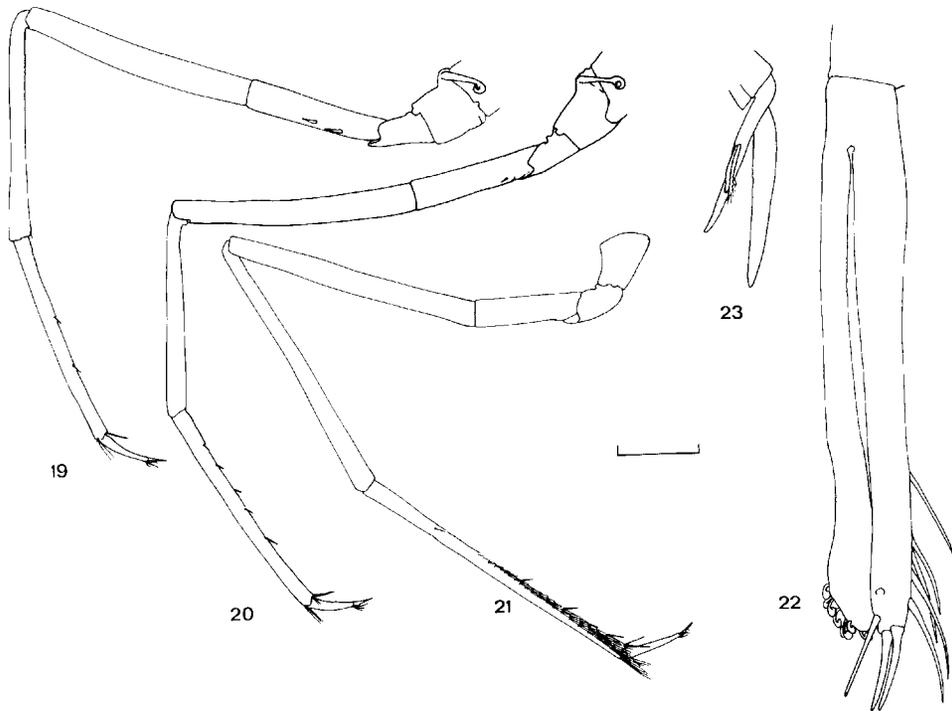


Figs. 7-13. *Salmoneus sketi* spec. nov., ♀ holotype, pochl. 5.8 mm. 7, right mandible; 8, right first maxilla; 9, right second maxilla; 10, right first maxilliped; 11, right second maxilliped; 12, right third maxilliped; 13, right third maxilliped, distal part. (Scale: 7-11 = 0.4 mm; 12 = 1.0 mm; 13 = 0.1 mm).



Figs. 14-18. *Salmoneus sketi* spec. nov., ♀ holotype, pochl. 5.8 mm. 14, right first pereiopod; 15, left first pereiopod; 16, left first pereiopod, fingers; 17, right second pereiopod; 18, right second pereiopod, fingers. (Scale: 14, 15, 17 = 1 mm; 16 = 0.4 mm; 18 = 0.1 mm).

Mandible (fig. 7) with two-segmented palp; ultimate segment with many setae. Molar process stout, with central groove, distally with many short spinules. Incisor process distally broad with eight teeth. First maxilla (fig. 8) with slender lower endite; upper endite broad with two rows of stout distal spines; palp bilobed. Second maxilla (fig. 9) with bifid upper endite with many long slender distal setae; lower endite short, blunt with few setae; palp small; scaphognathite well developed both anterior and posterior lobe rounded. Maxillipeds with exopods and epipods. First



Figs. 19-23. *Salmeoneus sketi* spec. nov., ♀ holotype, pocl. 5.8 mm. 19, right third pereiopod; 20, right fourth pereiopod; 21, right fifth pereiopod; 22, right second pleopod; 23, appendix interna and appendix masculina on endopod of second pereiopod. (Scale: 19-22 = 1 mm; 23 = 0.1 mm).

maxilliped (fig. 10) with endites separated by deep notch; upper endite broad, with many slender setae; lower endite small with few setae; palp overreaching small caridean lobe; epipod bilobed. Second maxilliped (fig. 11) with very broad dactylar segment; oblong propodal segment; short triangular carpal segment. Third maxilliped (fig. 12, 13) three-segmented; ultimate segment twice as long as penultimate, with numerous setae and three distal spines; antepenultimate segment as long as distal two segments together; very small arthrobranch present.

First pereiopods unequal in length and form. Right first pereiopod (fig. 14) shorter but more robust than left first pereiopod. Both movable and fixed finger with six teeth on cutting edges, and hooked distal part. Fingers about 0.8 times palm length. Palm swollen, without ornamentations. Carpus arched, short, about 0.6 times palm length, distally broadening. Merus slightly longer than palm, narrow, flexor margin flattened, excavate distally. Ischium 0.75 times merus length, broadening distally; two basal ventral spines present. Left first pereiopod (fig. 15) with both movable and fixed finger slender, each with four small triangular teeth on distal half of cutting edges; fixed finger with nine small teeth in proximal 1/5 (fig. 16). Distal part of both fingers hooked. Fingers 1.6 times palm length. Palm little swollen, without ornamentation. Carpus almost as long as palm, not arched. Merus 1.6 times carpus length, narrow, flexor margin strongly excavate. Ischium about half as long as merus, broadening distally; two basal ventral spines present. Second pereiopods (fig. 17) with simple, small chela (fig. 18); cutting edges entire. Fingers slightly longer than palm.

Carpus about one third of chela length, five-articulated; proximal segment slightly longer than four distal segments, which increase in length distally. Merus narrow, as long as proximal four carpal segments. Ischium nearly as long as merus: one basal ventral spine present. Third pereiopod (fig. 19) with slender dactylus, slightly curved; unguis 0.25 times the total dactylar length. Propodus three times as long as dactylus with two small ventral spines. Carpus almost as long as propodus. Merus as long as carpus. Ischium 0.6 of merus length with two ventral spines. Fourth pereiopod (fig. 20) as third pereiopod; one small ventral spine on ischium. Fifth pereiopod (fig. 21) slender, about 1.3 times longer than third and fourth pereiopod. Propodus with many distal setae; ischium without ventral spines.

Uropods overreaching telson; exopod with lateral spine at diaeresis.

Endopod of second pleopod with appendix interna as long as appendix masculina (fig. 22, 23).

Eggs ca. 100; diameter 0.5 mm.



Fig. 24. Map of the underwater cave off N coast of Lavernaka Island, Kornati Archipelago, Middle Dalmatia, Adriatic, indicating sites where specimens of *Salmoneus sketi* were seen (1-3) and caught (1, 3). Drawing by B. Sket.

Colour.— Transparent except for orange-red hepatopancreas, eyes and eggs (B. Sket personal communication; colour slides).

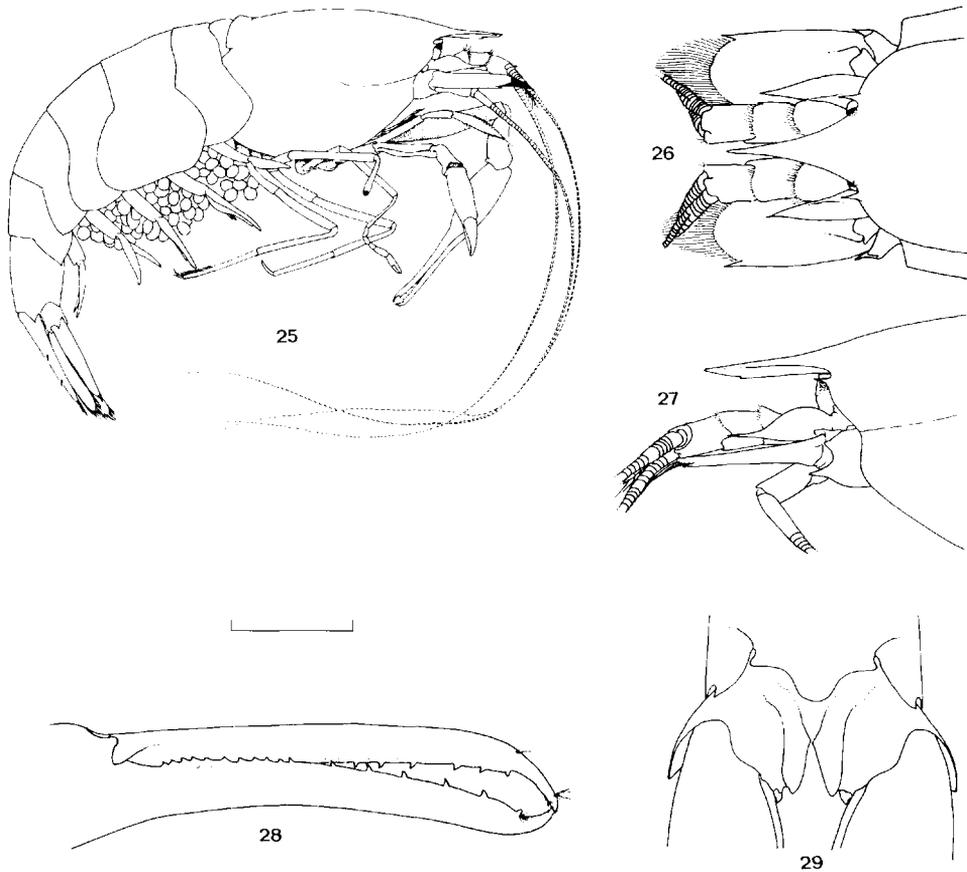
Description of ovigerous female paratype as far as different from holotype.— Rostrum elongate, about one third of pochl., reaching half of third segment of antennular peduncle, not carinate dorsally; one ventral tooth present (figs. 25, 26). Lateral margins of rostrum concave in dorsal aspect (fig. 27). Lateral eaves partly concealing eyes in dorsal view (fig. 27). Orbital teeth sharp.

Antennular peduncle reaching beyond tip of rostrum. Stylocerite not overreaching second antennular segment.

Mouthparts not studied.

Chela of left first pereiopod (fig. 28) with six small triangular teeth in distal half of movable finger. Fixed finger with five small triangular teeth in distal half and eleven small teeth in proximal half.

Habitat.— The locality where the specimens were caught is a small, vertical, marine cave with the entrance at 7 m and the bottom at 20 m depth approximately (fig. 24). Walls are partly covered by dripstone formations as well as by fingerlike formations of bryozoan origin, in some sheltered places very long tubes of Polychaeta (*Filogranula cf. annulata*



Figs. 25-29. *Salmoneus sketi* spec. nov., ♀ paratype, pochl. 6.9 mm. 25, habitus, lateral aspect; 26, anterior region, lateral aspect; 27, anterior region, dorsal aspect; 28, left first pereiopod, fingers; 29, sixth abdominal segment and basis uropods and telson, ventral aspect. (scale: 25 = 4 mm; 26, 27 = 2 mm; 28, 29 = 1 mm).

(O.G. Costa) are present. Horizontal surfaces are covered with fine silt. The shrimps were resting on walls or on the bottom. All specimens were caught by a "suction bottle" or "Sket bottle". Traps with pieces of apple, cheese, and smashed marine snails, left overnight, did not attract shrimps. A third specimen was seen below in the cave, this specimen was not caught. The salinity (S) in the cave is 37‰, which is the normal salinity in the Adriatic. Temperature is remarkably lower than outside the cave, probably the same as under the thermocline. Inner parts of the cave are completely dark.

Etymology.— *Salmoneus sketi* is named in honour of the collector, Dr B. Sket of Ljubljana University, Yugoslavia.

Remarks.— Banner & Banner (1981) revised all the records of *Salmoneus* species. They counted 16 species in the genus of which 13 are Indo-Pacific. At present five species of the genus *Salmoneus* are known from the Atlantic: *S. arubae* (Schmitt, 1936), *S. cavicolus* Felder & Manning, 1986, *S. jarli* (Holthuis, 1951), *S. ortmanni* (Rankin, 1898), *S. setosus* Manning & Chace, 1990, and *S. teres* Manning & Chace, 1990. Like *S.*

sketi, *S. arubae*, *S. cavicolus*, *S. jarli*, *S. ortmanni*, and *S. setosus* have the posterior margin of the telson straight, while *S. teres* and the Indo-Pacific species (except for *S. bruni* Banner & Banner, 1966) have the posterior margin emarginate. *S. jarli* is known from the East Atlantic (off Nigeria, 19 m depth; total length 11 mm), *S. setosus* and *S. teres* from Ascension Island, and *S. arubae*, *S. cavicolus*, and *S. ortmanni* from the West Atlantic. *S. jarli* and *S. sketi* are the only species known to have a slender first pereopod longer than the stout first pereopod. In the Mediterranean one small specimen (8 mm) of *Salmoneus* was found off Nabi Rubin, near the coast of Israël (Holthuis & Gottlieb, 1958: 39, 40, fig. 7) in 90 m depth. This specimen was damaged and could only be assigned provisionally to *S. jarli*. This specimen differs from the holotype of *S. jarli* in some characters, but this could be intra-specific variation as noted by Holthuis and Gottlieb. From these two specimens of *Salmoneus jarli*, *Salmoneus sketi* differs in several characters (table 2).

Table 2. Morphological differences between *Salmoneus sketi* and *Salmoneus jarli*.

	<i>Salmoneus sketi</i>	<i>Salmoneus jarli</i>
Rostrum:	overreaches second segment of antennular peduncle.	does not overreach second segment of antennular peduncle.
1st left leg:	slender, with very long chela with dentate cutting edges; merus with excavated flexor margin; ischium with two ventral spines.	robust, cutting edges unarmed; merus without excavated flexor margin; ischium without ventral spines.
1st right leg:	robust, cutting edges dentate; ischium with two ventral spines.	slender, cutting edges unarmed; ischium without ventral spines.
Leg 3-5:	dactyli 0.3 times propodus length.	dactyli 0.8 times propodus length.
Telson:	dorsal spines at 0.55 and 0.70 of telson length.	dorsal spines at 0.50 and 0.80 of telson length.
Size:	total length 20 and 22 mm.	total length 8 and 11 mm.

Felder & Manning (1986) showed that sexual and size-related intra-specific differences occur in *S. cavicolus*. The variable characters include: spination of the ischium, size and shape of the rostrum, relative lengths of antennular peduncle-segments, stylocerite, scaphocerite and rostrum. This could also be the case in other species of the genus. Unfortunately only small samples of most species in the genus are known. Biological data are also scarce.

The differences recorded in table 2 are here considered sufficient to regard the Adriatic specimens of *S. sketi* not conspecific with *S. jarli*.

The presence of an appendix masculina in ovigerous females in *Salmoneus* could be an indication of protandic hermaphroditism, as was recently discussed by Carvacho (1989: 255).

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