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A New Species of Bobtail Squid, *Euprymna megaspadicea*, from Okinawa, Japan

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Abstract: *Euprymna megaspadicea* n. sp. collected from Nago Bight, Okinawa Island, Japan, is described. This species is characterized by its small size compared with its congeners, and by having four rows of suckers on all arms, arm II longer than the other arms and a hectocotylized left arm I in males. Modification of the hectocotylus affects almost the whole length of the arm, and is characterized by the fusion of all sucker pedicels giving the arm a peculiar massive, wavy and twisted appearance.

Keywords: new species, *Euprymna*, hectocotylus, Nago Bight, Okinawa

Introduction

During a survey cruise of the R/V *Yoko-Maru* of the Seikai Fisheries Research Institute, three specimens of small bobtail squid (sepiolid) were collected in October 1997 from Nago Bight, Okinawa Island. The family Sepiolidae in the Indo-West Pacific has never been completely revised, but a close examination of these specimens indicated that they represent an undescribed taxon of the genus *Euprymna*.

Systematics

Family Sepiolidae Leach, 1817

Euprymna megaspadicea n. sp.
(Figs. 1- 4)

Material examined: Two males (holotype and paratype) and one female (paratype).

Diagnosis: Small species of *Euprymna* with four rows of suckers on all arms, arm II longer than other arms, and hectocotylized left arm I in male. Hectocotylized arm longer than opposite right arm I. Along distal 4/5 of hectocotylized arm, sucker pedicels are swollen and fused together, giving the arm a characteristic wavy and twisted configuration. Pedicels form single ventral row and two dorsal rows with wide medial groove. Three to four normal suckers and 1-2 papillae on proximal 1/5 of the hectocotylized arm.

Description of the holotype: Mantle short, saccular, and bluntly rounded posteriorly. Mantle width about 80% DML. Obscure opaque belt extending from posterior tip of mantle to posterior border of both fins, while remaining area of mantle surface covered by many microscopic chromatophores. Mantle connected to head at nuchal region. Ventral side of mantle slightly longer than dorsal side with shallow excavation in middle with blunt ventro-lateral angle on both sides of mantle reaching level of center of eye (Fig. 1 A, B).

Fins large and attached to middle of latero-dorsal mantle. Fin length (FL) about 60% of DML

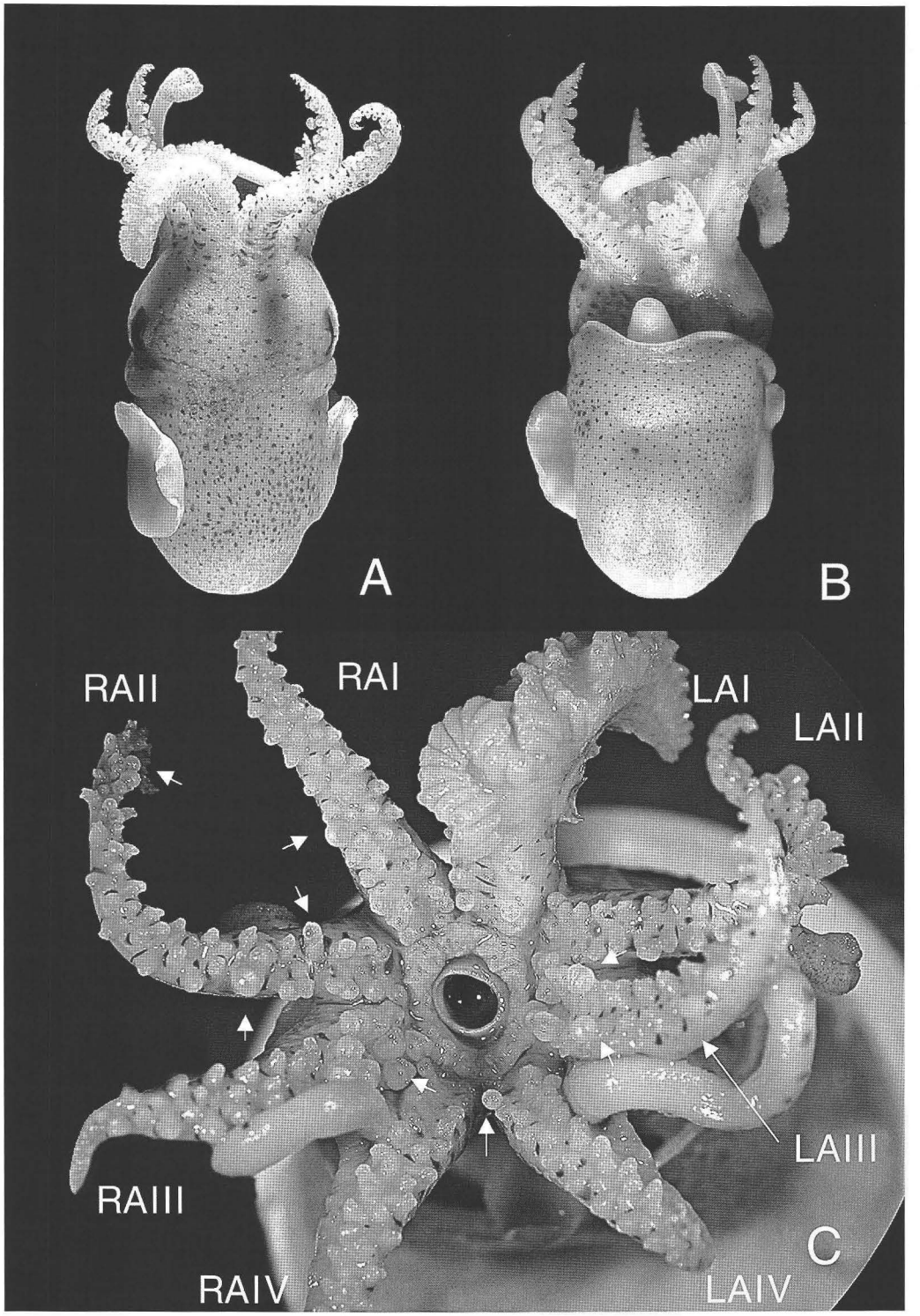

Fig. 1. *Euprymna megaspadicea* n. sp., holotype, male, 13.9 mm DML. **A**. Dorsal view. **B**. Ventral view. **C**. Oral view. Arms are labeled AI –AIV from dorsal to ventral; R, Right; L, left. Small arrows indicate enlanged suckers.

and fin width (FW, single lobe) about 86% of FL. Fins semicircular, with large anterior free lobe. Basal part of dorsal surface of fins with sparsely distributed chromatophores, and ventral surface not pigmented (Fig. 1 A, B).

Funnel short and covered basally by ventral margin of mantle. Dorsal pad of funnel organ V-shaped, with broad rami and slender terminal papilla. Ventral pads ovo-triangular, narrow anteriorly and wide posteriorly. Funnel locking cartilage simple and parallel-sided, with rather shallow groove corresponding and corresponding to slender mantle (Fig. 3B).

Head squarish and dorso-ventrally depressed, with prominent eyes. Eye opening antero-posteriorly ovally elongate, with developed dorsal eyelid of lunate shape.

[Many arm suckers were dislodged during preservation and handling.] Judging from sucker pedicel arrangement, all arms equipped with four rows of suckers. Consistency of four rows usually maintained in mid-part of arms, but elsewhere frequently only two rows present. Arm formula 2.3.1.4 (excluding hectocotylized arm) (Fig. 1C).

Normal arm I (right) has more than 14 oblique transverse rows of suckers. Proximal 1st to 3rd sucker rows biserial, sucker pedicels elongate. Remaining suckers in four rows with distalmost ones so small that sucker arrangement becomes obscure. Judging from attached suckers, marginal suckers a little larger than medial ones, especially at middle portion of arm. This arm has neither an aboral keel nor an interbranchial web.

Arm II longest of all and rather slender, with more than 18 oblique transverse rows of suckers. Proximal 1st to 4th sucker rows biserial, sucker pedicels elongate. Remaining suckers in four rows. Judging from attached suckers, ventral marginal suckers twice as large as medial suckers at middle portion of arm. Dorsal marginal suckers 1.5 times larger than medial ones at middle portion of arm. This arm also has neither an aboral keel nor an interbrachial web.

Arm III very similar to arm II in general morphology, with 12-14 oblique transverse rows of suckers. Proximal 1st to 4th sucker rows biserial. Remaining suckers in four rows. Both marginal and medial suckers of this arm nearly same size basally. Shallow interbranchial web present between arm III and arm IV.

Arm IV shortest, with general configuration similar to that of other arms, with 12-13 oblique transverse rows of suckers. Judging from attached suckers, ventral marginal suckers twice as large as medial suckers at middle portion of arm. (Fig. 1B, C)

In males, the left arm I hectocotylized, massive; and about 20% longer than right arm I, with only 3-4 normal suckers and a short papilla basally. Distal to normal suckers, approximately 12 rows of suckers with swollen, fused pedicels. All transverse rows of suckers in this region fused and thickened to become elongated fleshy pads, which together with pronounced broadening of arm that follows distally, creates distinctive wavy S-shaped outline to ventral side of arms, making it appear twisted. Arm broad distally. Suckers widely spaced, ventral rows fused to form single row with elongate pedicels; modification of sucker pedicels of dorsal rows of suckers less spectacular than in ventral rows; dorsal suckers in two rows, suckers crowded, fleshy, with somewhat palisade appearance. Broad, shallow, medial longitudinal groove present between dorsal and ventral rows of suckers on this distal portion of arm (Fig. 1C, Fig. 2G).

Tentacles very delicate, with thin, slender stem. Clubs strongly curled with neither lunate flap nor aboral keel, and covered with crowded, packed, microscopic, multi-rowed suckers.

Upper beak with long, curved rostrum and acute tip. Upper rostral length 0.82 mm. Jaw angle approximately 90°. Rostrum and shoulder regions darkly pigmented. Hood large, merging into narrow wings laterally. [Lateral wall damaged in handling.] Hood, wings and lateral walls lightly pigmented (Fig. 2A, B). Lower beak with short rostrum and blunt tip. Jaw edge nearly straight beneath rostral tip. Lower rostral length 0.75 mm, longer than hood length. Jaw angle obscure, continuing to wing shoulder. Hood narrow, merging into long and round wings. Wing fold rises along jaw angle and forms shallow shoulder groove. Crest long and dome-shaped; profile of

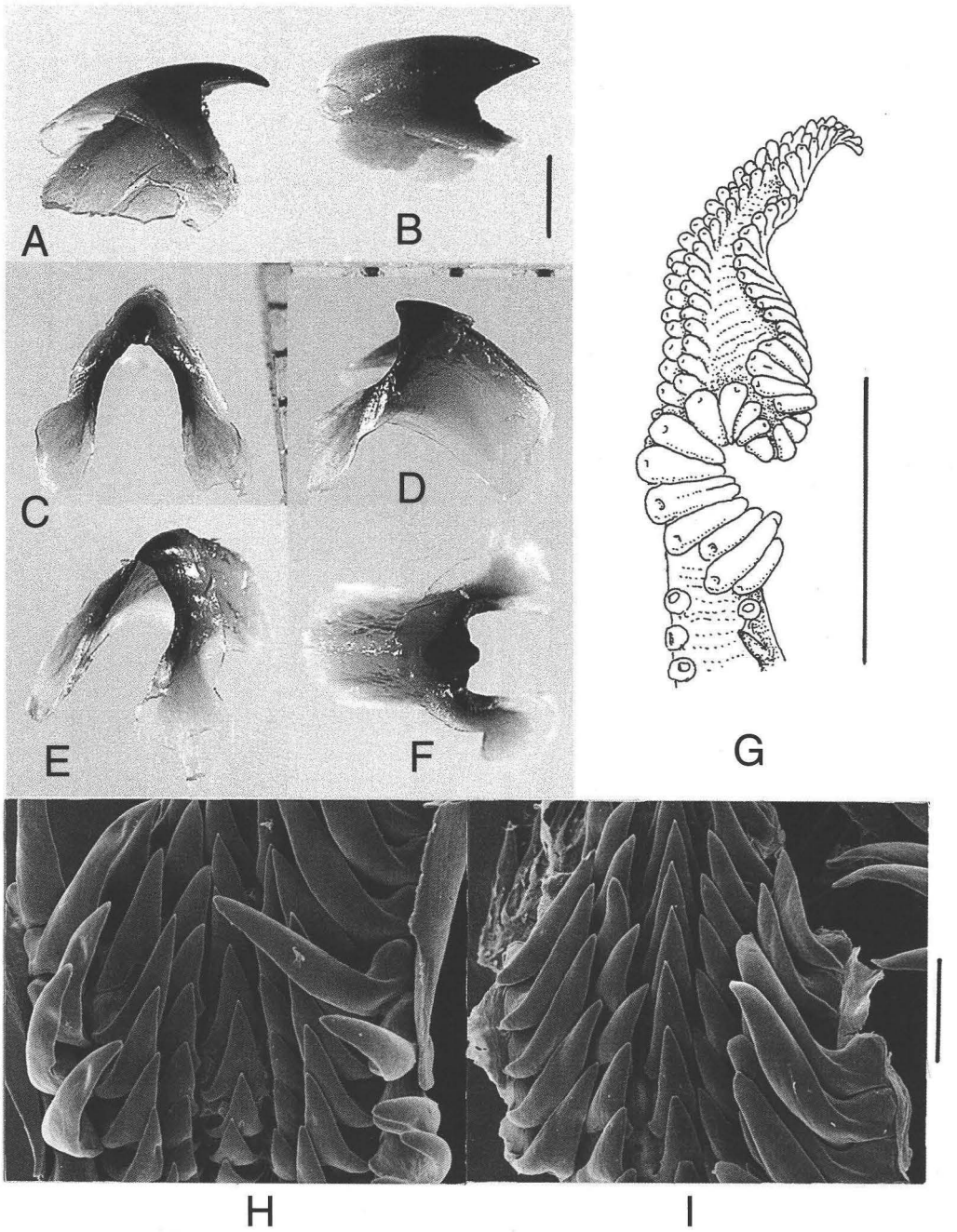

Fig. 2. *Euprymna megaspadicea* n. sp. **A-B**. Upper beak (URL = 0.82 mm). **C-F**. Lower beak (LRL = 0.75 mm) of holotype (A-F: scale = 1 mm). **G**. Hectocotylized arm of paratype #1 (male, 14.1 mm DML, scale = 5 mm). **H**. Anterior portion of radula ribbon. **I**. Posterior portion of radula ribbon of holotype, marginal teeth damaged (scale = 0.1 mm).

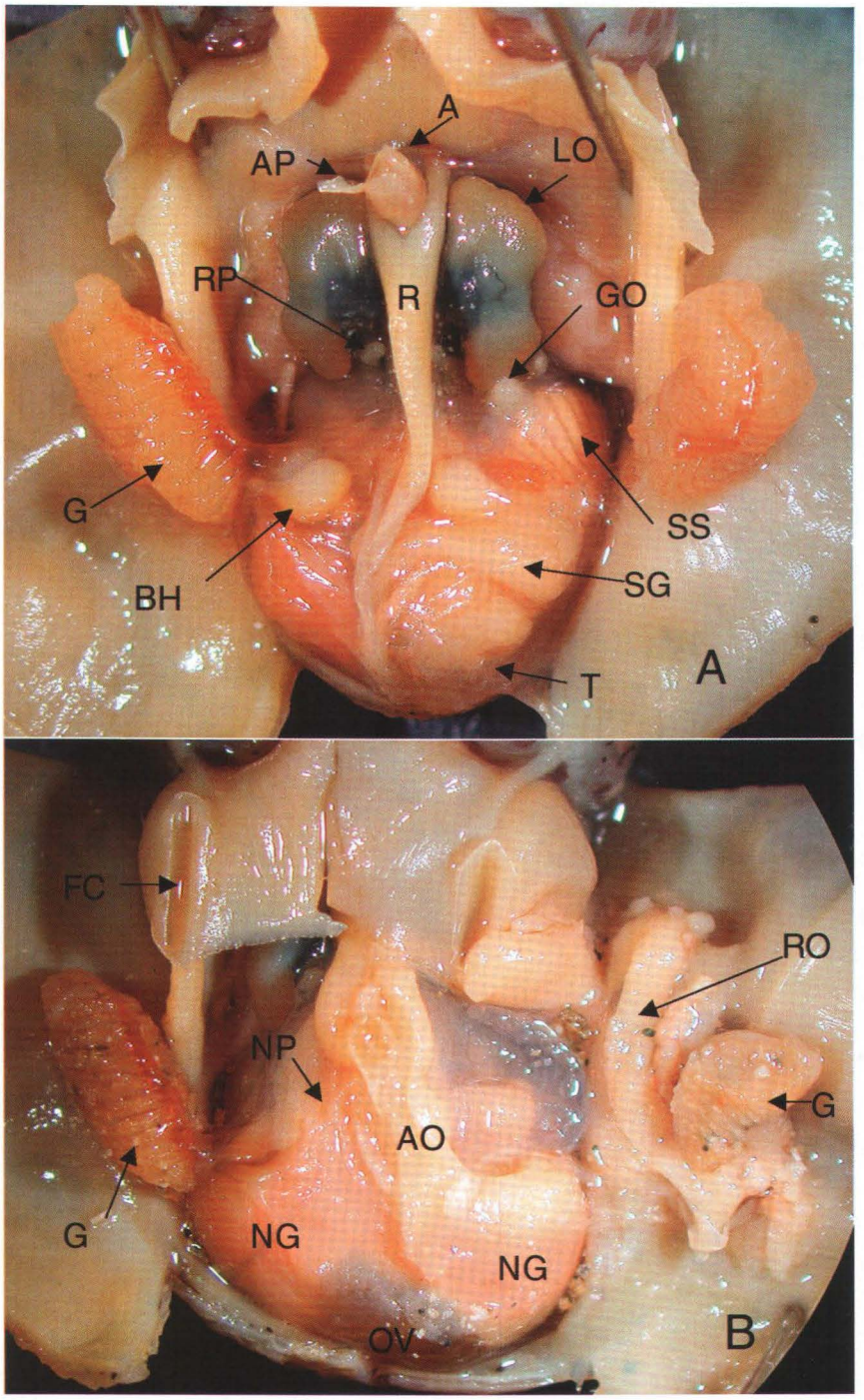

Fig. 3. *Euprymna megaspadicea* n. sp. **A**. Mantle cavity of holotype. **B**. Mantle cavity of paratype #2, (female, 16.2 mm DML). A, anus; AO, Axial organ; AP, anal flaps; BH, Branchial heart; FC, Funnel cartilage; G, Gill; GO, Genital opening; LO, Light organ; NG, Nidamental gland; NP, Nidamental gland pore; OV, Ovary; R, Rectum; RO, Rod-like organ; RP, Renal pore; SG, Spermatophoric gland; SS, Spermatophore storage; T, Testis.

lateral wall forms nearly parallelogram shape. Rostrum, jaw edge and shoulder regions darkly pigmented. Wings and lateral walls lightly pigmented, with transparent marginal regions (Fig. 2C - F).

Radula with seven transverse rows of teeth. Rhachidian teeth equilateral trianglular, without cusp, as large as first lateral teeth. First lateral teeth scalene trianglular with small projections at inner basal margins. Second lateral teeth also scalene triangular, 1.5 taller than rhachidian teeth. Third lateral teeth long, saber-like in shape, curved inwardly, and twice as tall as second lateral teeth (Fig. 2H, I).

Mantle cavity of holotype (Fig. 3A) with saddle-shaped light-organ in anterior third. Single lobe of light-organ (LO) somewhat renal-shaped, rather acute anteriorly and posteriorly, and weakly constricted in middle. Ink sac integrated in light organ complex. Gill (G) well developed with 19-21 lamellae on outer demibranch, with large branchial heart (BH). Testis (T) located in posterior half of mantle cavity. Thick tube-like spermatophoric gland (SG) anterior to ventral testis. Large spermatophore storage sac (SS), in which a dozen complete spermatophores are packed, situated antero-dorsal to testis on left side. Genital opening (GO) positioned close to posterior edge of left light organ.

In female (Paratype #2: Fig. 3B), ovary (OV) packed with large eggs situated in posterior half of mantle cavity. Pair of large leaf-like nidamental glands (NG) extending along ventral ovary. Sigmoid rod-like organ (RO) firmly attached on inner wall of mantle, overhanging left gill which seems to be less functional than right one. Posterior portion of rod-like organ originally connected with groove on an axial organ (AO) lying on visceral mass, detached during dissection.

Measurements in mm:

	Holotype	Paratype #1	Paratype #2
Registration number	NSMT-Mo 74407	NSMT-Mo 74408	NSMT-Mo 74409
Sex	Male	Male	Female
ML (Dorsal mantle length)	13.9	14.1	16.2
VML (Ventral mantle length)	15.7	15.8	16.7
FL (Fin length)	10.9	11.9	13.9
FW (Fin width = single lobe width)	7.5	8.6	9.9
HL (Head length)	5.2	6.9	7.4
HW (Head width)	11.4	11.3	12.3
ALI (1st right arm length)	8.3	9.4	10.7
ALII (2nd right arm length)	13.5	13.3	11.8
ALIII (3rd right arm length)	10.5	10.7	11.1
ALIV (4th right arm length)	7.1	8.2	9.9
HCAL (Hectocotylus length)	10.5	10.4	—
TtL (Right tentacle length)	18.7	16.7	14.0
CbL (Right club length)	3.5	3.9	3.9

Type depository: Department of Zoology, National Science Museum, Tokyo.

Holotype: NSMT-Mo 74407; paratype #1: NSMT-Mo 74408; paratype #2: NSMT-Mo 74409.

Type Locality: Nago Bight, Okinawa Island: R/V *Yoko-Maru* trawl station F300-3 (25 October, 1997) 26°33.8′N, 127°49.7′E, at 300 m depth. Collected by Dr. J. Kosuge, Seikai Fisheries Research Institute, Ishigaki Branch (Fig. 4).

Distribution: Hitherto known only from the type locality. Occurred with *Sepiolina nipponensis* (Berry, 1911).

Etymology: The species name is derived from the conspicuous and massive modification of the hectocotylized arm.

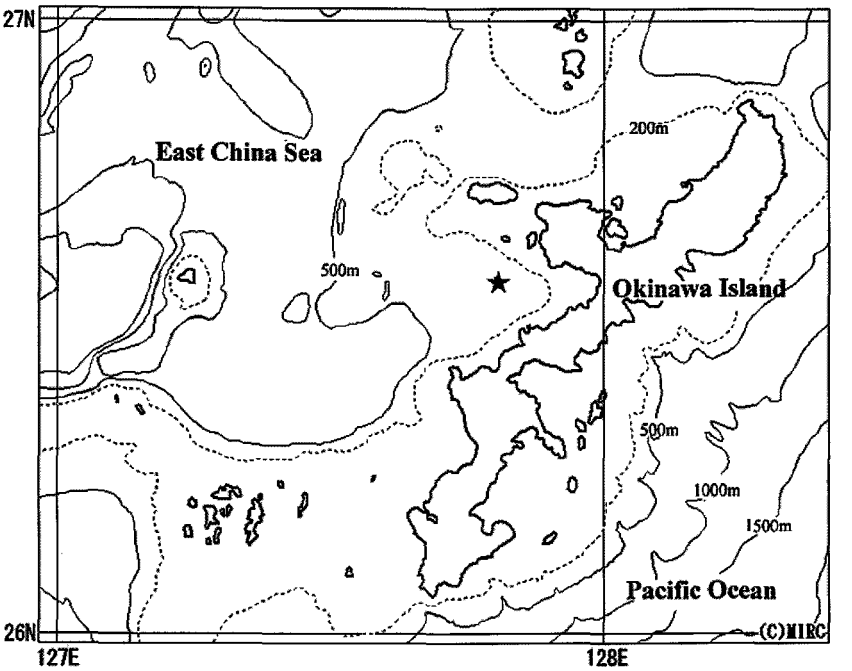

Fig. 4. Collection locality of *Euprymna megaspadicea* n. sp. (star).

Remarks: The genus *Euprymna* was established by Steenstrup (1887). The type species is *Inioteuthis morsei* Verrill, 1881 from Tokyo (Yedo) Bay, Japan. Eleven species, including two obscure ones, were listed by Sweeney & Roper (1998). Norman & Lu (1997), however, concluded only six species are valid in the genus *Euprymna*, namely, *E. morsei* (Verrill, 1881), *E. tasmanica* (Pfeffer, 1884), *E. scolopes* Berry, 1913, *E. berry* Sasaki, 1929, *E. hoylei* Adam, 1986 and *E.* sp.1 (= *E. stenodactyla* Adam, 1986). They retained *E. albatrossae* Voss, 1963, *E. bursa* (Pfeffer, 1884) and *E. phenax* Voss, 1963 as unresolved species. Nateewathana (1997) reported *E. hyllebergi* from the Andaman Sea. Lu & Boucher-Rodoni (2001) found *E.* sp. 1 and sp. 2 from the central South Pacific but they hesitated to give new names to them due to only a single female specimen being available for each taxon.

Among the above seven valid and three unresolved species, *E. phenax* and *E.* sp. 1 are distinguished from the others by having two rows of suckers on the normal arms and 6-8 rows of suckers on the normal arms, respectively. The remainders have four rows of suckers on normal arms. In distinguishing among species that all have four rows of suckers, the occurrence and arrangement of enlarged suckers on the arms of males have been considered as one of the most important specific characters. However, those arm suckers are easily dislodged in preserved specimens and positive identification is sometimes difficult. Therefore, to compare hitherto described species with the present new species, size at maturity, hectocotylized arm structure and occurrence of enlarged suckers on the arms of males in seven valid species and the present new species are summarized in Table 1. *Euprymna bursa* is known only from female types from Hong Kong and systematic evaluation is difficult.

The present new species, *Euprymna megaspadicea*, is apparently different from other known species in having: (1) a hectocotylized arm much longer than the opposite right arm I, (2) palisade-like structure of hectocotylus occupying nearly 4/5 of the distal portion of hectocotylized arm, (3) a single row of much thickened ventral elongate pedicels and two rows of less thickened

Table 1. Comparison of hectocotylized arm and enlarged sucker arrangement of male *Euprymna* with 4 rows of suckers on the arms.

	Mature size DML mm	HAL vs. RAL	Palisade-like structure of HA	Suckers on proximal portion of HA	Enlarged suckers
E. megaspadicea n. sp.	14	20% longer	4/5 of HA, 3 rows, ventral row much thickened with wide medial groove.	3-4 normal suckers with 1-2 papillae.	Uncertain AI, II-v; III-v,d
E. morsei (Verrill, 1881)	35-40	Little shorter	Half length of HA, 4 rows, both rows thickened with wide medial groove.	25-35 normal suckers with 1-2 papillae.	*AII, III, IV-v.
E. tasmanica (Pfeffer, 1884)	24-33	Equal or little shorter	Half length of HA, 4 rows, both rows thickened with narrow medial groove.	29-38 normal suckers with 1 papilla.	*AII, III, IV-v,d + 2GES on AII, III-v
E. scolopes Berry, 1913	30-35	Equal	2/3 of HA, 4 rows, both rows thickened. Medial groove uncertain.	48 normal suckers with 1-2 papillae.	* AII-v,d; III-v; IV-d.
E. berryi Sasaki, 1929	35-40	Little shorter	Half length of HA, 4 rows, both rows thickened with wide medial groove	33-40 normal suckers with 2 papillae.	*AII, IV-v,d.
E. albatrossae Voss, 1962	20-24	Little shorter	Half length of HA, 4 rows, both rows thickened with a narrow mesial groove.	35 normal suckers with 2 papillae.	*AI, II, IV-v,d.
E. hoylei Adam, 1986	11-18	Equal or little shorter	Half length of HA, 4 rows, only visible on ventral side	20-25 normal suckers with 1-3 papillae.	*AII-v; IV-v,d.
E. hyllebergi Nateewathana, 1997	31	Much shorter	Half length of HA, 4 rows without medial groove.	33-35 normal suckers with 2 papillae.	AIII-v; IV-v,d.

DML, dorsal mantle length: HAL, hectocotylized arm length; RAL, right arm I length; HA, hectocotylized arm; GES, greatly enlarged sucker; d, dorsal row; v, ventral row; *, see Norman & Lu (1997) for stylized representation of enlarged sucker arrangements on right arms of mature males.

dorsal fleshy pads with a wide medial groove on the hectocotylus, and (4) 3-4 normal suckers with 1-2 papillae on the proximal portion of the hectocotylus. In addition, both male and female *E. megaspadicea* mature at much smaller sizes (13-16 mm ML) than the other species (20-40 mm ML), except for *E. hoylei* (11-18 mm ML). According to Norman & Lu (1997), females of *E. bursa* are also much larger (25-34 mm ML) than mature female *E. megaspadicea* (16 mm ML).

It was not possible to determine the exact arrangement of enlarged suckers on the arms of males due to dislodgement of some suckers. The enlarged suckers may occur on the ventral row of arms I and II, and both dorsal and ventral rows of arm III. Sucker enlargement is less obvious than in the other species; the enlarged suckers are about twice the diameter of the medial suckers, and there are no greatly enlarged suckers. The mature female has a large concretion over the left nidamental gland pore connecting to the inner mantle wall and left gill base. It is not clear whether this concretion is a normal condition or a disorder. The examination of additional specimens is necessary to verify this.

Although most members of the genus have been reported from shallow coastal waters to the continental shelf shallower than 200 m depth, *Euprymna megaspadicea* was collected by a bottom trawl from an unusual depth for the genus at 300 m off Okinawa Island, southwestern Japan. *Sepiolina nipponensis* (Berry, 1911) was found in the same collection. The habitat of *E. megaspadicea* may also be different from other members of the genus.

Euprymna megaspadicea can thus be clearly distinguished from other known *Euprymna* species based on its small size at maturity, the massive configuration of the modified part of its hectocotylus with a few normal suckers (3-4) basally, and by its inhabiting relatively deeper

waters than the others.

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沖縄から採集されたミミイカ属の1新種

窪寺恒己・奥谷喬司

要　約

西海区水産研究所の陽光丸によって沖縄島名護湾の水深300 mから採集された小型のミミイカ属は新種と判定されたので，記載する。

***Euprymna megaspadicea* n. sp. オキナワミミイカ**（新種・新称）

小型のミミイカで，(1) 腕の吸盤は4列であるが，基部や末端では2列になる傾向がある，(2) 雄の左第1腕が交接腕に変形し，その腹側の吸盤柄が肉質の膨隆物となり1列の波状に配列，背側は2列の乳嘴列となり中央は溝状に空く独特の形状を示す。ミミイカ属のなかでは，最も深い水深（300 m）に生息する。