

SPADELLA LEGAZPICHESSI, A NEW BENTHIC
CHAETOGNATH FROM ENEWETAK,
MARSHALL ISLANDS

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Abstract.—*Spadella legazpichessi* is described from adult mature individuals and compared with related species, *S. schizoptera*, *S. moretonensis*, *S. johnstoni*, *S. sheardi*, *S. nana*, *S. pulchella*, *S. hummelincki*, with which it agrees in the presence of adhesive digital organs. The diagnostic characteristics of these species and *S. legazpichessi* are compiled in a table together with information on their geographical distribution.

Spadella is a genus of Chaetognatha including animals of benthic regimen. These animals are small, from less than 1 mm to less than 1 cm. Their restricted habitat and movements limit the distribution of the species. Specimens of *Spadella* do not appear in the usual plankton collections, and collectors of benthic animals usually overlook these small organisms. Therefore, they are obtained only occasionally. Up to now the number of species is one dozen, but I am sure that with proper sampling along the coastal regions of the world, many new species will be found, and a more adequate distributional range of all the known species of *Spadella* will be obtained.

Alvariño (1970) reviewed the geographic distribution of the species. Since then two more species of *Spadella* have been described, *Spadella bradshawi* Bieri, 1974 and *Spadella gaetanoi* Alvariño 1978, inhabiting California and the Hawaiian Islands, respectively. Also, *S. angulata* was observed at the Laccadive Islands (Nair and Rao, 1973). Now specimens of a new *Spadella* have been collected at the lagoon of Enewetak (formerly Eniwetok), Marshall Islands.

The new species of *Spadella* described here is related to *S. schizoptera*, *S. moretonensis*, *S. johnstoni*, *S. sheardi*, *S. nana*, *S. pulchella*, *S. hummelincki*, in the presence of adhesive digital organs on the ventrolateral sides of the tail segment. However, *S. schizoptera*, *S. johnstoni*, and *S. sheardi* have been described with two pairs of lateral fins, while *S. moretonensis*, *S. nana*, *S. pulchella*, and *S. hummelincki* have only one pair of lateral fins. Intestinal diverticula are absent in these species and in *Spadella* n. sp., although Yosii and Tokioka (1939) indicated they were present in *S. schizoptera*, where they are absent according to Conant (1895), Ritter-Zahony (1911), Mawson (1944). Probably the specimens analyzed by Yosii and Tokioka (1939) do not belong to *S. schizoptera*.

Spadella legazpichessi new species

Figs. 1, 2

Material.—Holotype (USNM No. 60191), paratypes (USNM No. 60192) collected at Enewetak atoll lagoon, Marshall Islands, in May 1979.

Diagnosis.—The anatomical features described here are based on mature adult specimens.

The body is opaque, with well developed muscles on the dorsal and ventral sides. Lateral sides very narrow. The whole animal presents a peculiar iridescence characteristic of most Chaetognatha. No pigment or pigmentation patterns have been observed (Fig. 1A, B).

Total length when mature, up to 2 mm, tail fin not included. The body is widest at the region of the transverse septum separating trunk and tail segments.

The head is large, strong, about the same length and width, but wider than the neck. It is about 13% of the total length of the animal. The neck is distinct and covered by a thick collarette (Fig. 2A).

The caudal segment constitutes 50% of the total length of the animal.

The eyes are large, oval, placed at center of dorsal side of the head, and at about the same distance from each other or slightly closer to each other than to the sides of the head. The pigmented region is large, formed by 2 branches; the longer extending parallel to the longitudinal axis of the body and curving laterally at each end; it is crossed at midlength by a short, thick, bifurcated transverse branch that runs medially. The pattern of the pigment in the eyes of *Spadella legazpichessi* is similar to that found in most species of *Spadella*. The pigment separates 3 large and one small clear amber spaces, filled by lenses. The bifurcation of the transverse branch of pigment is at times quite deep (Fig. 2A).

The hooks are strong, thick, strongly curved, as in *Sagitta ferox* and *S. robusta*, usually a group of 8 or 9 at each side of the head. The anterior teeth are 3 to 5 per set, long curved inward and posteriorly. The second and third teeth at each side, counting from the center of the head, are longer than the others, the third being the longest; the fifth is the shortest. No posterior sets of teeth were observed.

The corona ciliata is ring-shaped, with the transverse axis slightly longer than the longitudinal axis. It is located at the dorsal side of the neck, extending into the collarette region of the neck (Figs. 1A and 2A).

The collarette extends in a thick stratum from the head to level of posterior septum. It is thickest at the neck, tapering towards the posterior part of the trunk, and extending as a narrow stratum to the tip of the tail.

Intestinal diverticula absent.

The ventral ganglion is large, thick, occupying totally the width of the

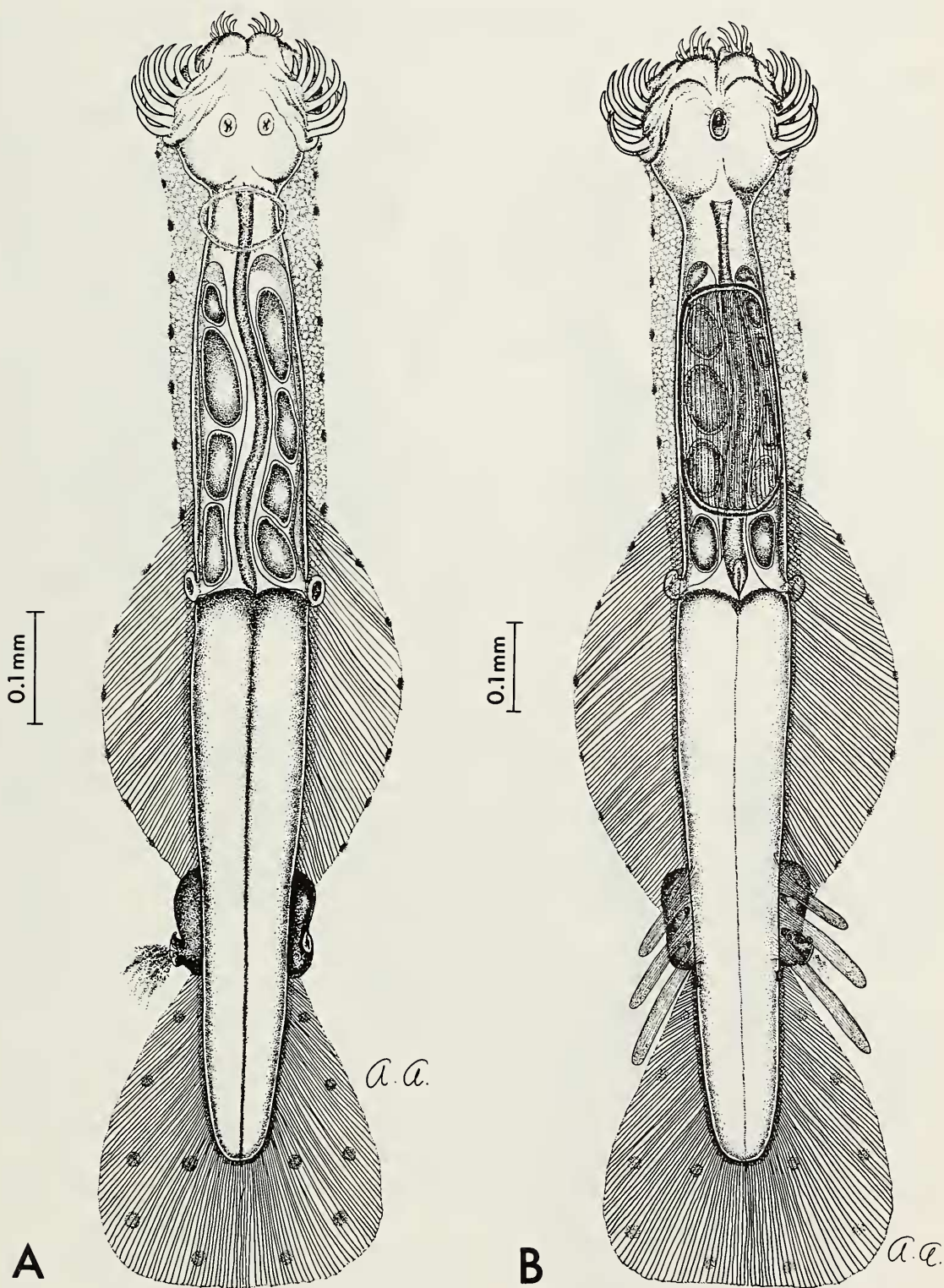


Fig. 1. *Spadella legazpichessi*: A, Dorsal view; B, Ventral view.

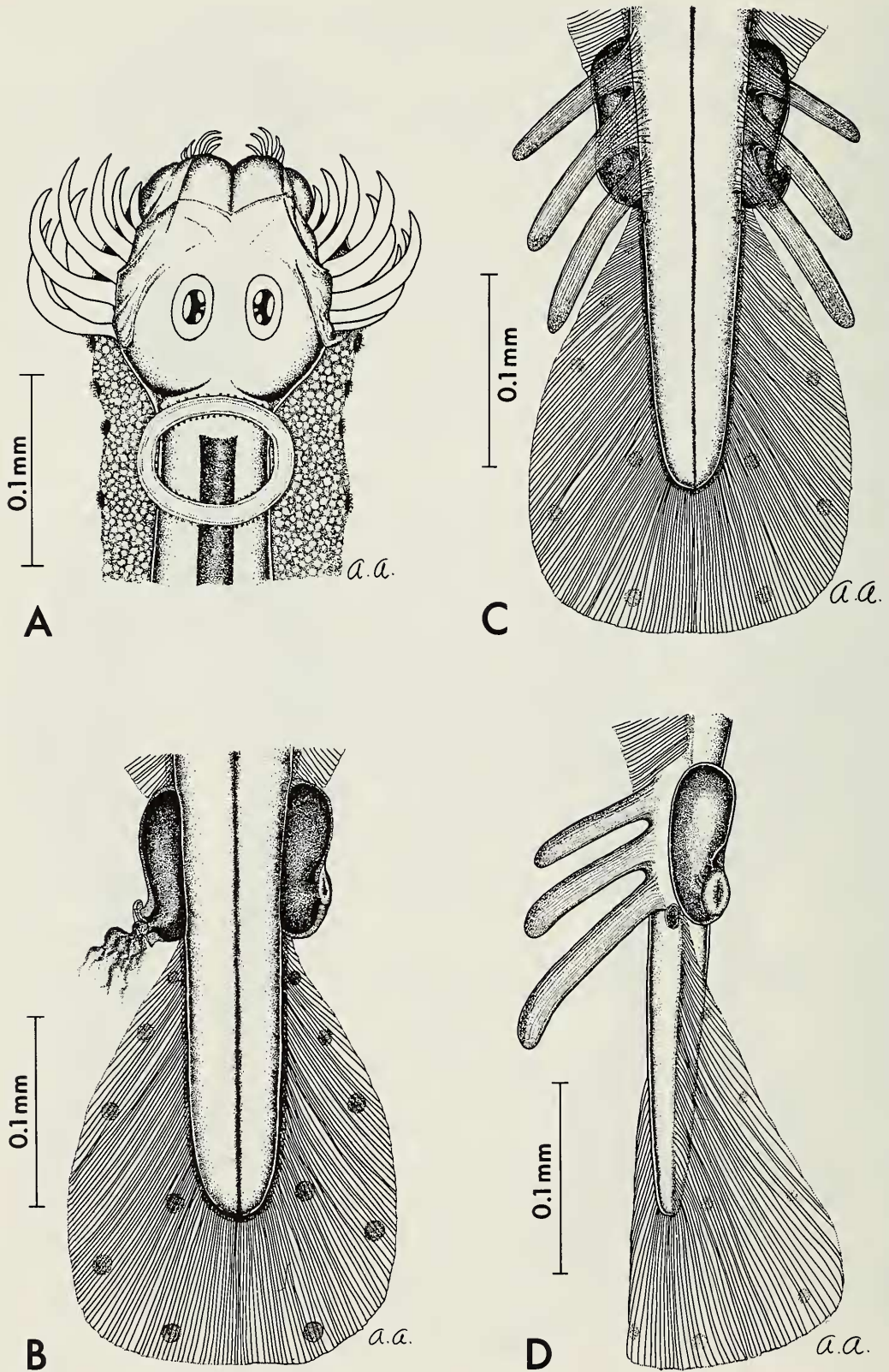


Fig. 2. *Spadella legazpichessi*: A, Dorsal view of head, with detail of hooks, teeth, eyes, corona ciliata, neck, collarette, and anterior part of intestine; B, Dorsal view of posterior part

trunk and half the length of the trunk segment. It is located at midlength of the trunk, as close to the neck as to the posterior septum (Fig. 1B).

There is one pair of lateral fins, extending from a level on the trunk anterior to the opening of the oviducts, to the seminal vesicles. They are completely rayed. The caudal fin is long, spatula-shaped, rounded laterally along the tip of the tail segment, with a straight posterior edge. It is not continuous with the lateral fins, and starts at posterior edge of the seminal vesicles. The portion of the tail segment surrounded by the tail fin is about 16% of the total length of the animal (Fig. 1A, B).

Adhesive digital organs are formed by three long rigid finger-like processes covered by a few small thin papillae. They extend along the ventrolateral side of the tail segment. The most anterior finger-like structure has part of the anterior edge joined to the posterior edge of the lateral fins, but the other 2 fingers are free. The posterior finger is the longest, and the anterior one is the shortest. The adhesive organs are at the ventrolateral side of the tail segment, exactly at the level of the seminal vesicles. Thus in the tail segment the seminal vesicles are dorsolateral, while the adhesive organs are ventrolateral (Fig. 2C, D). The adhesive organs are strengthened by long thin rays or muscle-like fibers, similar to the fin rays. The tip of the longest finger when extended, reached half-way between the seminal vesicles and the tip of the tail segment. These finger-like organs extend ventrally to support the animal away from the substratum while crawling, or to help in fastening the animal strongly to the substratum during the crawling motion, while the fins are used during the darting and swimming activities. In the dozens of specimens analyzed no variability was observed in the adhesive digital organs, such as that found by Feigenbaum (1976) in *S. schizoptera* reared in the laboratory. Such variability might be an artifact of the culture environment, not occurring in nature. However, adhesive organs in young specimens are not fully developed, the anterior finger appears first and the other two at each side of the animal are already incipient.

A cup-like structure is located ventrally at each side of the tail between the origin of the tail fin and the seminal vesicles. These cups may have additional adhesive function from the papillae covering the cup process and the secreted mucus (Fig. 2C, D).

The ovaries extend to the neck region. The ova are few and large, and they press laterally against the intestine, which usually runs in an S-shape

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of tail segment, with detail of seminal vesicles and tail fin. The left seminal vesicle is bursting; C, Ventral view of posterior part of tail segment, with detail of seminal vesicles, adhesive digital organs, and tail fin; D, Left side view of posterior part of tail segment, showing the dorsolateral position of seminal vesicles, and ventrolateral position of adhesive digital organs.

Table 1.—Differential characteristics of mature adult species of *Spadella* with digital adhesive organs.

Charact.	Species <i>S. schizoptera</i> Conant 1895	<i>S. moretonensis</i> Johnston and Taylor 1919	<i>S. johnstoni</i> Mawson 1944	<i>S. sheardi</i> Mawson 1944
Body length (mm)	1.9–4.9; wider at level of posterior septum	3.68	4.6; slender, yellow with brownish spots on corona ciliata	3.9–6.5; opaque, mauve brownish pigment along 3 longitudinal and 2 transverse bands. At level of oviducts, yellow spots on body.
Head	Broader than body with narrow neck. A pair of pads at mouth.	Broader than long. Neck conspicuous.		
Tail segment % to total length	47.0–53.7	56.5; two club- shape papillate bodies on posterior part of ventral side	52.0	44.8
Lateral paired fins	2 pairs; anterior pair extending from a point slightly behind the ventral ganglion to opening of oviducts. The second pair from this point to seminal vesicles.	1 pair, from oviducts to tail fin. Completely rayed and covered with sensory spots.	Similar to <i>S.</i> <i>schizoptera</i>	2 pairs; anterior short, on trunk. Posterior from opening of oviducts to seminal vesicles.

Table 1.—Continued.

<i>S. nana</i> Owre 1963	<i>S. pulchella</i> Owre 1963	<i>S. hummelincki</i> Alvariño 1970	<i>S. legazpichessi</i> Alvariño n. sp.
0.75–2.40	1.9–2.7; clusters of redish cells at anal region	2.0–3.0; broadest at the trunk	1.8–2.2; thick, strong, opaque, widest at mid-length.
Broader than widest part of body. Neck distinct. A pair of papillae between anterior teeth and mouth	Slightly broader than widest part of trunk. Neck distinct. A pair of prominences as in <i>S. nana</i> but with fewer papillae.	Large, roundish; smaller than in <i>S. pulchella</i> . Neck thick but distinct.	Large, roundish. Neck well distinct.
40–50	52–55	49	50
1 pair; from a level anterior to opening of oviducts to seminal vesicles.	1 pair; from a point anterior but close to oviducts to seminal vesicles extending ventrally over seminal vesicles joining tail fin	1 pair, long, narrow, from level anterior to opening of oviducts to seminal vesicles extending ventrally over seminal vesicles joining tail fin	1 pair, extending from posterior part of trunk to seminal vesicles.

Table 1.—Continued.

Charact.	Species <i>S. schizoptera</i> Conant 1895	<i>S. moretonensis</i> Johnston and Taylor 1919	<i>S. johnstoni</i> Mawson 1944	<i>S. sheardi</i> Mawson 1944
Caudal fin	Long, spatula shape	Spatula shape, completely rayed, covered with sensory spots.		Spatula shape
Eyes		Large, with no pigment		Small, widely spaced and overlain by brown pigment
Hooks	8–11, long, curved. Points sharp	9, slightly curved like in <i>E. hamata</i>	10–11	Up to 11
Anterior teeth	2–3 long, slender curved towards the midline where they meet.	3–4, stout, curved.	2, long, about half length of hooks.	3, long, about $\frac{1}{3}$ to $\frac{1}{2}$ length of hooks.
Posterior teeth	None	None	None	None
Corona ciliata	Three corned shape or pear-shaped to roughly triangular. Part on head and part on neck.	Roughly elliptical, slightly pointed at anterior end.	Elliptical-rectangular, mainly on neck.	Triangular
Ventral ganglion	Large, thick, overlaid by numerous sensory spots.	Large at anterior half of trunk.		

Table 1.—Continued.

<i>S. nana</i> Owre 1963	<i>S. pulchella</i> Owre 1963	<i>S. hummelincki</i> Alvariño 1970	<i>S. legazpichessi</i> Alvariño n. sp.
Spatula shape, starting at posterior end of seminal vesicles	Spatula shape starting at a distance of posterior end of seminal vesicles. This distance is equal to the length of the vesicle.	Long spatulated shape, starting at a distance of posterior end of seminal vesicles equal to half the length of the vesicle. No rayless zone.	Spatulate in shape, starting at posterior end of seminal vesicles. Covered by 12 sensorial spots. No rayless zone.
	The pigment in a longitudinal band crossed by a short band at the center.	Large, roundish. Larger than in <i>S. pulchella</i> . Pigment in a thick X-shape.	Large, oval. Pigment in a longitudinal band tilted towards the sides, and at midlength a short band towards the center
5-9	8-10	8-9 each side. Slender, slightly curved.	8-9 at each side. Strong, curved like in <i>S. ferox</i>
1-3, the innermost longer than the others. Curved towards the midline.	2-4, long, slender, curved.	4 at each side. Long, thin, bent at about midlength.	Up to 5 at each side. First 3 longer than the others. The 3rd at each side is the longest. Curved towards the ventral side.
None	None	None	None
Variable in shape. Located at the neck extending towards the head.	Broad, irregular oval, located at neck and extending towards the head.	On neck, roundish with peak towards center of head.	Like a ring at dorsal part of neck.
As broad as long.	Large, midway between posterior edge of corona ciliata and posterior septum.	Large, thick, about half length of trunk, and almost as wide as trunk. Closer to posterior septum than to neck.	Large, thick at midlength of trunk, and about 50% length of trunk. As close to neck as to posterior septum.

Table 1.—Continued.

Charact.	Species <i>S. schizoptera</i> Conant 1895	<i>S. moretonensis</i> Johnston and Taylor 1919	<i>S. johnstoni</i> Mawson 1944	<i>S. sheardi</i> Mawson 1944
Sensorial spots	Abundant, extending on longitudinal and transverse rows.	On tail fin, lateral fins, sides of body and head.	Arranged in two symmetric groups along the body.	
Ovaries	Reaching neck or anterior end of ventral ganglion or its midlength.	Reaching to level of ventral ganglion. Few large ova. Opening of oviducts swollen and trilobed.		Up to neck. Open at clear space between posterior end of anterior fin and anterior end of posterior fin.
Seminal vesicles	Ellipsoidal, reniform, touching both lateral and tail fins.	Small, inconspicuous, on posterior third of tail segment.	Oval, yellow in color in living specimens.	
Intestinal diverticula	Present or absent (1)		Absent	
Adhesive organs	Hand shaped, prolongation of lateral fins with 4, 5, 6 finger-like processes, extending from posterior end of lateral fins. First finger longest and outmost shortest. All	Rudimentary.	At ventral side of seminal vesicles, extending over length of tail fin.	Laterally at ventral side tail between posterior fins and seminal vesicles, arranged in 2 groups at each side, one towards the anterior part of the animal and other towards the end. 10-11

Table 1.—Continued.

<i>S. nana</i> Owre 1963	<i>S. pulchella</i> Owre 1963	<i>S. hummelincki</i> Alvarino 1970	<i>S. legazpichessi</i> Alvarino n. sp.
Arranged symmetrically in pairs on caudal fin and longitudinal rows on the body.	Arranged symmetrically as in <i>S. nana</i> . Lateral spots on outer edges of collarette and lateral fins are conspicuous.	Numerous	Symmetrically arranged on tail fin (6 at each side) and 6 conspicuous along edge of lateral fins and more than 6 at each side along edges of collarette.
Reaching to neck. 2–5 huge ova and intestine is pushed into an S-shape.	Up to midlength of trunk, 2–3 large ova.	Reach to neck or anterior end of ventral ganglion. Few large ova.	Reach neck region. Few large ova, pushing intestine into an S-shape.
Oval, roundish anterior to tail fin. Protected ventrally by prolongations of lateral and tail fins.	Oval, extending from posterior end of lateral fins to adhesive organs.	Oval or pear shaped, touching posterior end of lateral fins to the adhesive organs and apart from tail fin. Open by lateral dorsal slit at about midlength.	Ellipsoidal, reniform, touching posterior end of lateral fins and anterior end of tail fin. Open at middle of edge towards posterior half of vesicle.
Absent	Absent	Absent	Absent
Extending ventrally from posterior end of lateral fins to seminal vesicles. Divided in 2 stout distally tubercular fingers, with muscular fibers. First finger is longest. In small specimens, only one finger per organ.	Extending from posterior end of seminal vesicles to the point the caudal fin starts. Not associated with lateral fins, not attached to caudal fin. 2–3 fingers in each organ. The innermost finger longer, slender, undivided; the	One hand shaped at each side, with 3 short, thick stout fingers each covered by thin papillae. Appear as extension of lateral fins, strengthened by ray-like pattern, continuation of the lateral fins and rising from latero-ventral	Three long thin fingers in each organ, prolongations of posterior end of lateral fins, but attached also at latero-ventral part of tail at level of seminal vesicles only. Not attached to tail fin. Outermost finger

Table 1.—Continued.

Charact.	Species	<i>S. schizoptera</i> Conant 1895	<i>S. moretonensis</i> Johnston and Taylor 1919	<i>S. johnstoni</i> Mawson 1944	<i>S. sheardi</i> Mawson 1944
		have adhesive papillae. A sensory spot at base of outermost branch.			fingers on each side, covered with papillae.
Collarette		Thick at neck, extending along base of lateral fins to seminal vesicles.	Thick at neck reaching lateral fins. Thus neck appears wider than the head.		
Geographic distribution		Bahamas, Florida, New South Wales? Misaki (Japan)?	Queensland	New South Wales	New South Wales.

(1) Characteristic varies with authors (see Alvarino, 1970).

from neck to anus. The opening of the oviducts are dorsolateral cups with an outer rim. The lateral fins extend ventrally anterior to the openings of the oviducts. The ventral disposition of the fins and dorsal placement of oviducts constitute a protective functional device to help in the transference of sperm during the copulatory process.

The seminal vesicles touch both posterior end of lateral fins and anterior end of caudal fin. They are large, reniform, about 8% of the total length of the animal. They open at the dorsal side by a dorsolateral slit in the posterior half, just beyond the midlength of the vesicle. This opening protrudes toward the posterior part in a short bottle neck, which adapts to the opening of the oviducts (Fig. 2B, D).

The sensory spots appear distributed on the tail fin, and along the edges

Table 1.—Continued.

<i>S. nana</i> Owre 1963	<i>S. pulchella</i> Owre 1963	<i>S. hummelincki</i> Alvariño 1970	<i>S. legazpichessi</i> Alvariño n. sp.
	other may split at the tip. Abundant papillae cover tip of 2 or 3 digitations.	side of tail segment between posterior end of seminal vesicles and start of tail fin. Attached by a point at tail fin, at the sensory club.	is the longest, reaching midlength from vesicle to tip of tail. Fingers strengthened by thin muscular fibers. Large sensory club on ventral side of tail at posterior end of seminal vesicles.
Thick at neck, tapering progressively towards the seminal vesicles. At head appears continuous with hood.	Very thick at neck and anterior part of trunk, extending along base of lateral fins to posterior septum.	Wide, thick, extending from head to posterior septum, widest at anterior half of trunk.	Thick at neck extending along lateral part of trunk, tapering towards posterior part of tail segment.
Florida	Puerto Rico	Southwest of Bahía Fosforescente, Puerto Rico	Enewetak (Marshall Islands)

of the lateral fins and edges of the collarete, from the head to the posterior part of the trunk. In the tail fin are 6 at each side, 6 along the edge of each lateral fin, and more than 6 along the edge of the collarete, from the point the collarete joins the anterior edge of the lateral fins to the head.

Remarks.—*Spadella legazpichessi* differs from *S. schizoptera*, *S. johnstoni*, *S. sheardi* in many anatomical characters, especially in the number of lateral fins, from *S. schizoptera* probably also in the intestinal diverticula, and from *S. moretonensis*, *S. nana*, *S. pulchella*, and *S. hummelincki* mainly in the shape of hooks, head, characteristics of the adhesive organs, position of ventral ganglion, and position of seminal vesicles (Table 1).

Distribution.—The specimens studied were collected at Enewetak atoll, Marshall Islands, on sand, rubble coral, and living coral. The collections

were obtained with a bottom emergence trap for epibenthic and hypopelagic organisms, during studies on benthic marine communities. In those collections were also trapped pelagic species of Chaetognatha, *Sagitta ferox*, *S. robusta*, *S. neglecta*, *S. oceania*, which might be swimming and feeding in the water stratum over the bottom.

Etymology.—Named after the navigator Miguel López de Legazpi, whose party discovered the Marshall Islands in 1565, then named "Islands of Bearded people," and James R. (Tony) Chess, who kindly provided me with the material for this study. Legazpi's expedition reached those islands and atolls with four sailing vessels under Legazpi's Command (*San Pedro*, *San Pablo*, *San Juan* and *San Lucas*) departing from Navidad port (north of Acapulco) on November 1564 and reaching those islands, coral reefs, and atolls in January 1565, in their route to the Philippines. Legazpi's expedition constitutes the initiation of the first round trip across the Pacific, inaugurating with their return from the Philippines to Acapulco, the first regular transoceanic route, which also lasted longest in history, 1564 to 1815 (Colección de Diarios y Relaciones para la Historia de los Viajes y Descubrimientos).

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