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Euprymna berryi Sasaki, 1929 ニヨリミミイカ(新称)について

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Identity of *Euprymna berryi* Sasaki, 1929 (Cephalopoda: Sepiolidae)

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Abstract: As the results of critical observations on fashion of arm sucker enlargement, morphology of tentacular suckers and bodily and spermatophoric proportions, it was concluded that the genus *Euprymna* in the Japanese waters contains two sympatric species, *E. morsei* (Verrill, 1888) and *E. berryi* Sasaki, 1929.

Verrill (1881) described *Inioteuthis Morsei* from Bay of Yeddo (=Tokyo). This species was transferred to the genus *Euprymna* created by Steenstrup (1887) based on morphology of hectocotylus. The name *E. morsei* had been universally used for Japanese *Euprymna* until Sasaki (1913) separated them into two species, *E. morsei* and *E. similis*. Later, he (1929) erected *E. berryi* for *E. morsei* auct. and made *E. similis* synonymous with *E. morsei* sensu Sasaki. Because of such slight differences, some subsequent authors (e.g. Adam 1954, Okutani 1979) considered that these two would be conspecific.

This paper re-evaluates some conventional characters and gives a critical consideration of these two nominal species with a relief of other criteria and allometry.

Before going further, we extend our sincere gratitude to Mr. Kenjiro Konno and Dr. Susumu Segawa, Tokyo University of Fisheries, for their warm helps and advices rendered during the present study. We owe Prof. Kengo Soma of the same university for his instruction of SEM techniques. Many specimens were collected with helps of Mr. Yasuyuki Koike and the staff of Banda Marine Laboratory as well as Mr. Akira Maekawa and other students of our laboratory.

Materials and Methods

The total number of *Euprymna* was 124. But, only mature 42 males (7.00–35.30 mm DML) were used for the study; 54 females (7.20–53.35 mm DML) and smaller immature specimens were examined freely for reference. Among these

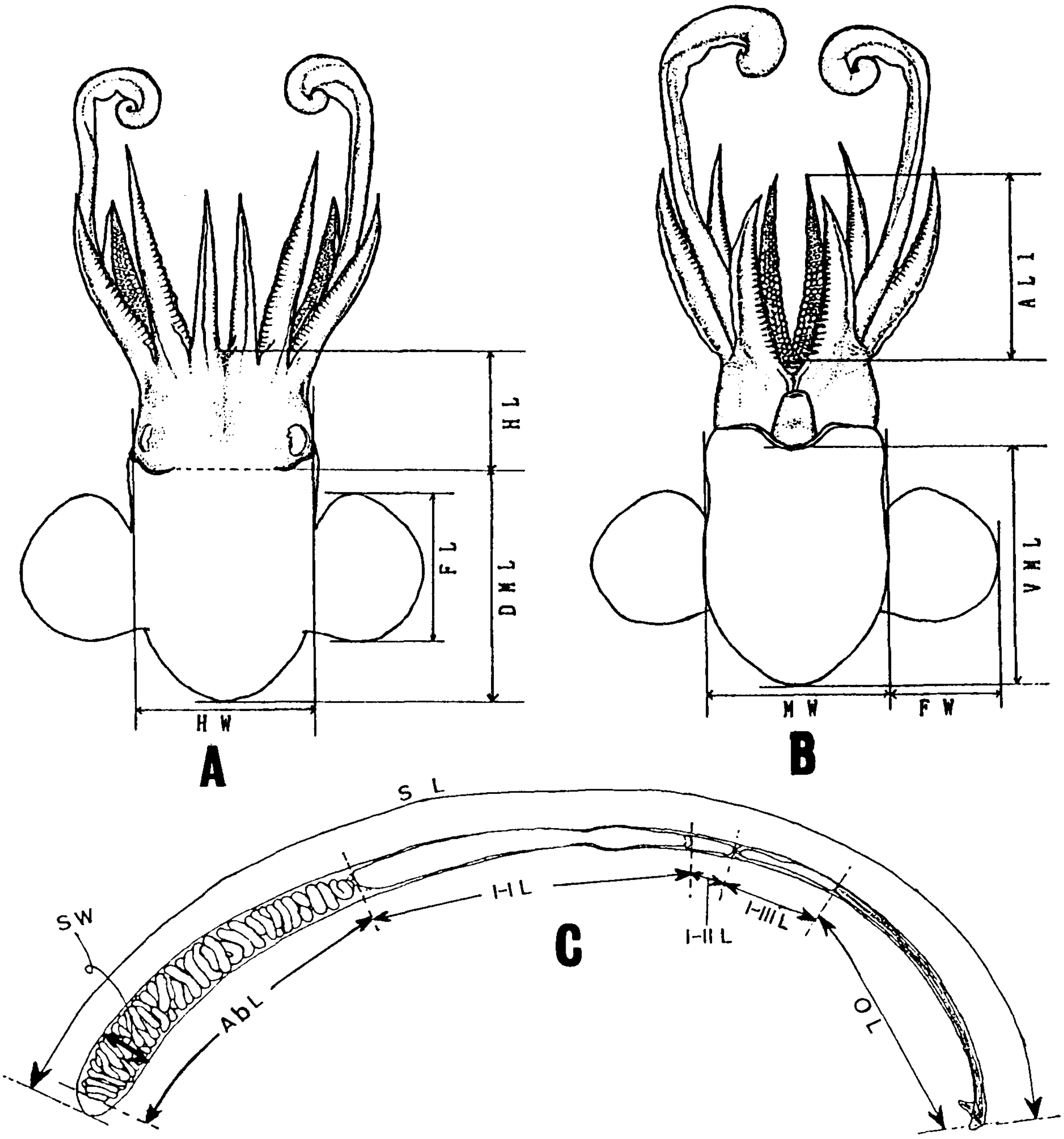


Fig. 1. Measurements of *Euprymna* ミミイカ類の測定方法

A. Dorsal view. DML: Dorsal mantle length; FL: Fin length; HL: Head length; HW: Head width.

B. Ventral view. AL1: First arm length; FW: Fin width; MW: Mantle width; VML: Ventral mantle width.

C. Spermatophore. AbL: Aboral part length; I-IL: Intermediate first part length; I-IIL: Intermediate second part length; I-IIIL: Intermediate third part length; OL: Oral part length; SL: Spermatophore length; SW: Spermatophore width.

42 males, 7 were from the Pacific coast of Ibaraki and Chiba Prefectures, 33 were from Tokyo Bay-Sagami Bay area and 2 from near Yaku Island, south of Kyushu (Table 1). Twenty-nine of them were dip-netted under nightlight at Banda Marine Laboratory or from catches of a trap-net fixed near Takanoshima, Tateyama Bay, by Mr. A. Maekawa who used these animals for feeding behavior study. Other specimens were taken by either beam-trawl or larva net

on board the R/V *Soyo-Maru*, Tokai Regional Fisheries Research Laboratory, and deposited in the National Science Museum, Tokyo. The collecting seasons were extended to various months of years (Appendix Table 1).

The measurements on both animal and spermatophore were illustrated in Fig. 1. The abbreviations and measurements mostly follow Roper and Voss (1983). However, some are different from theirs: FW (fin width) is not a width all across both lobes of fins together with mantle, but a transverse length of each odd lobe. On spermatophore, ABL (aboral part length), I-I to IIIL (lengths of intermediate 1st to 3rd part) and OL (oral part length) were measured. The indices of spermatophoric measurements are percentage of SL (spermatophore length) not of DML.

Table 1. Number of males used in the present study by locality
産地別標本数

Locality \ Species	*Euprymna morsei*	*Euprymna berryi*	Total
Kashima, Ibaraki Pref.	—	1	1
Ohara Coast, Chiba Pref.	1	—	1
Kominato Coast, Chiba Pref.	5	—	5
Tateyama Bay, Chiba Pref.	22	7	29
Tokyo Bay	—	1	1
Sagami Bay	1	2	3
Yaku Island	—	2	2
	29	13	42

Results

1. *Morphological characters*:

On 42 males of the present specimens, the following description can be given: The mantle is dome-shaped, slightly depressed dorso-ventrally, wider anteriorly than posteriorly. The anterior dorsal margin is fused with the head in distance of ½ to ⅔ of MW. The ventral margin is shallowly emaginated leaving blunt lateral lobes on both sides. The fins are oval and attached on the lateral mantle slightly anteriorly to the middle and have rather deep incision at anterior attachment. The head is also depressed dorso-ventrally, HL is about half of ML, but HW is almost equal to MW. The eyes are situated slightly dorsally and posteriorly with oval orbit. No olfactory papilla is present.

The funnel is conical tapering towards the tip reaching to the base of the arm IV. The funnel locking cartialge is elongate oval in shape with shallow groove. The mantle locking cartilage is a slender ridge slightly shorter than twice the length of groove of funnel cartilage. The funnel organs are consisted of inverted V-shaped dorsal pad and a pair of pyriform ventral pads. They are flat except a mesial fleshy ridge running along the central axis of the dorsal pad.

The funnel valve is inverted heart-shaped and situated at halfway between the anterior tip of dorsal pad and free margin of the funnel.

Arms are unequal with a formula of II, III, IV, I (12 specimens) followed by II, III, I, IV (9 spec.) and III, II, IV, I (8 spec.). The longest arm exceeds DML. Interbrachial web is most prominent between arms III and IV, but very slight between arms I's, I and II, and II and III. No web is present between arms IV's. Arms are roundish aborally and rather flat orally. A low aboral swimming keel is present on all arms, but that of the arm IV is situated more ventrally as a continuation of the interbrachial web. Four rows of conical pedicels are present on the oral surface. Suckers are situated in an oblique position on the tops of these pedicels. The suckers are spherical in shape except those on the modified portion of the hectocotylized arm. The marginal suckers are always larger than mesial suckers. There are some enlarged suckers but the fashion of enlarge sucker distribution shows specific difference (see next section).

Hectocotylization is affected on the left arm I, which is shorter and thicker than the counter arm and is usually reflected dorsally. In this arm, one or two suckers at 2nd to 3rd of the ventral row from the base are lacking, instead sucker pedicels of them are swollen into one or two large conical papillae. Sucker pedicels of distal half of this arm are also transformed into conical papillae that are packed together forming a parisade-like structure. The proximal part of sucker cup is extended over the opening which is circular and has 15 triangular sharp teeth along the $\frac{2}{3}$ of inner margin.

Tentacle stalk is slightly flattened orally. The club is only slightly wider than the stalk and curled ventrally with a pointed tip which reflected dorsally. There is a ventral web extending backwards to the one-third of the stalk. Suckers are very small and crowded. Two types of suckers exhibit specific difference (see next section). The chitinous area of the suckers consists of three zones encircling the opening. The innermost zone is consisted of 19–25 pieces of fan shaped blocks, the intermediate one, 19–25 pieces of septangonal or octangonal blocks, and the outermost zone, 38–51 pieces of polygonal blocks that are alternating with 2–3 former pieces per one block. These blocks are ornamented with minute pores and low pegs superficially. The central opening is rather tubular and connects to the inner cavity. The sucker pedicels are cylindrical distally but thickened basally.

Radula has seven teeth which are all sharply pointed and bend forwards. The outer marginal is longer than the others and overlaps inner marginal.

A saccular light organ is present on both sides of the ink sac. The "penis" is apparent between the renal opening and the posterior end of the mantle cavity. Spermatophore is thicker towards the aboral part and tapers towards the oral part. Intermediated part is divisible into three parts.

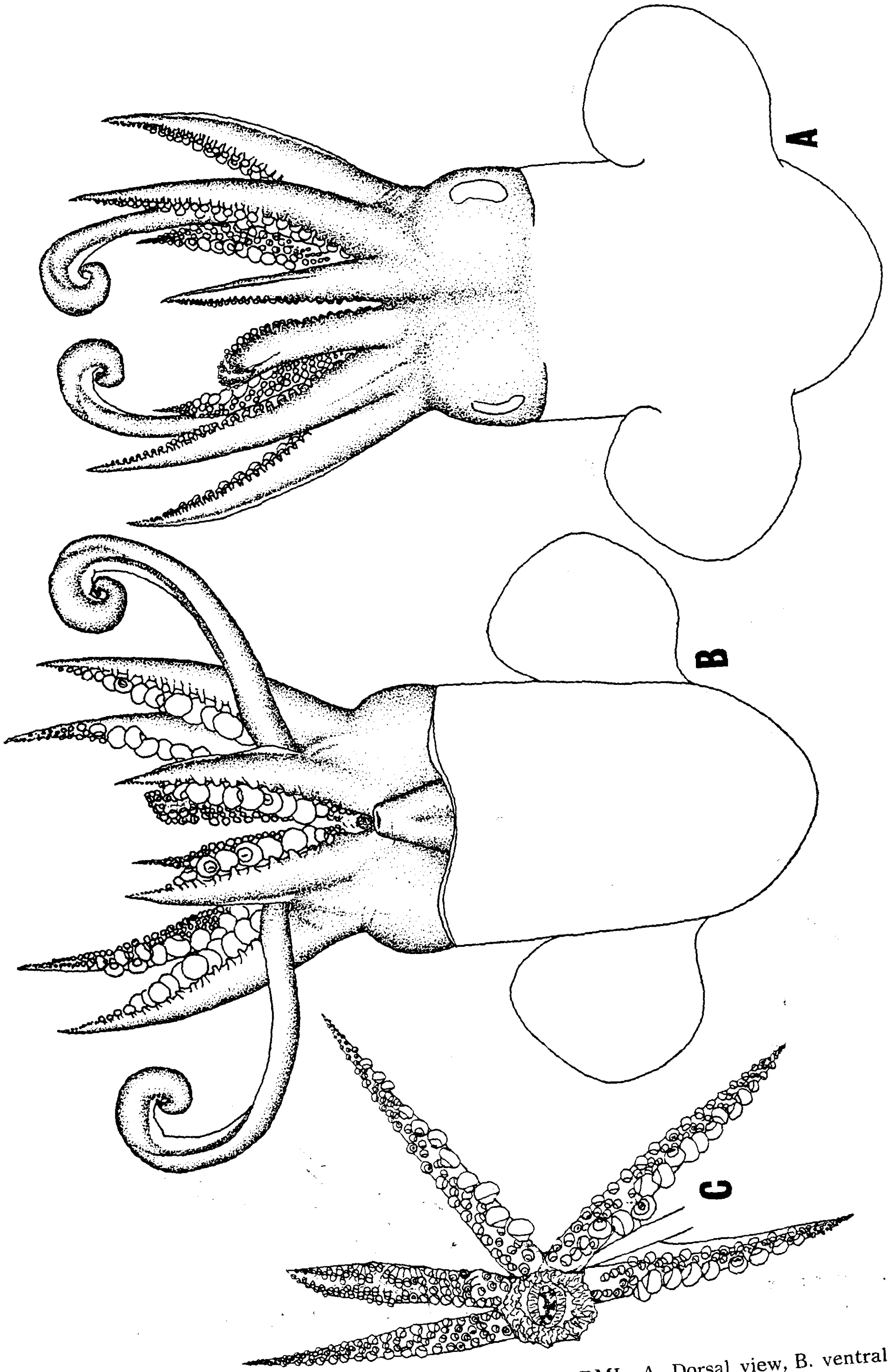


Fig. 2. *Euprymna morsei* (Verrill), male, 18.75mm DML. A. Dorsal view, B. ventral view, C. Oral view. ミミイカ

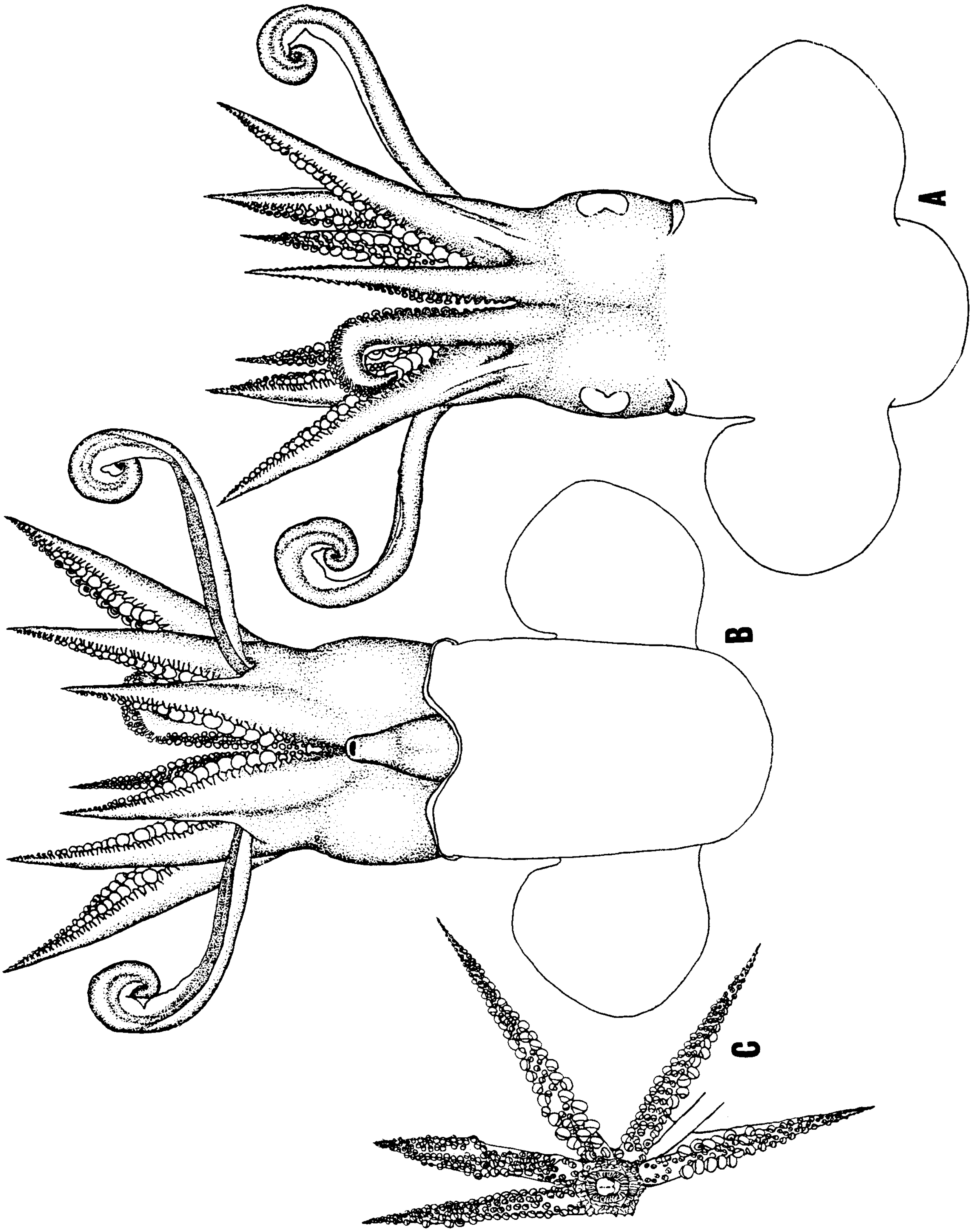


Fig. 3. *Euprymna berryi* Sasaki, male, 35.30mm DML. A. Dorsal view, B. Ventral view, C. Oral view. ニヨリミミイカ（新称）

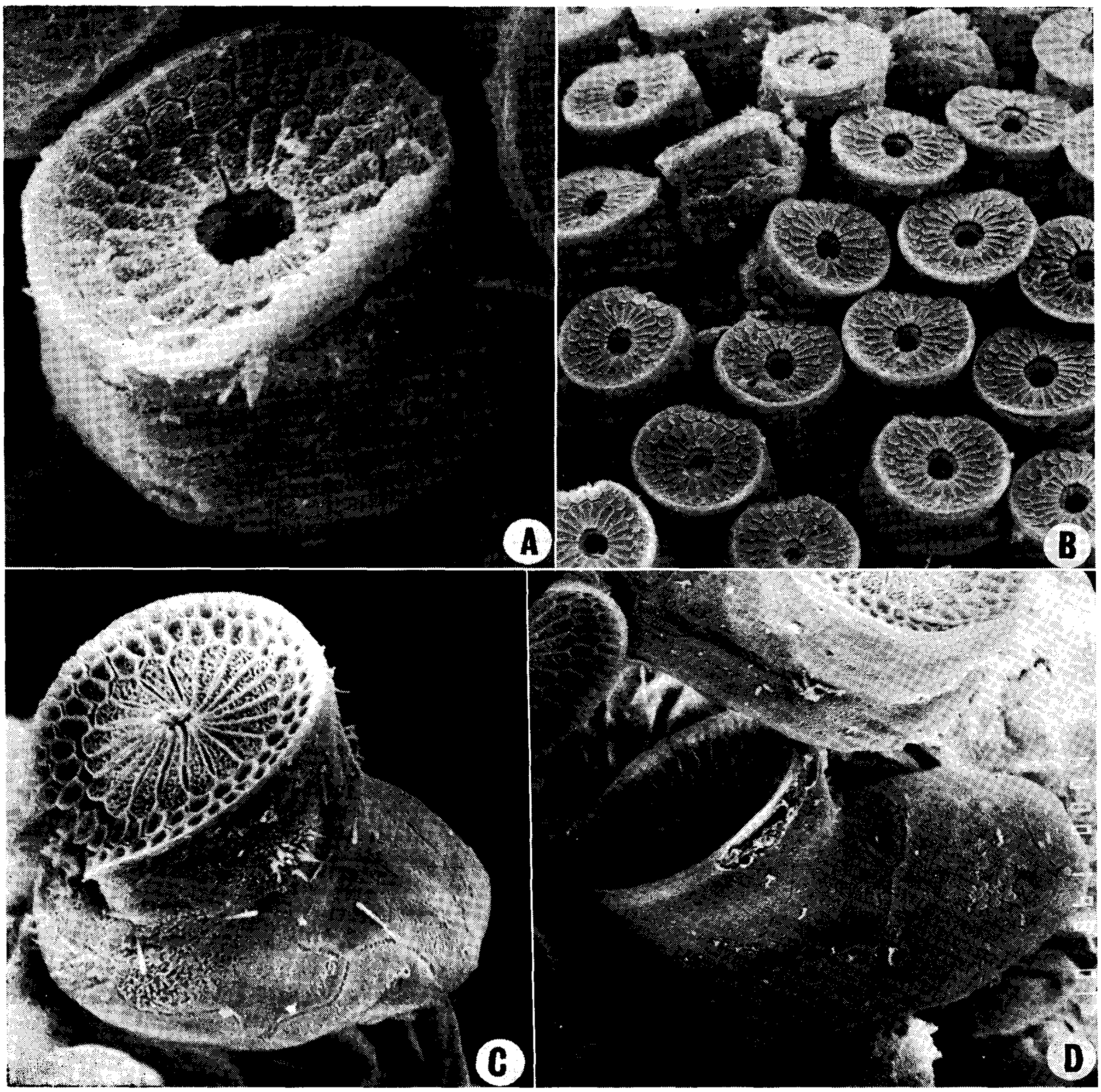


Fig. 4. Tentacle suckers 触腕吸盤
A, B. *Euprymna morsei*, 20.80mm DML. A, ×700; B, ×210
C, D. *E. berryi*, 25.90mm DML. C, ×620; D, ×770

2. *Specific difference in morphological characters*:

Out of 42 male specimens, 29 specimens ranging from 7.00 mm to 18.75 mm DML have enlarged suckers only on the ventral rows of arms. In the arm I, marginal suckers are slightly larger than mesial ones. On the arm II to IV, enlarged suckers become apparent from the proximal 3rd or 4th suckers. This type is identifiable to be *E. morsei* (Fig. 2).

In 13 specimens raging from 13.30 to 35.30 mm DML, both dorsal and ventral rows have enlarged suckers. The arm I is similar to that of the preceding type, but arm III has several enlarged suckers from the proximal 5th to 8th. In the arms II and IV, enlargement occurs from the proximal 2nd to 4th suckers on both dorsal and ventral rows. This character well agrees with *E. berryi* (Fig. 3).

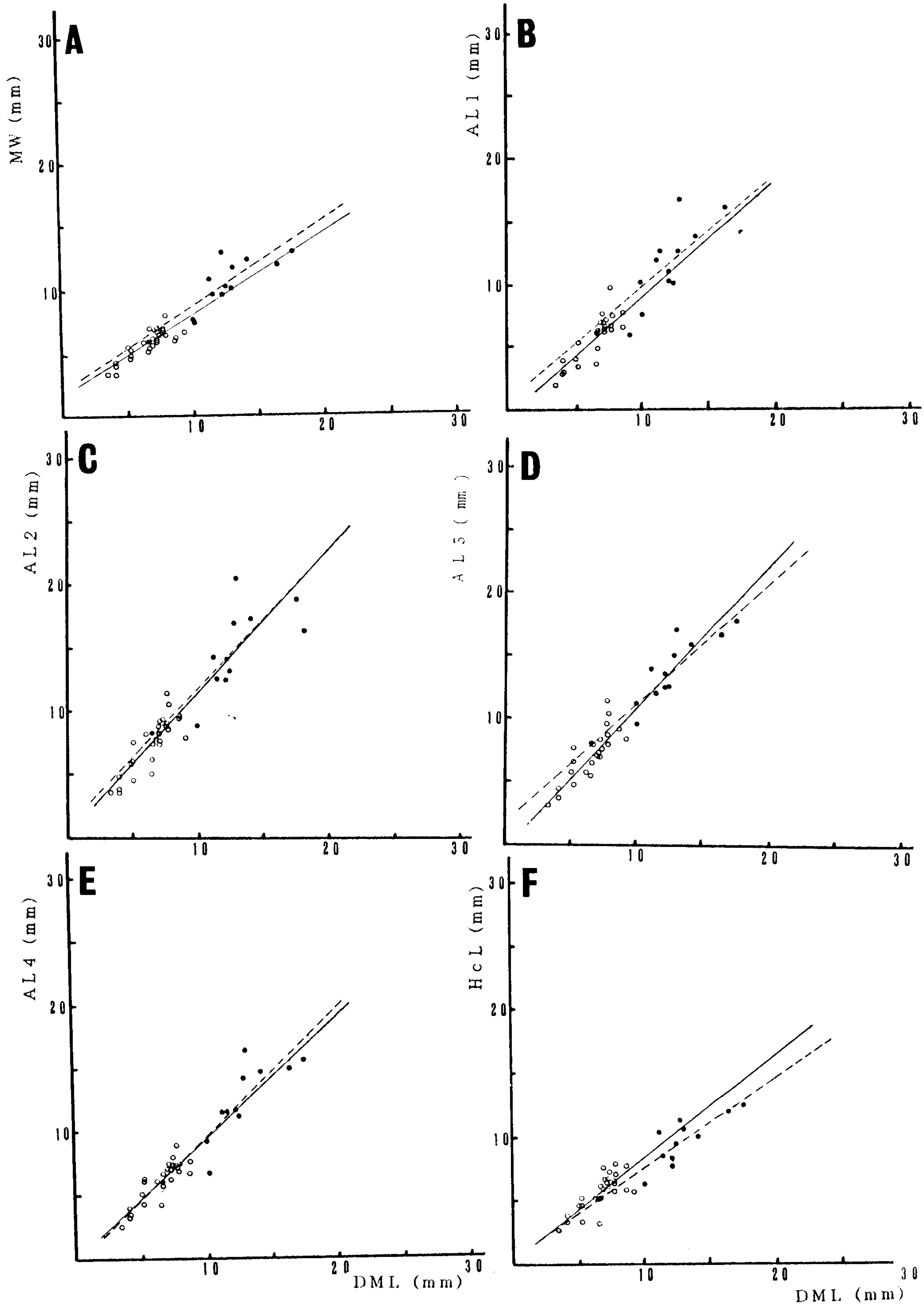
As was described by Sasaki (1929), *E. morsei* has cup-shaped or spherical tentacle suckers, while *E. berryi* has goblet-shaped or smoking-pipe-shaped suckers (Fig. 4).

The former one is more frequent in smaller specimens, while the latter is so

Table 2. Ranges, means and standard deviations of indices in males of *Euprymna morsei* (Em) and *E. berryi* (Eb) 雄の指数の範囲・平均値・標準偏差

Indices (% of DML)	Species	N	Range	Mean	S. D.
VML	Em	29	0.92—1.13	1.02	0.0031
	Eb	13	0.90—1.15	1.05	0.0064
MW	Em	29	0.71—1.12	0.91	0.0160
	Eb	13	0.73—1.07	0.85	0.0100
FL	Em	28	0.53—0.82	0.67	0.0048
	Eb	12	0.46—0.69	0.59	0.0070
FW	Em	28	0.35—0.66	0.54	0.0077
	Eb	12	0.35—0.75	0.55	0.0157
HL	Em	29	0.44—0.86	0.60	0.0111
	Eb	13	0.39—0.63	0.52	0.0048
HW	Em	29	0.84—1.28	1.00	0.0109
	Eb	13	0.81—1.12	0.96	0.0106
AL1	Em	27	0.56—1.25	0.87	0.0246
	Eb	13	0.75—1.28	0.95	0.0204
AL2	Em	27	0.77—1.47	1.12	0.0302
	Eb	12	0.88—1.57	1.23	0.0308
AL3	Em	26	0.83—1.47	1.08	0.0276
	Eb	13	0.94—1.31	1.10	0.0117
AL4	Em	26	0.65—1.19	0.94	0.0174
	Eb	12	0.68—1.25	0.97	0.0193
HcL	Em	29	0.46—1.05	0.82	0.0170
	Eb	12	0.61—0.91	0.74	0.0082

Fig. 5. Relationship between dorsal mantle length and mantle width (A), 1st arm length (B), 2nd arm length (C), 3rd arm length (D), 4th arm length (E), and hectocotylized arm length (F). 外套背長と体各部の関係
Open circles and solid line: *E. morsei*; filled circles and broken line: *E. berryi*.


A
MW (mm)
B
AL 1 (mm)
C
AL 2 (mm)
D
AL 3 (mm)
E
AL 4 (mm)
F
HcL (mm)
10
20
30
DML (mm)

in larger ones, although this character almost accords with the different fashion of sucker enlargement mentioned above.

3. *Allometrical survey*:

Eleven indices were obtained (Table 2), and correlation coefficient and regression line were also computed on the items for comparative purpose (Table 3). Four other parameters were obtained for only *E. morsei* and are not used for the

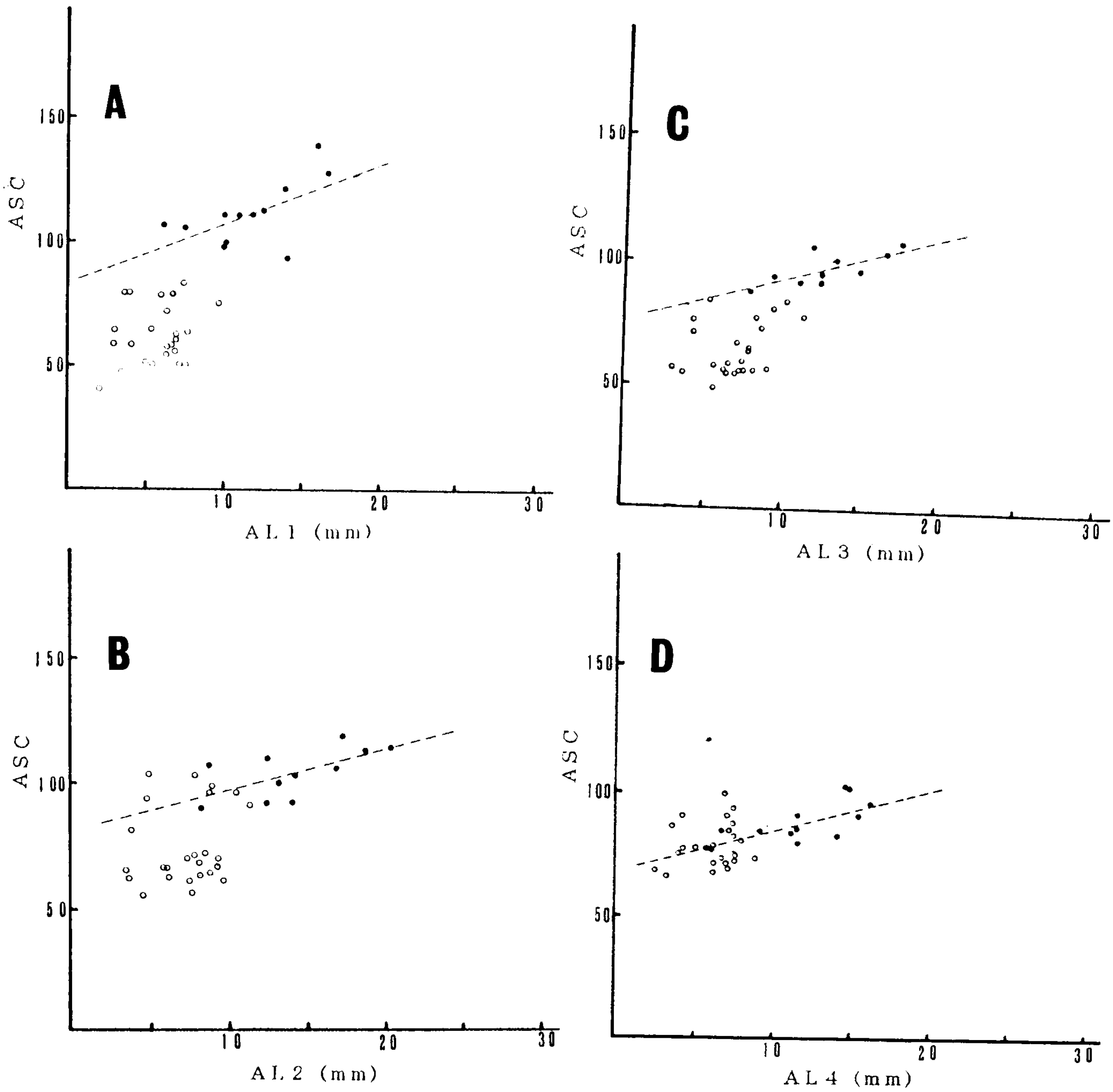


Fig. 6. Relationship between arm length (A, 1st; B, 2nd; C, 3rd; D, 4th arms) and arm sucker count (ASC). 各腕長と吸盤数の関係
Open circles: *E. morsei*; filled circles and broken line: *E. berryi*.

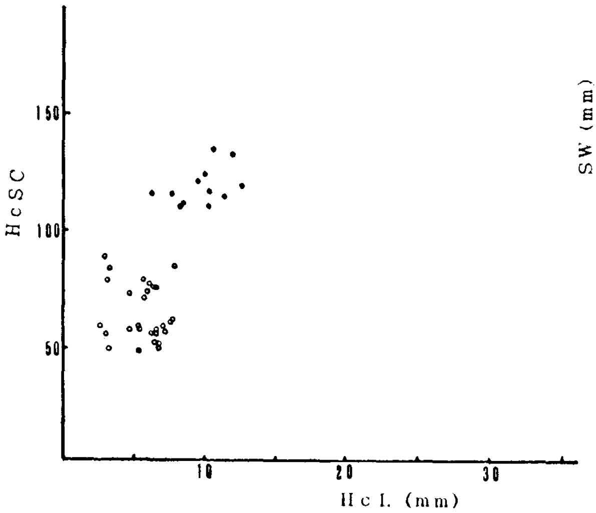


Fig. 7. Relationship between hectocotylized arm length (HcL) and sucker count of thesame (HcSC). 交接腕長と吸盤数の関係
Open circle: *E. morsei*; filled circle: *E. birryi.*

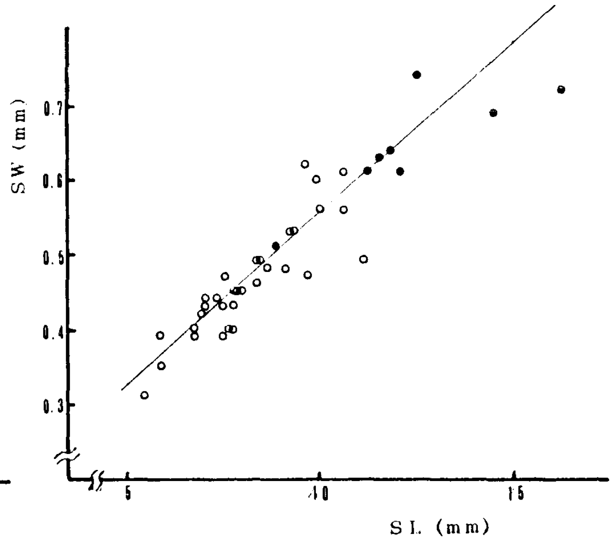


Fig. 8. Relationship between spermatophore length (SL) and spermatophore width (SW). Open circles and solid line: *E. morsei;* filled circles: *E. berryi.*

Table 3. Correlation of morphological parameters in males of *Euprymna morsei* (Em) and *E. berryi* (Eb). A (regression coefficient), B (vertical intercept) and R (correlation coefficient) for the line Y=AX+B in Figs. 5 and 6. Figs. 5・6の Y=AX+B 直線の各係数。

Relationship	Species	N	A	B	R
DML-AL1	Em	27	0.9248	−0.7000	0.8106
	Eb	13	0.8757	1.8966	0.8026
DML-AL2	Em	27	1.1672	−0.5523	0.8407
	Eb	12	1.1250	1.1738	0.8270
DML-AL3	Em	26	1.1071	−0.3636	0.8360
	Eb	13	0.9488	3.6207	0.9038
DML-AL4	Em	26	0.9462	−0.0137	0.8647
	Eb	12	0.9955	−0.6165	0.8663
DML-HcL	Em	27	0.8101	0.3165	0.8396
	Eb	12	0.6929	1.1157	0.8799
DML-MW	Em	29	0.6388	3.4568	0.8482
	Eb	13	0.6690	4.2515	0.8455
AL1-ASC	Em	24	—	—	—
	Eb	12	1.2180	83.1372	0.6085
AL2-ASC	Em	35	—	—	—
	Eb	11	0.8048	80.9218	0.6372
AL3-ASC	Em	25	—	—	—
	Eb	10	0.8529	75.6106	0.7629
AL4-ASC	Em	24	—	—	—
	Eb	12	0.8246	67.7778	0.6835

Table 4. Ranges, means and standard deviations of DML, SL, SW and five spermatophoric indices* in male *E. morsei* (Em) and *E. berryi* (Eb).
精莢各部の指数の範囲・平均値・標準偏差

Dimensions & indices	Sp.	N	Range	Mean	S. D.
DML	Em	19	10.10 —18.85	14.26	2.123
	Eb	6	13.30 —35.30	23.38	7.233
SL	Em	35	5.44 —11.17	8.15	1.390
	Eb	8	8.89 —16.22	12.38	2.186
SW	Em	35	0.31 — 0.62	0.47	0.074
	Eb	8	0.51 — 0.74	0.63	0.071
AbLI	Em	35	0.069— 0.324	0.168	0.0592
	Eb	8	0.059— 0.312	0.206	0.0913
I-ILI	Em	35	0.142— 0.325	0.253	0.0435
	Eb	8	0.217— 0.412	0.323	0.0694
I-IILI	Em	35	0.000— 0.095	0.037	0.0296
	Eb	8	0.000— 0.043	0.013	0.0136
I-IIILI	Em	34	0.064— 0.119	0.082	0.0111
	Eb	8	0.075— 0.136	0.107	0.0179
OLI	Em	34	0.381— 0.535	0.441	0.0351
	Eb	8	0.246— 0.411	0.322	0.0560

AbLI: Aboral part length index, AbL/SL; I-(I-III) LI: intermediate (1st to 3rd) part length index, I-(I-III) L/SL; OLI: Oral part length index, OL/SL.

Table 5. Correlation of morphological parameters of spermatophores of *E. morsei*. A (regression coefficient), B (vertical intercept) and R (correlation coefficient) for the line Y=AX+B in Fig. 8.
Fig. 8 の Y=AX+B 直線の各係数

Index (% of SL)	N	A	B	R
SW	35	0.045964	0.0938995	0.854781
AbLI	35	0.0287224	−0.0666145	0.68414
I-ILI	35	−0.0238667	0.447862	−0.77376
I-IILI	35	—	—	—
I-IIILI	34	−0.00288065	0.105041	−0.366799
OLI	34	—	—	—

present study. Fourty-three spermatophores of both species were also measured (Appendix table 2) and five spermatophoric indices were computed (Table 4).

Among contemporary indices, both species do not exhibit a spectacular difference between them. Only FLI and HLI show slightly over 10% difference. In connection with this, female *E. morsei* does not differ from male in these indices, but female *E. berryi* slightly differs from male in ALI and ALII. Coefficients for DML-MW, DML-ALI to IV and DML-HcL are quite high ($R>0.80$) in both species, but a considerable difference between two was detected

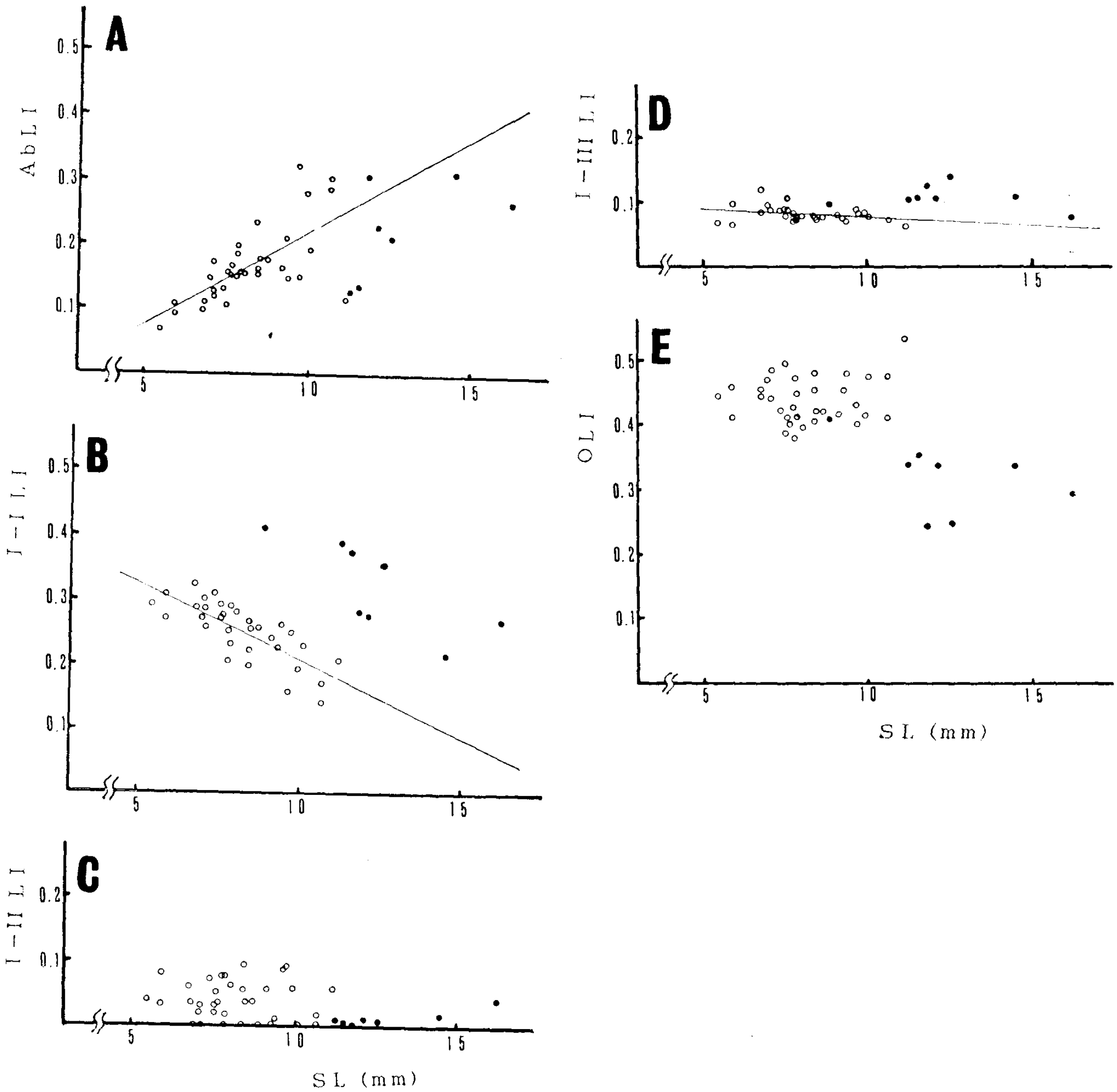


Fig. 9. Relationship between spermatophore length and aboral part length index(A), intermediate lst part length index (B), 2nd part length index (C), 3rd part length index (D), and oral part langth index. 精莢長に対する精莢各部の比率
Open circles and solid line: *E. morsei*: filled circles; *E. berryi*. For definition of index, see footenote of Table 4.

in DML-HcL (Fig. 5). The correlation between ALI-IV and ASC of each arm of *E. morsei* is abandoned at $\alpha=0.05$ significant level (Fig. 6). While, that in *E. berryi* was still low (R=0.60–0.76). HcL-HcSC was not so significant in both species (Fig. 7).

Significant differences are apparent in spermatophoric indices (Table 4), namely, AbLI (18.4%), I-ILI (21.7%), I-IILI (64.9%) I-IIILI (23.4% and OLI (27.0%), respectively.

Regression coefficient was computed for spermatophoric proportions in *E. morsei* (Table 5). Number of specimen of *E. berryi* in hand was so small that no statistical test was made for comparison, but the difference from

E. morsei is visually presented (Figs. 8 & 9).

Discussion

In spite of the fact that Verrill's original description of "*Inioteuthis Morsei*" was very brief, the name *morsei* had been applied to Japanese species by Appellöf (1886), Hoyle (1886), Steenstrup (1887), Ortmann (1888), Wülker (1910) and Berry (1912) before Sasaki (1913) first separated Japanese *Euprymna* into two species, *E. mosei* and *E. similis*.

In the original description in Japanese of *E. similis*, Sasaki (1913) emphasized the following two characters with which it was separable from *E.* "*morsei*". (1) In the arm II, 10–12 enlarged suckers are present only on the ventralmost (outer) row among four series. These enlarged suckers begin not from the base but several suckers distally. The suckers of dorsal outer row are slightly larger than mesial ones. (2) In the arm III and IV, enlarged suckers are counted 10 or more unlike *E.* "*morsei*" in which only limited number of central suckers are enlarged. He also mentioned that the tentacle suckers are short and its length equals to the width, while those in *E.* "*morsei*" have a smoking-pipe like appearance.

Later, Sasaki (1929) assured that the tentacular suckers of the type specimen of *E. morsei* were identical with those of *E. similis*, which was then synonymized. From this standpoint, Sasaki (1929) created a new species *E. berryi* that is characterized by different fashion of sucker enlargement and shape of tentacle suckers. Adam (1954), however, claimed that the shape of tentacle suckers may transform from globular (or short cylindrical) to elongate (or smoking-pipe shape), suggesting that *morsei* and Sasaki's *berryi* would be synonymous.

According to our critical observation on fully mature males of *Euprymna* from Japanese waters, we could recognize validity of criteria (such as fashion of arm sucker enlargement and morphology of tentacular suckers), used by Sasaki (1913). Allometrical examination on six items (Fig. 5) indicates that both two are so close that they have very similar bodily proportions. However, sucker counts of some arms (Fig. 6) and some spermatophoric proportions (Fig. 9) clarly separate *E. morsei* and *E. berryi*.

要　約

佐々木（1913）は日本のミミイカ属 ***Euprymna*** には２種あり，***E. morsei***（Verrill, 1881）と ***E. similis*** n. sp. とした。***E. similis*** が前種と異る点は，第２腕の吸盤が腹外列のみ拡大していること，第３・４腕に拡大吸盤が10以上あること，及び触腕吸盤が円筒杯形である（前種では煙管の雁首状）ことなどであった。のち（1929），彼は ***E. morsei*** の模式標本の触腕吸盤を観たところこれは上記の ***E. similis*** と同一であることが判り，却ってそれまで多くの著者が ***E. morsei*** と呼んでいた種の多くが別種であると判定し ***E. berryi*** の名を創設した。

しかしAdam (1954) などは触腕吸盤の形態差などを種内変異の域を出ないと考え，*E. berryi* は *E. morsei* の異名とした。

今回，各地から採集されたミミイカ属の成熟雄42個体について腕吸盤の拡大様式，触腕の吸盤形態のみならず体各部の相対比率，腕長と吸盤数，精莢各部位の比率等につき詳しく検討を行った結果，Sasaki (1929) の見解を支持する結論を得た。

すなわち，日本周辺に産するミミイカ属は *E. morsei*(Verrill, 1881)ミミイカと *E. berryi* Sasaki, 1929 ニヨリミミイカ（新称）の2種がほぼ同所的分布をしている。

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Appendix Table 1. Materials examined 調査標本一覧表

No.	Species	DML(mm)	Date	Locality	Method	Depository
6.	*Euprymna morsei*	14.75	1985. 2.14	Tateyama Bay	Trap Net	TUF
7.	*E. morsei*	14.90	1985. 2.14	Tateyama Bay	Trap Net	TUF
8.	*E. morsei*	15.05	1985. 2.14	Tateyama Bay	Trap Net	TUF
9.	*E. morsei*	15.85	1985. 2, 14	Tateyama Bay	Trap Net	TUF
11.	*E. morsei*	8.30	1983. 7. 9	Kominato, Chiba Pref.	Dip Net	TUF
12.	*E. morsei*	13.55	1985. 5. 5	Tateyama Bay	Dip Net	TUF
13.	*E. morsei*	14.65	1985. 5. 4	Tateyama Bay	Dip Net	TUF
14.	*E. morsei*	18.75	1984. 11. 9	Tateyama Bay	Dip Net	TUF
15.	*E. morsei*	10.65	1983. 6. 9	Kominato, Chiba Pref.	Dip Net	TUF
16.	*E. morsei*	10.65	1983. 6. 9	Kominato, Chiba Pref.	Dip Net	TUF
17.	*E. morsei*	13.40	1984. 6.24	Tateyama Bay	Dip Net	TUF
18.	*E. morsei*	10.10	1983. 7.25	Kominato, Chiba Pref.	Dip Net	TUF
19.	*E. morsei*	14.00	1985. 3. 9	Tateyama Bay	Dip Net	TUF
20.	*E. morsei*	14.65	1985. 4.21	Tateyama Bay	Dip Net	TUF
21.	*E. morsei*	12.65	1985. 4.21	Tateyama Bay	Dip Net	TUF
33.	*E. morsei*	14.35	1985. 3.10	Tateyama Bay	Dip Net	TUF
41.	*E. berryi*	25.90	1979. 8.29	Tateyama Bay	Trap Net	TUF
45.	*E. berryi*	24.50	1981. 1. —	Kashima, Ibaraki Pref.		TUF
55.	*E. berryi*	22.55	1985. 9.10	Tateyama Bay	Trap Net	TUF
56.	*E. berryi*	23.15	1985. 9.10	Tateyama Bay	Trap Net	TUF
57.	*E. berryi*	20.35	1985. 9.10	Tateyama Bay	Trap Net	TUF
59.	*E. morsei*	15.75	1985. 7.16	Tateyama Bay	Dip Net	TUF
60.	*E. morsei*	7.00	1985. 7.20	Tateyama Bay	Dip Net	TUF
62.	*E. morsei*	15.85	1985. 7.28	Tateyama Bay	Dip Net	TUF
63.	*E. berryi*	35.30	1985. 8.10	Tateyama Bay	Trap Net	TUF
64.	*E. morsei*	17.45	1985. 8.11	Tateyama Bay	Trap Net	TUF
66.	*E. morsei*	15.65	1985. 8.24	Tateyama Bay	Dip Net	TUF
67.	*E. berryi*	13.30	1985. 8.10	Tateyama Bay	Trap Net	TUF
70.	*E. morsei*	8.30	1985. 10. 20	Tateyama Bay	Dip Net	TUF
78.	*E. morsei*	13.85	1985. 10	Kominato, Chiba Pref.		TUF
88.	*E. morsei*	8.35	1985. 8.12	Tateyama Bay	Dip Net	TUF
89.	*E. morsei*	10.55	1984. 6.30	Tateyama Bay	Dip Net	TUP
94.	*E. morsei*	15.75	1984. 8. 3	Tateyama Bay	Dip Net	TUF
95.	*E. berryi*	20.10	1984. 8.26	Tateyama Bay	Trap Net	TUP
102.	*E. berryi*	33.00	1958. 3.16	35°20.5' N, 139° 45.6'E, Depth 25m	Beam Trawl	NSMT-Mo 59214
105.	*E. berryi*	26.30	—	Tokyo Bay	Trawl	NSMT-Mo 59217
109.	*E. berryi*	25.15	1959. 2. 3	30°31.2' N, 131° 51.3' E, Depth 65-68m	Beam Trawl	NSMT-Mo59218a
110.	*E. berryi*	24.55	1959. 2. 3	30°31.2' N, 131° 51.3' E, Depth 65-68m	Beam Trawl	NSMT-Mo59218b
112.	*E. berryi*	28.55	1968. 12. 12	35°09.5' N, 139° 42.5' E, Depth: 55m	Beam Trawl	NSMT-Mo 59220
115.	*E. morsei*	17.45	1972. 12. 8	Ohara, Chiba Pref,	Larval Net	NSMT-Mo 59222
117.	*E. morsei*	13.30	1951. 8.28	Sagami Bay	Larval Net	NSMT-Mo 59257
123.	*E. morsei*	14.75	1985. 11. 30	Tateyama Bay	Trap Net	TUF

TUF: Tokyo University of Fisheries; NSMT: National Science Museum, Tokyo.

Appendix Table 2. Spermatophoric dimensions (in mm) and indices* of *E. morsei* (Em) and *E. berryi* (Eb).

Species	DML	SL	SW	AbLI	I-ILI	I-IILI	I-IIILI	OLI
Em	14.75	8.00	0.45	0.157	0.283	0.064	0.079	0.398
Em	14.90	8.39	0.46	0.155	0.225	0.095	0.076	0.457
Em	14.90	7.83	0.45	0.156	0.234	0.079	0.074	0.450
Em	15.05	9.72	0.47	0.150	0.252	0.094	0.083	0.402
Em	15.85	6.72	0.40	0.100	0.325	0.050	0.085	0.446
Em	15.85	7.33	0.44	0.131	0.311	0.072	0.089	0.422
Em	15.85	11.17	0.49	0.177	0.207	0.059	0.064	0.535
Em	13.55	8.44	0.49	0.178	0.263	0.038	0.074	0.422
Em	13.55	8.67	0.48	0.176	0.258	0.037	0.077	0.423
Em	14.65	8.39	0.46	0.165	0.268	0.056	0.080	0.407
Em	14.65	9.11	0.48	0.165	0.243	0.059	0.081	0.419
Em	18.75	7.06	0.43	0.173	0.259	0.000	—	—
Em	18.75	7.78	0.45	0.187	0.206	0.000	0.086	0.474
Em	18.75	8.39	0.49	0.236	0.198	0.000	0.080	0.483
Em	10.65	7.06	0.44	0.121	0.304	0.023	0.089	0.443
Em	10.65	7.50	0.43	0.107	0.272	0.021	0.078	0.496
Em	13.40	7.50	0.39	0.159	0.292	0.032	0.090	0.389
Em	13.40	7.61	0.40	0.169	0.279	0.037	0.089	0.404
Em	10.10	5.44	0.31	0.069	0.294	0.040	0.068	0.445
Em	10.10	5.89	0.35	0.093	0.274	0.053	0.065	0.460
Em	14.00	6.78	0.39	0.110	0.290	0.036	0.119	0.456
Em	14.00	7.56	0.47	0.153	0.274	0.052	0.106	0.414
Em	14.65	5.89	0.39	0.108	0.309	0.034	0.096	0.411
Em	14.65	7.06	0.43	0.126	0.288	0.031	0.087	0.485
Em	12.65	7.83	0.45	0.157	0.285	0.018	0.076	0.415
Em	14.35	7.72	0.40	0.153	0.252	0.079	0.074	0.429
Em	14.35	7.78	0.43	0.199	0.252	0.079	0.076	0.381
Em	15.75	9.39	0.53	0.146	0.263	0.012	0.071	0.481
Em	15.75	10.06	0.56	0.193	0.231	0.000	0.078	0.476
Em	15.85	9.28	0.53	0.211	0.228	0.000	0.075	0.455
Em	15.85	10.67	0.56	0.304	0.173	0.020	0.074	0.413
Em	15.65	9.67	0.62	0.324	0.165	0.009	0.079	0.432
Em	15.65	10.67	0.61	0.287	0.142	0.000	0.073	0.477
Em	10.55	6.94	0.42	0.148	0.272	0.000	0.096	0.473
Em	15.75	9.94	0.60	0.280	0.195	0.000	0.083	0.415
Eb	13.30	8.89	0.51	0.059	0.412	0.000	0.096	0.411
Eb	20.10	12.56	0.74	0.212	0.356	0.010	0.136	0.248
Eb	35.30	16.22	0.72	0.267	0.271	0.043	0.075	0.296
Eb	25.90	11.83	0.64	0.306	0.284	0.000	0.123	0.246
Eb	25.90	12.11	0.61	0.230	0.278	0.012	0.106	0.340
Eb	22.55	14.50	0.69	0.312	0.217	0.017	0.107	0.340
Eb	23.15	11.28	0.61	0.127	0.390	0.011	0.104	0.340
Eb	23.15	11.56	0.63	0.136	0.375	0.008	0.107	0.355

*AbLI = AbL/SL × 100 ; I-(I-III)LI = I-(I-III)L/SL × 100 ; OLI = OLI/SL × 100