

## ***Scorpaena pepo*, a New Species of Scorpionfish (Scorpaeniformes: Scorpaenidae) from Northeastern Taiwan, with a Review of *S. onaria* Jordan and Snyder**

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**Hiroyuki Motomura, Stuart G. Poss, and Kwang-Tsao Shao (2007)** *Scorpaena pepo*, a new species of scorpionfish (Scorpaeniformes: Scorpaenidae) from northeastern Taiwan, with a review of *S. onaria* Jordan and Snyder. *Zoological Studies* 46(1): 35-45. A new species of scorpionfish, *Scorpaena pepo*, is described on the basis of 4 specimens collected from off the northeastern coast of Taiwan in the northwestern Pacific Ocean, at a depth of ca. 200 m. The new species is closely related to *S. onaria* with which co-occurs in Taiwan. The 2 species are distinguished from other Indo-Pacific species of *Scorpaena* by the following combination of characters: the lateral surface of the lacrimal with a single spine, the posterior margin of the anterior lacrimal spine with an additional spine, the median interorbital ridge well developed, embedded cycloid scales covering the anteroventral surface of the body and the pectoral-fin base, a high body depth (36.4-45.1% of SL), 43-48 longitudinal scale series, and the lateral line sloping steeply downward above the anterior 1/2 of the pectoral fin. The new species can be distinguished from *S. onaria* by having 16 pectoral-fin rays; 46-48 longitudinal scale series; the posterior margin of the maxilla extending well beyond a vertical through the posterior margin of the orbit; the highest portion of the median interorbital ridge greater in height than the interorbital ridges; the posterior end of the base of the 1st suborbital spine located below the eye, between the posterior margins of the pupil and orbit; the supraocular tentacle being shorter than the pupil diameter, its length 1.7-3.9% (mean 3.1%) of SL; and the head and body when fresh yellowish-orange, with numerous scattered small distinct black spots, except on ventral surface. *Scorpaena pepo* sp. nov. is a large species (attaining at least 245.1 mm SL), whereas *S. onaria* from the northwestern Pacific Ocean is relatively small (the largest specimen, 187.9 mm SL). Two geographical populations regarded as *S. onaria* are compared in detail with *S. pepo*.  
<http://zoolstud.sinica.edu.tw/Journals/46.1/35.pdf>

**Key words:** Scorpaenidae, New species, *Scorpaena pepo*, Taiwan, *Scorpaena onaria*.

From 16 to 21 May 2005, the 7th Indo-Pacific Fish Conference, which was organized by the Ichthyological Society of Taiwan, the National Museum of Marine Biology and Aquarium, and Academia Sinica, was held in Taipei, Taiwan. During the conference, the 1st author found a large number of large-sized individuals (the largest, over 40 cm total length) of scorpionfish, collected from off the northeastern coast of Taiwan at a depth of ca. 200 m, at Taipei Fish Market on Wan-Da Road. In the market, these fresh scorpi-

onfish were tinged with bright yellowish-orange and had numerous small black spots scattered on the entire head, body, and fins. Of over 30 individuals of the species found at the market, 3 smaller specimens (223.1-245.1 mm standard length) were purchased by the 1st author on 18 and 19 May and registered at Academia Sinica, Taipei and the Australian Museum, Sydney. On 19 May 2005 another specimen (172.9 mm standard length) apparently conspecific with those from the fish market, collected from the same locality, was

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found in the collection of the Department of Zoology, National Taiwan University, Taipei.

These 4 specimens were identified as being attributable to *Scorpaena* by having the following diagnostic characters for the Indo-Pacific species of *Scorpaena*: 12 dorsal-fin spines, teeth on the palatines, an occipital pit, the posterior lacrimal spine directed posteroventrally, some pectoral-fin rays branched in adults, and the pored lateral-line scales continuing onto the caudal-fin base (Poss 1999, Motomura et al. 2005b). The specimens were most similar in overall body appearance to *S. onaria* Jordan and Snyder, 1900 which co-occurs with the former in Taiwan. However, the former differed from *S. onaria* in several aspects, including the numbers of the pectoral-fin rays and longitudinal scale series, head morphology, and coloration. Thus, the specimens from northeastern Taiwan are described herein as a new species, *S. pepo*. In addition to a description of *S. pepo*, a review of the related species, *S. onaria*, is also given.

## MATERIALS AND METHODS

Counts and measurements follow Motomura (2004a b), with additional counts following Motomura et al. (2005b). Standard length is expressed as SL. The last 2 soft rays of the dorsal and anal fins are counted as single rays, as each pair are associated with a single pterygiophore. Pectoral-fin ray counts begin with the uppermost element. Terminology of the head spines follows Randall and Eschmeyer (2001) and Motomura et al. (2005b). Institutional codes follow Leviton et al. (1985) with additional institutional abbreviations as follows: Research Center for Biodiversity, Academia Sinica, Taipei, Taiwan (ASIZP); Division of Fisheries Sciences, University of Miyazaki, Japan (MUFS); and Museum of New Zealand Te Papa Tongarewa (NMNZ).

### *Scorpaena pepo* sp. nov.

#### New English name: Pumpkin Scorpionfish

(Figs. 1, 2A)

*Holotype*: ASIZP 65020, male, 244.3 mm SL, off NE coast of Taiwan, hook and line fishing, ca. 200 m depth; purchased at Taipei Fish Market by H. Motomura, 19 May 2005.

*Paratypes*: AMS I. 43631-001, male, 223.1 mm SL, same data as for holotype except date, 18 May 2005; ASIZP 65021, female, 245.1 mm SL, same data as holotype; NTUM 4555, male, 172.9

mm SL, Nanfanggao, Ilan, NE Taiwan, 25 Dec. 1981.

*Diagnosis*: An Indo-Pacific species of *Scorpaena* with the following combination of characters: pectoral-fin rays 16; longitudinal scales series 46-48; embedded cycloid scales covering anteroventral surface of body and pectoral-fin base; lateral line sloping steeply downward above anterior 1/2 of pectoral fin; posterior margin of maxilla extending well beyond a vertical through posterior margin of orbit; median interorbital ridge well developed, its highest portion greater in height than interorbital ridges; lateral surface of lacrimal with a single spine; anterior lacrimal spine with an additional spine; posterior lacrimal spine simple; 3 suborbital spines, posterior end of 1st suborbital spine base located below eye between posterior margins of pupil and orbit; space between upper and lower opercular spines not covered with fleshy skin; supraocular tentacle shorter than pupil diameter, its length 1.7-3.9% (mean 3.1%) of SL; underside of lower jaw without tentacles; no skin flap on pectoral-fin axil; relatively deep body (depth 36.4-42.6% of SL); head and body yellowish-orange when fresh, with numerous small distinct black spots, averaging about 1/10 body scale diameter in size, scattered on entire head and body (except for ventral surface of head and body), dorsal, anal and caudal fins, and upper 1/2 of pectoral fin; a large black blotch at the margin of membrane between 6th and 10th or 11th dorsal-fin spines in males.

*Description*: Proportional measurements as percentages of SL of the specimens of *Scorpaena pepo* are given in table 1. Frequency distributions of selected meristic characters are presented in table 2. Features for the holotype are presented first, followed by paratype data (if different) in parentheses.

Dorsal fin with 12 spines and 9 soft rays (last split to base); 1st spine length more than 1/2 that of 2nd spine; 3rd (4th in 2 paratypes) spine longest, subequal to length of 2nd anal-fin spine; 4th to 11th spines becoming progressively shorter; length of 11th spine 1.7 in last spine; interspinous membranes moderately incised; all soft rays branched; 1st (2nd in 2 paratypes) soft ray longest, length subequal to length of longest anal-fin soft ray; membrane between soft rays weakly incised; posterior branch of last soft ray joined by membrane to caudal peduncle for more than 3/4 its length. Anal fin with 3 spines and 5 soft rays (last split to base); 1st spine 2.1 (1.9-2.1; mean 2.0) in 2nd spine; 2nd spine longest; all rays branched;

**Table 1.** Morphometric characters, expressed as percentages of standard length, of *Scorpaena pepo* sp. nov. and the southwestern Pacific and northwestern Pacific populations of *S. onaria*. Means in parentheses include type data

	<i>Scorpaena pepo</i> sp. nov.		<i>Scorpaena onaria</i>			
	Holotype ASIZP 65020	Paratypes <i>n</i> = 3	Northwestern Pacific			Southwestern Pacific
			Holotype USNM 49405	Paratypes <i>n</i> = 2	Non-types <i>n</i> = 27	Non-types <i>n</i> = 24
Standard length (mm)	244.3	172.9-245.1	157.7	136.6-144.8	81.1-187.9	56.5-265.2
Body depth	40.1	36.4-42.6 (39.6)	38.2	37.7-39.0	36.6-41.8 (39.4)	36.5-45.1 (40.9)
Body width	26.1	23.3-29.4 (26.7)	23.3	21.4-23.1	20.0-26.5 (22.7)	17.7-28.6 (24.1)
Head length	46.7	46.8-49.3 (48.0)	48.1	47.2-50.4	45.7-50.4 (48.0)	44.8-50.1 (47.6)
Snout length	13.3	13.1-13.8 (13.4)	12.5	11.8-12.3	11.8-14.4 (12.9)	12.4-14.5 (13.5)
Orbit diameter	10.1	10.4-12.3 (10.8)	12.9	13.1-14.4	11.0-15.5 (12.9)	9.7-14.2 (11.8)
Interorbital width <sup>1</sup>	6.9	6.6-7.0 (6.8)	7.5	-	5.4-8.0 (6.5)	4.8-7.5 (6.3)
Interorbital width <sup>2</sup>	6.5	5.8-6.4 (6.2)	6.2	5.4-5.6	4.7-6.6 (5.7)	4.1-7.0 (5.8)
Head width	16.1	16.7-16.9 (16.6)	16.1	-	14.2-16.1 (15.5)	15.6-16.5 (16.0)
Upper-jaw length	23.7	23.7-25.2 (24.3)	24.2	23.1-24.2	22.5-24.5 (23.5)	22.1-26.3 (23.8)
Maxilla depth	7.3	7.2-8.1 (7.5)	8.9	7.1-8.4	6.2-8.4 (7.2)	6.5-8.4 (7.4)
Suborbital space	4.1	3.4-4.6 (4.1)	3.6	3.7-4.2	1.8-4.8 (3.1)	2.5-5.7 (4.2)
Postorbital length	25.2	23.7-26.4 (25.4)	25.1	23.9-25.8	21.9-26.1 (23.9)	21.8-26.2 (24.0)
Between tips of opercular spines	6.8	6.9-8.1 (7.3)	8.9	-	7.5-9.3 (8.5)	6.9-9.7 (8.6)
Occipital pit length	6.4	6.6-6.7 (6.6)	6.5	-	5.5-6.7 (6.1)	6.1-7.6 (6.8)
Occipital pit width	6.4	6.4 (6.4)	6.4	-	5.7-6.8 (6.3)	6.2-7.1 (6.6)
Post-occipital pit length	8.9	8.8-10.1 (9.3)	11.5	-	7.6-10.5 (9.0)	6.2-9.6 (8.3)
Predorsal-fin length	38.3	38.9-39.5 (38.9)	42.2	40.3-42.5	36.5-42.8 (39.9)	37.0-42.3 (39.4)
Preanal-fin length	76.6	74.5-79.0 (76.3)	75.6	71.2-73.0	71.2-78.0 (74.3)	71.2-78.7 (74.3)
Prepelvic-fin length	45.7	43.6-46.7 (45.6)	44.6	44.4-45.4	42.8-48.3 (45.1)	37.7-48.0 (44.9)
1st dorsal-spine length	6.5	7.0-8.4 (7.5)	-	9.2-9.7	7.8-10.9 (9.1)	6.5-11.4 (8.8)
2nd dorsal-spine length	12.6	13.4-13.9 (13.3)	- <sup>3</sup>	15.6-16.7	14.2-18.3 (15.7)	11.7-18.1 (15.1)
3rd dorsal-spine length	16.9	15.2-17.2 (16.4)	- <sup>3</sup>	20.0-21.2	19.0-22.8 (20.4)	16.7-23.3 (20.0)
4th dorsal-spine length	15.6	16.8 (16.2)	19.5	-	17.4-22.0 (19.5)	16.9-21.8 (19.4)
5th dorsal-spine length	-	16.3-17.6 (17.0)	18.8	-	16.4-21.8 (18.7)	16.3-22.5 (18.8)
6th dorsal-spine length	13.2	13.9-15.2 (14.1)	17.9	-	16.2-19.6 (17.6)	14.7-20.2 (17.4)
7th dorsal-spine length	13.8	12.6-14.3 (13.6)	16.2	-	14.7-18.7 (16.3)	14.5-18.5 (16.5)
8th dorsal-spine length	13.0	11.9-13.7 (13.0)	14.9	-	13.2-16.7 (14.8)	12.6-17.3 (14.8)
9th dorsal-spine length	11.1	9.8-11.2 (10.6)	12.3	-	10.6-14.4 (12.5)	10.8-14.4 (12.7)
10th dorsal-spine length	8.8	7.6-9.4 (8.6)	9.9	-	8.5-12.0 (9.8)	7.5-11.8 (10.0)
11th dorsal-spine length	6.8	6.7-7.3 (6.9)	8.1	7.9-8.9	6.6-10.2 (8.3)	7.1-9.8 (8.7)
12th dorsal-spine length	11.5	11.1-12.5 (11.9)	14.3	14.4-14.6	12.7-16.0 (14.5)	11.1-16.3 (14.1)
Longest dorsal-ray length	19.5	18.0-19.7 (19.1)	19.2	20.6	18.2-22.0 (19.7)	17.7-23.1 (21.0)
1st anal-spine length	7.0	7.7-8.6 (7.9)	8.5	9.1-10.0	7.9-10.5 (9.2)	6.0-10.1 (8.8)
2nd anal-spine length	15.1	14.7-17.1 (15.9)	16.9	17.8	16.7-20.2 (18.8)	14.5-21.2 (17.8)
3rd anal-spine length	12.3	12.3-16.6 (14.0)	14.5	15.3-16.1	14.1-18.0 (15.7)	13.6-17.9 (16.1)
Longest anal-ray length	20.7	17.9-22.7 (20.2)	21.3	19.8-21.2	19.1-23.5 (20.6)	19.3-23.6 (21.7)
Pectoral-ray length	27.8	26.9-29.4 (28.1)	26.5	26.1-29.8	23.4-31.6 (27.5)	25.8-30.2 (28.2)
Pelvic-spine length	13.3	12.8-16.1 (14.3)	14.2	15.2	14.0-19.6 (15.8)	12.5-18.0 (15.7)
Longest pelvic-ray length	23.2	23.9-26.1 (24.4)	23.5	22.1-22.3	20.4-25.5 (22.9)	22.3-27.1 (24.5)
Caudal-fin length	24.1	25.4-27.5 (25.8)	29.0	28.9-30.6	26.1-31.2 (28.7)	27.7-33.0 (29.7)
Caudal-peduncle length	16.0	15.8-16.9 (16.4)	16.6	15.7-16.1	15.1-18.0 (16.2)	14.8-18.4 (16.4)
Caudal-peduncle depth	10.5	10.5-10.9 (10.7)	10.1	9.5-10.5	9.5-11.2 (10.3)	9.2-12.4 (11.2)

<sup>1</sup>At vertical midline of eye; <sup>2</sup>at posterior end of preocular spine base; <sup>3</sup>probable regenerated spine; -no data.

posterior branch of last soft ray not joined by membrane to caudal peduncle; membrane between soft rays weakly incised. Pectoral fin with 16 rays, an uppermost ray and lower 10 rays (9 in 2 paratypes) unbranched, remaining rays branched; 8th ray longest, length less than head length; lower unbranched rays thickened; distal margin of fin slightly bilobed. Pelvic fin with 1 spine and 5 soft rays, all soft rays branched; 2nd soft ray longest, length longer than longest dorsal-fin spine; last soft ray joined by membrane to body for more than 1/2 its length. Caudal fin with 14 segmented rays, most rays branched; posterior margin of fin slightly rounded.

Longitudinal scale series 47 (46-48); pored lateral-line scales 23 (22 in 2 paratypes); scales above lateral line 7 (6 in 2 paratypes), below 16 (17 in 1 paratype); predorsal scale rows 6 (5 in 1 paratype); scale rows between base of 6th dorsal-fin spine and lateral line 8 (6 in 1 paratype),

between base of last dorsal-fin spine and lateral line 8 (7-9). Gill rakers on upper limb 5; lower limb 10 (11 in 1 paratype), including 2 (3 in 1 paratype) rakers on hypobranchial; gill rakers short and spinous, longest raker on 1st gill arch shorter than longest gill filament; 4th gill slit closed by membrane. Vertebrae 24. Swimbladder absent.

Body moderately compressed anteriorly, progressively more compressed posteriorly; nape and anterior part of body moderately arched; body moderately deep, but less than head length. Numerous small papillae on head, especially on dorsal surface, snout, and lateral surface above suborbital ridge; numerous tiny tentacles and cirri on head, including dorsal margin of eye; a very short tentacle at posterior end of supraocular spine base, its length about 1/5 (1/3 in 1 paratype; absent in 1 paratype) pupil diameter; a large fimbriate flap at posterior lacrimal spine, its length greater than supraocular tentacle, joined posteriorly

**Table 2.** Frequency distribution of selected meristic characters in *Scorpaena pepo* sp. nov. and the southwestern Pacific (S) and northwestern Pacific (N) populations of *S. onaria*

	Pectoral-fin rays (one side/other side)					Longitudinal scale series						
	16/16	16/17	17/17	17/18	18/18	43	44	45	46	47	48	
<i>S. pepo</i> sp. nov.	4 <sup>H</sup>								2	1 <sup>H</sup>	1	
<i>S. onaria</i> (S)			19	4	1	2	6	9	4	2		
<i>S. onaria</i> (N)		3	25	2 <sup>H</sup>		4	11 <sup>H</sup>	6	7	1		
	Pored lateral-line scales				Scales above / below lateral line							
	22	23	24		4	5	6	7	/	15	16	17
<i>S. pepo</i> sp. nov.	2	2 <sup>H</sup>					2	2 <sup>H</sup>			3 <sup>H</sup>	1
<i>S. onaria</i> (S)	2	20	1		10	13			7	13	3	
<i>S. onaria</i> (N)	1	26 <sup>H</sup>	2		2	26 <sup>H</sup>	1		19 <sup>H</sup>	8		
	Predorsal scale rows				Scales between base of last dorsal-fin spine and lateral line							
	3	4	5	6		7	8	9				
<i>S. pepo</i> sp. nov.			1	3 <sup>H</sup>		1	2 <sup>H</sup>	1				
<i>S. onaria</i> (S)	3	13	7	1		1	22					
<i>S. onaria</i> (N)		3	19	8 <sup>H</sup>		18 <sup>H</sup>	10	1				
	Upper limb			Gill rakers Lower limb			Total					
	4	5	6	10	11	12	14	15	16	17		
<i>S. pepo</i> sp. nov.		4 <sup>H</sup>		3 <sup>H</sup>	1			3 <sup>H</sup>	1			
<i>S. onaria</i> (S)	4	20		4	11	9	2	3	11	8		
<i>S. onaria</i> (N)	4	25 <sup>H</sup>	1	19 <sup>H</sup>	11		3	17 <sup>H</sup>	9	1		

<sup>H</sup>Indicates the holotype.

to head by fringed skin; a few small tentacles associated with pored lateral-line scales; pectoral-fin axil without a skin flap; no distinct tentacles on lateral surface of body, except at pored lateral-line scales, on fin rays and membranes, on maxilla, and on underside of lower jaw.

Ctenoid scales covering an area between posterior tips of upper and lower opercular spines, but not on opercular margin; cycloid scales, covered with thin skin, covering an area surrounded by upper preopercle, lower posttemporal, and upper opercular spines; embedded cycloid scales covering an area adjacent to postorbital, sphenotic, pterotic, and upper preopercular spines; other parts of head not covered with scales; well-exposed ctenoid scales covering entire lateral surface of body, but not extending onto rays or membranes of fins, except at base of caudal fin; embedded cycloid scales covering ventral surface of body, including breast and between pelvic fins, and pectoral-fin base; scales on pectoral-fin base covered by epidermis. Lateral line sloping steeply downward above proximal 1/2 of pectoral fin.

Mouth large, slightly oblique, forming an angle of about 40° (30° in 1 paratype) to horizontal axis of head and body; posterior margin of maxilla extending well beyond a vertical through posterior margin of orbit; lateral surface of maxilla smooth, without distinct ridges; lower jaw with a symphyseal knob. Width of symphyseal gap separating premaxillary teeth bands slightly greater than width of each band; premaxilla with a band of short, incurved, conical teeth; tooth band narrowing posteriorly; tooth band on premaxilla wider than that of lower jaw; lower jaw with a band of villiform teeth, most teeth shorter than those of upper jaw; small teeth on vomer and palatines. Underside of dentary with 3 small sensory pores on each side, 1st pore below anterior lacrimal spine, 2nd pore below and between anterior and posterior lacrimal spines, 3rd pore located on posterior margin of dentary; a pair of small pores behind symphyseal knob of lower jaw; a pair of small pores on side of symphyseal knob; underside of lower jaw smooth, without ridges.

Dorsal profile of snout steep, forming an angle of about 50° to horizontal axis of head and body. Nasal spine simple, conical, directed upwards, its length slightly greater than anterior nostril diameter. Anterior nostril with a distinct tentacle, its length greater than nasal spine. Ascending process of premaxilla not intruding into interorbital space, its posterior margin not extending beyond level with posterior margin of posterior

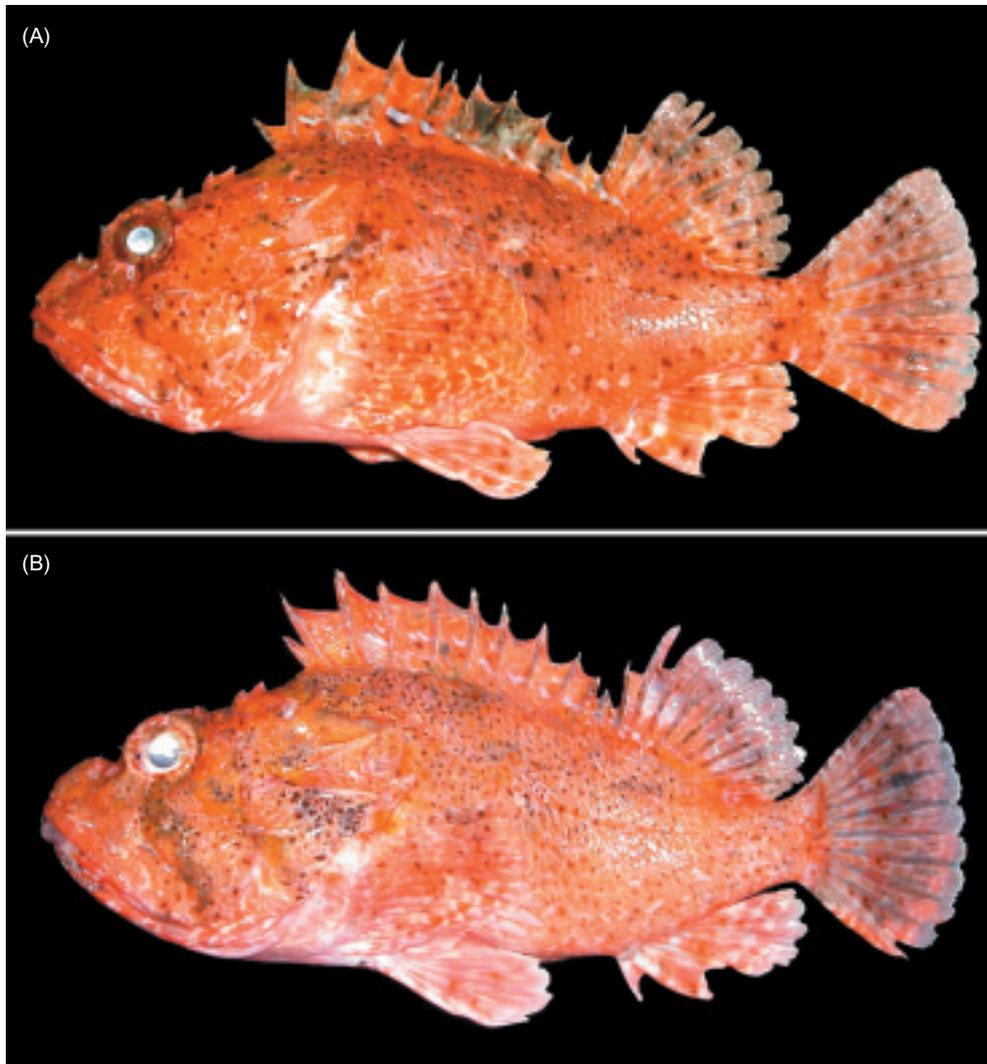
nostril. A well-developed median interorbital ridge running from posterior margin of ascending process of premaxilla to posterior end of supraocular spine base (slightly posterior to posterior end of preocular spine base in 2 paratypes); median interorbital ridge higher than interorbital ridges in lateral view. Interorbital ridges well developed, separated by a deep channel, beginning posterior to a line through posterior margins of posterior nostrils and then conjoined level with, and between origins of, tympanic spines, forming a distinct ridge to anterior angular edge of occipital pit; interorbital ridges diverging anteriorly and posteriorly in dorsal view, with least distance between interorbital ridges narrowest at level of anterior margin of pupil; interorbital space moderately deep, about 1/4 of orbit extending above dorsal profile of head. Preocular spine simple (with an additional small spine laterally in 1 paratype), directed nearly dorsally. Supraocular spine simple, its tip located near vertical midline of eye, spine shorter than preocular, postocular, and tympanic spines. Postocular spine simple (with 2 points in 1 paratype), its length slightly less than tympanic spine. Tympanic spine simple, pungent; bases of tympanic spines joined with interorbital ridges and a transverse ridge in front of occipital pit. Interorbital, coronal, and pretympanic spines absent. A distinct transverse ridge (formed from posterior part of interorbital ridges) anterior to occipital pit slightly curved posteromedially in dorsal view; occipital pit relatively shallow, center of pit usually slightly convex; a distinct transverse ridge in rear of occipital pit between bases of nuchal spines; occipital pit surrounded laterally by tympanic and parietal spines, and low ridges between tympanic and parietal spines on each side. Parietal spine simple, its base curving strongly into occipital pit. Nuchal spine simple (with 2 points in 1 paratype); nuchal and parietal spines joined at base. Sphenotic with 2 (3 in 1 paratype) small, sharp spines. Postorbital smooth, embedded in skin (with 1 or 2 slender spines in 3 paratypes). Pterotic spine simple, pointed. Upper posttemporal spine simple, pointed, small, directed posteriorly (ventroposteriorly in 2 paratypes), its length much shorter than lower posttemporal spine. Lower posttemporal spine simple, its base length approximately equal to that of pterotic spine. Supracleithral spine simple, not strongly pointed. Cleithral spine flattened, pointed.

Lateral surface of lacrimal with a strongly pointed spine, spine located below anterior margin of orbit. Anterior lacrimal spine pointed, directed

forward, its tip reaching dorsal margin of upper-jaw lip; an additional short spine near posterior base of anterior lacrimal spine, the additional spine directed anteriorly. Posterior lacrimal spine simple, directed ventroposteriorly, its tip not reaching upper-jaw lip; posterior lacrimal spine larger than anterior spine. Suborbital ridge with 3 spines, posterior end of 1st spine base below and between posterior margins of pupil and orbit, 2nd spine extending beyond orbit, 3rd spine at end of suborbital ridge. Broad space between ventral margin of eye and suborbital ridge. Suborbital pit absent. Preopercle with 5 spines, uppermost largest, with a supplemental preopercular spine on its base; 2nd to 5th spines without a median ridge, directed posteriorly; 2nd spine smallest, with narrow base;

3rd to 5th spines with broad base. Dorsal ramus of preopercle without serrae or spines. Upper opercular spine simple, with a low median ridge. Lower opercular spine simple with a distinct median ridge. Space between upper and lower opercular spines without distinct ridges (with a low ridge in 1 paratype) and not covered with fleshy skin. Posterior tips of upper and lower opercular spines not reaching opercular margin.

Origin of 1st dorsal-fin spine anterior to base of supracleithral spine. Posterior margin of opercular membrane extending beyond a vertical through origin of 4th dorsal-fin spine. Posterior tip of pectoral fin not reaching a vertical through tip of depressed pelvic fin and origin of last dorsal-fin spine. Posterior tip of depressed pelvic fin not



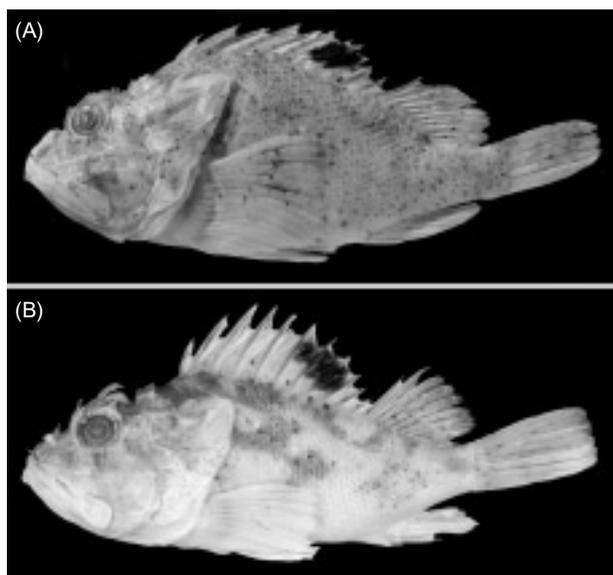
**Fig. 1.** Color photographs of *Scorpaena pepo* sp. nov. (A) ASIZP 65020, holotype, male, 244.3 mm SL, off the northeastern coast of Taiwan; (B) ASIZP 65021, paratype, female, 245.1 mm SL, collected with holotype. Note that the body color is slightly faded in photographs taken 2 days after collection. Photos by H. Motomura.

reaching anus. Origin of pelvic-fin spine posterior to origin of pectoral fin. Origin of 1st anal-fin spine posterior to origin of last dorsal-fin spine.

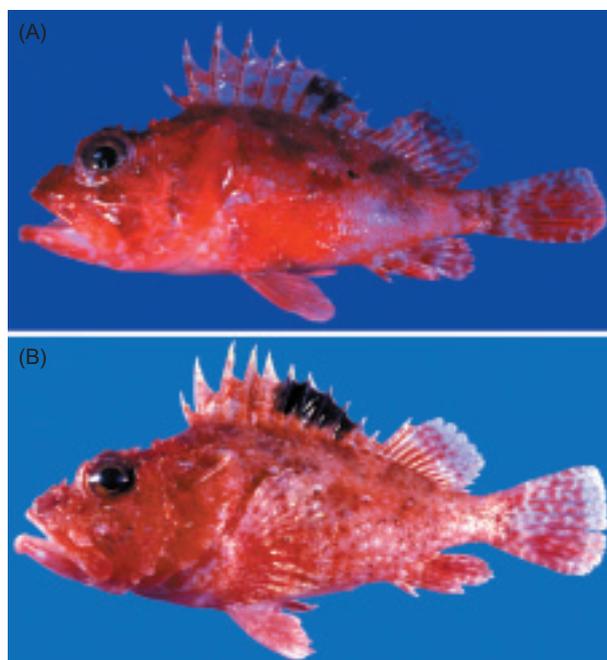
*Color when fresh:* Head and body bright yellowish-orange (Fig. 1; yellow and light orange pigments not evident in photos taken 2 days after collection), mottled with very pale gray blotches dorsally; small distinct black spots scattered on head and body, except for ventral surface, median fins and upper 1/2 of pectoral fin. Underside of lower jaw bright orange, mottled with distinct white blotches. One or 2 irregular narrow white bands across spinous portion of dorsal fin medially; membrane of spinous portion of dorsal fin yellowish-orange, mottled with poorly defined whitish and blackish blotches; a large black blotch, greater than orbit diameter, on outer margins of membranes between 6th and 11th (tenth in 1 paratype) spines in males (absent in females). Soft-rayed portion of dorsal fin orange proximally, grayish subdistally, with poorly defined whitish blotches and blackish spots over fin; distal margin of the fin whitish. Pectoral-fin base whitish; pectoral fin yellowish-orange with small black spots scattered dorsally, poorly defined whitish blotches ventrally. Pelvic and anal fins yellowish-orange, with poorly defined whitish blotches. Caudal fin yellowish-orange basally, gray subdistally, whitish distally,

with irregular white markings arranged into weakly organized transverse bars, and with scattered small indistinct black spots. Color when alive unknown.

*Color of preserved specimens:* Head and body dark yellow dorsally, mottled with large poorly defined gray blotches, becoming pale yellow ventrally (Fig. 2A). Small distinct black or gray spots, averaging about 1/10 body scale diameter in size, scattered over head and body, except for on ventral surfaces, median fins, and dorsal 1/2 of pectoral fin. An oblique, broad, blackish band from ventral margin of orbit to behind posterior margin of maxilla. Lips and underside of mandible pale yellow with poorly defined gray blotches anteriorly. Dorsal fin yellowish-white with a large dense black blotch, greater than orbit diameter, on outer margins of membranes between 6th and 11th (10th in 1 paratype) spines in males (absent in females). Pectoral fin yellowish with black spots on upper 1/2 of fin; inner surface of pectoral fin yellowish with indistinct grayish blotches centrally; axil of fin yellowish, without markings. Pelvic fin uniformly yellowish with 2 or 3 scattered gray spots. Anal fin yellowish, with a few scattered pale black spots. Caudal fin translucent yellow with small black



**Fig. 2.** Preserved specimens of *Scorpaena pepo* sp. nov. (A) and *S. onaria* (B). (A) AMS I. 43631-001, paratype, male, 223.1 mm SL off the northeastern coast of Taiwan (photo by C. Bento); (B) MUFs 14402, male, 164.6 mm SL, off the southeastern coast of Kyushu I. southern Japan (photo by H. Motomura).



**Fig. 3.** Color variation in *Scorpaena onaria*. (A) MUFs 12919, male, 142.2 mm SL, off the southeastern coast of Kyushu I. southern Japan (photo by H. Motomura); (B) FRLM 6927, male, 178.5 mm SL, off Mie, central Japan (photo by S. Kimura).

spots basally and centrally.

*Distribution:* Currently known only from off the northeastern coast of Taiwan, probably on deep-water rocky reefs.

*Etymology:* Derived from the Latin *pepo* meaning "pumpkin", alluding to the yellowish-orange body color of this species when fresh.

## DISCUSSION

*Scorpaena pepo* sp. nov. and *S. onaria* Jordan and Snyder, 1900 resemble each other in overall appearance and are distinguished from all other congeners in the Indo-Pacific Ocean by the following combination of characters: the lateral surface of the lacrimal with a single spine, the posterior margin of the anterior lacrimal spine with an additional spine, and the median interorbital ridge well developed, embedded cycloid scales covering the anteroventral surface of the body and the pectoral-fin base, a high body depth (36.4-45.1% of SL), 43-48 longitudinal scale series, and the lateral line sloping steeply downward above the anterior 1/2 of the pectoral fin (Motomura et al. 2005b, this study). Incidentally, these 2 species appear to be closely related to a Tahitian species, *S. lacrimata* Randall and Greenfield, 2004, and a Hawaiian species, *S. pele* Eschmeyer and Randall, 1975, but the 2 can be distinguished by 43-48 longitudinal scale series (vs. 61 in *S. lacrimata*; Randall and Greenfield 2004) and the well-developed median interorbital ridge (vs. absent in *S. pele*; Motomura et al. 2005b).

*Scorpaena onaria*, originally described from Misaki, Japan, was redescribed by Motomura et al. (2005b), with discussions of its distribution, morphological changes with growth, sexual dichromatism, and biology. The species is found in the northwestern Pacific (southern Korea, Japan, and Taiwan), southwestern Pacific (eastern Australia and northern New Zealand), and eastern Indian Oceans (off northwestern Australia and in the Andaman Sea), but has not been reported from the western central Pacific Ocean (Motomura et al. 2005b). A fish reported as *Scorpaena ballieui* by FSFRL (1976) from the North Pacific about midway between Japan and the Hawaiian Is. at a depth of 77 m is probably *S. onaria*, judging from a photograph (M.Pac-23) of the fish published by FSFRL (1976). However, the whereabouts of the specimen is currently unknown, and the locality cannot be verified.

Motomura et al. (2005b) recognized 2 geo-

graphically distinct populations for *S. onaria*: a northern population from the northwestern Pacific and a southern population from the southwestern Pacific. Motomura et al. (2005b) regarded specimens of *S. onaria* from northwestern Australia probably assignable to the southern population, but the status of *S. onaria* from the Andaman Sea remains unknown because specimens from the Andaman Sea are no longer available.

*Scorpaena pepo* can be distinguished from *S. onaria* by having 16 pectoral-fin rays (vs. usually 17 rays on each side of the body (ca. 82% of 54 specimens examined), rarely asymmetrically 16 and 17 rays (ca. 6%) or 17 and 18 rays (ca. 10%), and rarely 18 rays (ca. 2%) on each side in *S. onaria*; see Table 2). Five larger individuals of *S. pepo* (not retained), examined by the 1st author at the market in Taipei, also had 16 pectoral-fin rays on each side of the body. Mean values of the number of the pectoral-fin rays are 16.0 for *S. pepo*, 16.9 for the southern population of *S. onaria* and 17.0 for the northern population. In *S. pepo*, the number of scale rows counted in longitudinal series seems to be slightly greater (46-48, mean 47.0) than that of *S. onaria* (43-47, mean 44.8, based on 52 specimens; see Table 2), although examination of more specimens of *S. pepo* is required.

The morphology of the head, including the spine and ridge structures, of *S. pepo* is very similar to that of *S. onaria* (head of the latter is illustrated in Motomura et al. 2005b: fig. 3). However, the posterior margin of the maxilla in both sexes of *S. pepo* extends well beyond a vertical through the posterior margin of the orbit, whereas that in both sexes of the northern population and males of the southern population of *S. onaria* is located below the eye between the center of the pupil and the posterior margin of the orbit. In mature females from the southern population of *S. onaria* it extends slightly beyond a vertical through the posterior margin of the orbit (Motomura et al. 2005b). The posterior end of the 1st suborbital spine base (on infraorbital 2, not the lateral lacrimal spine) in *S. pepo* is located below the eye between the posterior margins of the pupil and orbit, whereas that of *S. onaria* is located below the eye between the center and posterior margin of the pupil (Motomura et al. 2005b; this study). The median interorbital ridge of *S. pepo* is well developed, with its highest part higher than the interorbital ridges. In *S. onaria* this ridge is lower than the interorbital ridges throughout its length.

In the field, the yellowish-orange coloration

easily distinguishes *S. pepo* from *S. onaria*, whose coloration is primarily red (Fig. 3; color variations of southern population of *S. onaria* were figured by Motomura et al. 2005b: fig. 1). In some near-shore scorpaenids, body coloration varies with depth. Individuals from shallow waters have brown or black spots on the fins, while in specimens from deeper water, these same markings are often red (Motomura and Shinohara 2005, Motomura et al. 2005a). However, this does not appear to be true in *S. onaria*, in which coloration of specimens taken from 8 to 1000 m were usually all primarily red (Fig. 3). *Scorpaena pepo* has numerous small distinct black (sometimes gray in preservative) spots scattered over the head, and body, and medial fins (Figs. 1, 2A). Such spots are also present on the upper 1/2 of the pectoral fin. Although *S. onaria* also has similar spots on its body and fins, they are usually absent from the head, except rarely for a few that may be present on the opercle, and are usually fewer in number than seen in *S. pepo* (see Figs. 2B, 3; Motomura et al. 2005b: figs. 1, 2). Also in *S. pepo*, the spots are relatively small, their size averaging about 1/10 of a body scale diameter. In *S. onaria*, the diameter of an average spot is about 1/3 that of a body scale (Motomura et al. 2005b; Figs. 2B, 3).

*Scorpaena pepo* and the southern population of *S. onaria* have a short supraocular tentacle, which is usually shorter than the pupil diameter and the tentacle on the posterior lacrimal spine (the supraocular tentacle is absent on the right side of the head in 1 paratype of *S. pepo*). In contrast, the supraocular tentacle of the northern population of *S. onaria* is well developed and greater than the pupil diameter (often greater than the orbit diameter) and the length of a tentacle on the posterior lacrimal spine (Motomura et al. 2005b). The length of the supraocular tentacle of *S. pepo* is 1.7-3.9% (mean 3.1%) of SL, compared to 4.9-11.3% (mean 7.6%) of SL for the northern population of *S. onaria* (based on 19 specimens). As Motomura et al. (2005b) pointed out, the ventral margin of the dentary of individuals of the southern population of *S. onaria* is more convex, and the head is more rounded than for individuals of the northern population. The condition of the dentary in *S. pepo* is similar to that of the southern population of *S. onaria*.

The largest specimen of *S. pepo* collected (ASIZP 65021, northeastern Taiwan) and the largest individual from the southern population of *S. onaria* (NMNZ P. 40691, northern New Zealand; Motomura et al. 2005b) are 245.1 and 265.2 mm

SL, respectively. In contrast, the largest recorded size of the northern population of *S. onaria* is 187.9 mm SL (MUFS 14395, southern Japan; this study). *Scorpaena pepo* reaches at least 40 cm total length (Motomura, pers. obs., see “Introduction”). Thus, *S. pepo* is more similar to the southern population of *S. onaria* rather than the northern population, even though *S. pepo* co-occurs with the northern population of *S. onaria*, at least in Taiwan. However, with the exception of the presence or absence of a large black blotch on the spinous portion of the dorsal fin, the sexual dichromatism exhibited in the southern population of *S. onaria* (see Motomura et al. 2005b: 878-879) was not found in either *S. pepo* or the northern population.

The following additional characters of *S. pepo* appear to be diagnostic (but examination of more specimens is needed): the median interorbital ridge ending posterior to midway between the posterior ends of the preocular spine bases in dorsal view, sometimes ending midway between the posterior ends of the supraocular spine bases (vs. ending anterior to midway between the posterior ends of the preocular spine bases in *S. onaria*; Motomura et al. 2005b, this study); and the postorbital with 1 or 2 slender, sharp spines on both sides of the head (only the holotype lacks the spine), which are longer than the sphenotic spines (vs. the postorbital smooth, covered with skin, without the slender spines in *S. onaria*; Motomura et al. 2005b, this study).

There are several minor morphometric differences, e.g., orbit diameter, and spine and soft ray lengths, between *S. pepo* and the northern population of *S. onaria* (Table 1). However, these proportions change with growth (Motomura et al. 2005b: 877-878, fig. 7), and as mentioned above, there is a size difference between specimens of *S. pepo* (172.9-245.1 mm SL) and of the northern population of *S. onaria* (81.1-187.9 mm SL), suggesting that these morphometric differences are probably not reliable for species discrimination. Smaller specimens of *S. pepo* need to be analyzed for growth-related changes of the species, as done for the southern population of *S. onaria* by Motomura et al. (2005b).

*Comparative material examined:* 54 specimens of *Scorpaena onaria*. Data for 19 specimens (121.0-265.2 mm SL; deposited at AMS, CAS, MNHN, and NMNZ) from the southwestern Pacific Ocean were listed in Motomura et al. (2005b) and additional 5 specimens (56.5-164.3 mm SL) from the area are as follows: CSIRO CA 3172, 120.5

mm SL, Tasman Sea (33°08'S, 156°11'E), 142 m depth, coll. by FRV *Soela*, 28 Jan 1982; CSIRO H 643-18, 160.1 mm SL, northeast of Whitsunday Group (19°37-38'S, 150°30-32'E), Queensland, 312-318 m depth, coll. by FRV *Soela*, 15 Nov. 1985; CSIRO H 2466-02, 153.1 mm SL, Lord Howe Rise, Tasman Sea, 1000 m depth, coll. by A. Hinson; CSIRO H 6007-15, 56.5 mm SL, south of Norfolk I. (29°41-42'S, 168°01-02'E), Norfolk Ridge, Tasman Sea, 322-337 m depth, coll. by FRV *Tangaroa*, 14 May 2003; CSIRO H 6011-01, 164.3 mm SL, north of Norfolk I. (28°53-54'S, 167°41-42'E), Norfolk Ridge, Tasman Sea, 110-441 m depth, coll. by FRV *Tangaroa*, 15 May 2003. Data for 30 specimens (81.1-187.9 mm SL) from the northwestern Pacific Ocean are as follows: CAS 106275 (2 paratypes), 136.6-144.8 mm SL, Tokyo, Japan, coll. by K. Otaki; CAS 125248, 81.1 mm SL, Oki-shima Island, Sea of Japan, coll. by U.S. Fish Commission, 2 Aug. 1906; FRLM 6927, 178.5 mm SL, Koshika, Shima, Mie, Japan, 110 m depth, line-fishing, coll. by S. Kimura, 22 Dec. 1987; FRLM 8518, 117.3 mm SL, same data as FRLM 6927 except depth, 60-100 m, and date, 25 Jan. 1989; FRLM 21012, 126.2 mm SL, Wagu, Shima, Mie, Japan, 60-100 m depth, gill net, coll. by T. Yamashita and T. Sado, 22 Oct. 1997; FRLM 21879, 124.5 mm SL, Goza, Shima, Mie, Japan, 30-60 m depth, line-fishing, coll. by T. Yodo, 31 Mar. 1998; MUFS 12916-12920 (5 specimens), 120.3-153.3 mm SL, off Nango, Miyazaki, Japan, purchased at Meitsu Fish Market by H. Motomura, 19 Apr. 1997; the following 4 lots with the same collecting data as MUFS 12916 except for the date: MUFS 12993, 181.2 mm SL, 20 Dec. 1997; MUFS 13180, 157.4 mm SL, 17 May 1997; MUFS 14402, 164.6 mm SL, 21 Dec. 1997; MUFS 16396, 147.3 mm SL, 14 Sept. 1998; MUFS 13407-13409 (3 specimens), 144.1-180.9 mm SL, off Kawaminami, Miyazaki, Japan, purchased at Kawaminami Fish Market by H. Motomura, 5 June 1997; MUFS 14395-14400 (6 specimens), 110.2-187.9 mm SL, off Amami-oshima, Kagoshima, Japan, purchased at Meitsu Fish Market by H. Motomura, 20 Dec. 1997; NSMT-P 19211, 114.0 mm SL, Yawatano, Izu, Japan, 100 m depth, coll. by S. Tomotake, 12 Apr. 1968; NSMT-P, 48664, 157.7 mm SL, off Akajima Island, Goto Islands, Nagasaki, Japan, coll. by A. Morota, 4 Aug. 1995; NTUM 1435, 141.9 mm SL, off Hualien, Taiwan; OMNH 13888, 144.7 mm SL, off Himi, Toyama, Sea of Japan, purchased at a fish market by K. Hatooka, 22 Apr. 2000; USNM 49405 (holotype), 157.7 mm SL, Misaki, Japan, coll. by K. Otaki.

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