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CONTRIBUTIONS TO THE KNOWLEDGE OF THE RED SEA
No. 47

CEPHALOPODA FROM THE RED SEA

by
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The Cephalopoda dealt with in this paper have been entrusted to me for study by Dr. H. STEINITZ (Department of Zoology, The Hebrew University of Jerusalem) and by Dr. L. FISHELSON and Dr. CH. LEWINSOHN (Department of Zoology, Tel-Aviv University).

In a previous paper (ADAM, 1960) I mentioned 7 species from the Gulf of Aqaba. The present material has been collected in different parts of the Red Sea and comprises 23 species, 6 of which (*Sepiella inermis*, *Loligo duvauceli*, *Loligo edulis*, *Sepiola steenstrupiana*, *Thelidioteuthis alessandrinii* and *Octopus nanus* sp. nov.) have not yet been reported from the Red Sea. A new genus, *Enigmoteuthis*, is created for *Enoploteuthis dubia* ADAM.

A review of Cephalopoda of the Red Sea was given in my earlier paper (ADAM, 1959). Another paper (ADAM and REES, 1966) contains a review of Sepiidae which includes synonymy and description of the species.

ABBREVIATIONS

A–I, A–II, A–III, A–IV = length of the dorsal, dorso-lateral, ventro-lateral and ventral arms, in % of mantle length. The arm length in Decapoda is measured from first basal sucker or hook to tip of arm; in Octopoda, from mouth to tip of arm.
CLI = Length of tentacular club, in % of mantle length.
FLI = greatest fin length in % of mantle length.
FLbI = length of fin base, in % of mantle length.
fms. = fathoms.
ft. = feet.
FWI = greatest total fin width, in % of mantle length.
FWIs = Width of single fin in % of mantle length, measured from base of fin to free margin.
GL = length of shell(cuttlebone or gladius), in mm.
GStrI = length of striate zone of cuttlebone, in % of shell length.
GThI = thickness of cuttlebone, in % of shell length.
GWI = width of shell, in % of shell length.
Ha–I, Ha–II, Ha–III, Ha–IV = number of hooks of dorsal, dorso-lateral, ventro-lateral and ventral arms.
HcLI = (in Decapoda) length of modified portion, in % of total length of hectocotylized arm.
HLI = length of head in % of mantle length: measured from anterior point of nuchal cartilage to margin of web between dorsal arms in Decapoda; measured from midpoint between eyes to margin of dorsal web sector in Octopoda.

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Htp = number of pairs of hooks of tentacular club.
Hts = number of hooks of tentacular club, if there is a single series.
HWI = greatest head width, in % of mantle length.
l. = left.
LLI = in Octopoda, length of ligula, in % of total length of hectocotylized arm.
ML = dorsal mantle length in mm: in Decapoda, measured from medio-anterior point of mantle margin to posterior apex of body or fins (whichever is longest); in Octopoda, measured from posterior apex to midpoint between eyes.
MWI = greatest mantle width, in % of mantle length.
Nps = number of pairs of suckers on hectocotylized arm.
r. = right.
SIs = diameter of largest arm sucker, in % of mantle length.
SIt = diameter of largest tentacular sucker, in % of mantle length (SIT–m of median sucker, SIt—l of lateral sucker).
spec. = specimen.
SpLI = total length of spermatophore, in % of mantle length.
TLI = total length of tentacle, in % of mantle length.
VMLI = ventral mantle length, in % of dorsal mantle length.
WDI = in Octopoda, depth of deepest web sector, in % of longest arm.
W.f. = web formula, the depth of each sector in decreasing order and expressed alphabetically (A = dorsal sector, etc.).

SEPIIDAE

Sepia pharaonis EHRENBERG, 1831

Sepia pharaonis EHRENBERG, C.G., 1831, p. (?), –ADAM, W. and REES, W.J., 1966, p. 22, pl. 8, figs. 38–43, pl. 41, fig. 240. –VOSS, G.L., 1963, p. 20.

Type localities: Tor, Sinai; Massawa.

Distribution: Indo-Pacific, from the Red Sea to Japan and to Australia.

Material (Hebrew University):

a–E54/11: Eilat, 10–II–1954, leg. A. BEN-TUVIA: 1 ♀ (ML = 130 mm);

b–E57/413: South Red Sea, 1957, leg A. BEN-TUVIA: 1 ♂ (ML = 96 mm); 13 ♀ (ML = 56–142 mm);

c–E57/415: South Red Sea, 1957, leg. A. BEN-TUVIA: 1 ♀ (ML = 94 mm);

d–E57/433: North Massawa Channel, South Red Sea, 9–XII–1957, leg. A. BEN-TUVIA: 4 ♀ (ML = 60–86 mm);

e–E58/263,1: South Red Sea, winter 1957/8, leg. A. BEN-TUVIA and O.H. OREN: 1 ♀ (ML = 100 mm);

Material (Tel-Aviv University):

f–E62/4278: Bay of Archiko, 10–20 fms., 9–IV–1962: 1 spec. in bad condition (ML = 48 mm);

g–ISRSE/65/2475: Red Sea, 15°05′N–40°18′E, 2–8 m, 17–X–1965, leg. L. FISHELSON: 3 ♀ (ML = 74–105 mm);

h–ISRSE/65/2477: Red Sea, 15°05′N–40°18′E, 2–8m, 17–X–1965, leg. L. FISHELSON: 4 ♀ (ML = 66–79 mm);

i–ISRSE/65/2478: Red Sea, 15°05'N–40°18'E, 2–8m, 17–X–1965, leg. L. FISHELSON: 1 doubtful young spec. (ML = 21 mm), with the inner cone of the shell slightly developed.

REMARKS:

The collected specimens of this common species are relatively small, their mantle length attaining only 142 mm, wheras that of a female specimen from Eilat (ADAM, 1960, p. 4) attained 240 mm. ADAM and REES, (1966, p. 24) reported a shell from Madras of 295 mm length.

Sepia savignyi BLAINVILLE, 1827

Sepia savignyi BLAINVILLE, H.D. de, 1827, p. 285, -ADAM, W. and REES, W.J., 1966, p. 10, pl. 3, figs. 16, 17, pl. 4, figs. 18, 19, pl. 41, fig. 238, pl. 42, fig. 249.
Type locality: Red Sea.
Distribution: Red Sea; Gulf of Aden; Persian Gulf.
Material (Tel-Aviv University):
a–E 62/2365: Um Aabak, 2–8 m, 5–IV–1962: 2 ♀ (ML = 39 and 50 mm);
b–E 62/2377: Landing Bay, 2–8 m, Entedebir; 7–IV–1962: 1 ♀ (ML = 39 mm);
c–E 62/2378: Um Aabak, 2–8 m, 7–IV–1962: 1 young spec. (ML = 26 mm);
d–E 62/2383: Landing Bay, 2–8 m, Entedebir, 7– IV–1962: 1 young spec. (ML = 22 mm).

REMARKS:

This species of which only a few specimens have been reported, seems to be rather small, the longest shell known (ADAM, 1959, p. 143) measuring only 93 mm. *Sepia savignyi* resembles *Sepia dollfusi* by its tentacular club with subequal suckers, but the shell is different.

Sepia prashadi WINCKWORTH, 1936

Sepia prashadi WINCKWORTH, R., 1936, p. 16. -ADAM, W. and REES, W. J., 1966, p. 26, pl. 9, figs. 44–48, pl. 41, figs. 245, 246.
Type locality: Madras.
Distribution: Madras (shells): Mauritius (shells); Madagascar (shells); Gulf of Suez; Gulf of Oman.
Material (Hebrew University):
a–E 57/348: Sharam-a-Sheikh, Sinai Peninsula, 7-I-1957, leg. H. STEINITZ: 1 shell (GL = 93 mm.);
b–E 57/413:South Red Sea, 1957, leg. A. Ben-Tuvia: 3♀ (ML = 78, 79 and 92 mm);
c–E 57/414: South Red Sea, 1957, leg. A. BEN-TUVIA: 1 ♂ (ML = 91 mm);
d–E 58/95: South Red Sea, 8-II-1958, leg. O. H. OREN: 1 young spec. (shell: 31 × 14 mm).

REMARKS:

As ADAM and REES (1966, p. 28) mentioned already, the big tentacular suckers of the above-mentioned specimens are much more developed (SIt = 5,2–6,0) than in those from the Gulf of Suez (SIt = 2, 5–2, 6) and resemble those of the specimens from the Gulf of Oman (SIt = 5, 6–6, 1).

Sepia trygonina (ROCHEBRUNE, 1884)

Doratosepion trygoninum ROCHEBRUNE, A.T. de, 1884, p. 97, pl. V, fig.1.
Sepia trygonina, ADAM, W. and REES, W.J., 1966, p. 84, pl. 20, figs. 129–131, pl. 37, figs. 220, 221, pl. 46, fig. 277.
Type locality: Red Sea.
Distribution: Red Sea; Gulf of Aden; Ennûr (shells).
Material (Hebrew University):
a–E 58/33: South Red Sea, 33 fms., 8–II–1958, leg. O.H. OREN: 1 ♀;
b–E 58/46 South Red Sea, 8–II–1958, leg. O.H. OREN: 1 ♂.

MEASUREMENTS:

Locality	a		b	
Sex	♀		♂	
ML (in mm)	45		52	
VMLI	85		85	
MWI	38		38,5	
HLI	29		17,5	
HWI	33		29	
FLI	85		83	
FWIs	6,7		10,5	
	1.	r.	1.	r.
A–I	36	33	34,5	36,5
A–II	31	36	46	44
A–III	31	33	33	33
A–IV	33	33	36,5	34,5
TLI	—	—	135	95
CLI	—	—	11,5	11,5
SIs	1,55		1,35	
SIt	—	—	2,1	1,9
GL (in mm)	45		52	
GWI	22		21	
GThI	6,7		6,2	
GStrI	71		—	

DESCRIPTION:

The male specimen possesses near the base of the fins a series of elongate tubercles and on the outer side of these a series of small, oval or circular, dark-coloured patches, often raised as low tubercles.

The basal part of the hectocotylus is 8 mm long and bears a group of two, one of three and six transverse rows of four normal suckers. The transformed portion is 5 mm long, with a median groove and the ventral protective membrane broad, thick, expanded and transversely grooved. At the dorsal side of the median groove are two series each of eight minute suckers, the ventral portion has only three minute suckers of the medio-ventral series and no ventral suckers. The distal part of the arm is normal with quadriserial minute suckers.

The dorso-lateral arms of the male have their distal half very slender, with biserial minute suckers, the other arms are normal.

In the female, all the arms have their distal third with more or less widely spaced biserial suckers. According to ADAM and REES (1966, p. 85) only the lateral arms of the females have biserial suckers on the distal third. I had the opportunity to verify this point on one of these females and this specimen has also the dorsal and ventral armtips with biserial suckers, although less visible than on the lateral arms, where both series are widely spaced.

The shell of the male was badly damaged.

Sepia arabica MASSY, 1916

Sepia arabica MASSY, A. L., 1916, p. 228, pl. XXIII, figs. 1–5, pl. XXIV, fig. 10 -ADAM, W. and REES, W. J., 1966, p. 96, pl. 23, figs, 152–155, pl. 46, fig. 278.

Type localities: Laccadive Sea; Persian Gulf.

Distribution: Indian Ocean; Red Sea; Gulf of Aden.

Material (Hebrew University):

a–E 57/404, 1:Massawa Channel, South Red Sea, 1957, leg. A. BEN TUVIA: 1 young spec. (ML = 20 mm) in bad condition (doubtful);

b–E 57/414: South Red Sea, 1957, leg. A. BEN TUVIA: 8 young spec. (ML = up to 38 mm).

Sepia gibba EHRENBERG, 1831

Sepia gibba EHRENBERG, C. G., 1831. -ADAM, W. and REES, W. J., 1966, p. 100, pl. 25 figs. 159–161. -MAGNUS, D. E., 1967, p. 660.

Type locality: Red Sea.

Distribution: Red Sea.

Material (Hebrew University):

a-E 56/384: Shora-el-Manqata, Sinai Peninsula, 24-XI-1956, leg. J. WAHRMAN: 3 shells (broken):

b–E 60/31: Eilat, 4-V-1960, leg. H. STEINITZ: 1 ♂ (ML = 39 mm.);

c–E 60/62,1 (2): Eilat, 3 ft., 5-IX-1960, leg. E. Clark: 3 ♂ (ML = 27–62 mm): 3 ♀ (ML = 23–47 mm);

d–E 60/62 (2): Eilat, 3 ft., 5–IX–1960, leg. E. CLARK: 10 young spec. (ML = 9,5–24 mm).

REMARKS:

The same specimens have been described in detail by ADAM and REES (1966, p. 100). They were the first animals known with certainty to belong to this species.

MAGNUS (1967, p. 660) has observed the living animals in the harbour of Suakin, where they live during the night in partnership with *Diadema setosa* (LESKE).

Sepia? offlicinalis LINNE, 1758

Material (Hebrew University):

E 58/262: South Red Sea, winter 1957/1958, leg. A. BEN-TUVIA and O.H. OREN: 1 ♂ (ML = 65 mm).

REMARKS:

The identification of this specimen is doubtful. The shell is in very bad condition, but the posterior portion, covered by a glaze-like substance, and the inner cone are the same as in *Sepia officinalis*. The tentacular club is also the same.

The species has never been reported with certainty from the Red Sea and more material, in a better state of preservation, is needed before including it in the fauna of the Red Sea.

Sepiella inermis (FERUSSAC & d'ORBIGNY, 1835)

Sepia inermis FERUSSAC, A. de and ORBIGNY, A. d', 1835, p. 286, pl. 6bis, pl. 20, figs. 1–9.
Sepiella inermis ADAM, W. and REES, W.J., 1966, p. 123, pl. 38, figs. 222–227; pl. 40, figs. 233,234.
Type localities: Indo-Pacific: Batavia, Bombay, Pondichéry, coast of Coromandel.
Distribution: Indian Ocean.
Material (Hebrew University):
a–E 58/255, 2: South Red Sea, 7–II–1958, leg. O.H. OREN: 1 young spec. (ML = 23 mm) (identification somewhat doubtful);
Material (Tel-Aviv University):
b-E 62/4278: Bay of Archiko, 10–20 fms. 9–IV–1962: 4 ♂ (ML = 38, 38, 43 and 62,5 mm), 6 ♀ (ML = 40, 40, 40, 44, 44, and 46 mm), 11 young spec.

Measurements of the shells of 5 animals:

Locality	b	b	b	b	a
Sex	♂	♂	♀	♀	?
GL (in mm)	62,5	38	46	44	19
GWI	34,5	37	38	38,5	42
GThI	14,7	15,8	15,7	16,4	16

REMARKS:

The animals are partly macerated and could not be properly measured. The tentacular club bears more than 20 series of minute suckers and corresponds with the specimen from Aden, described by ADAM and REES (1966, p. 126).

The above-mentioned specimens seem to be the first ones collected in the Red Sea.

SEPIOLIDAE

Sepiola steenstrupiana LEVY, 1912

(Pl. I, fig. 6)

Sepiola steenstrupiana LEVY, F., 1912, p. LVI; 1912a, p. 286; 1912b, p. 89.
Sepiola (Eusepiola) steenstrupiana, NAEF, A., 1923, p. 610, figs. 344f, 354–356.
Sepiola tenera NAEF, A., 1912, p. 269, figs. 1,2.
Type locality: Villefranche.
Distribution: Mediterranean.
Material (Hebrew University):
a–E 56/396: Red Sea, exact locality unknown, 2–VIII–1956: 1 ♂;
b–E 58/77 Red Sea, exact locality unknown, 10–II–1958, leg.O.H. OREN: 1 ♀ (badly preserved).

Measurements:

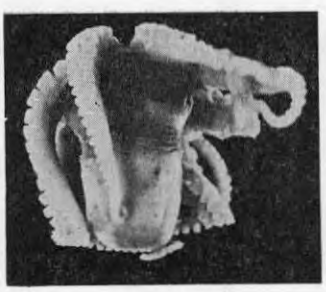
Locality	a
Sex	♂
ML (in mm)	8,5
VMLI	112
MWI	100
HLI	83
HWI	104
FLI	57
FLbl	41
FWI	165
FWIs	35
A–I	83
A–II	94
A–III	83
A–IV	71
TLI	118
CLI	47
SIs	4,7–7,1
SIt	2,4

DESCRIPTION:

The male specimen is well preserved. It possesses the typical light organs on the ink-sac. These are elongate-oval with a constriction in the middle and measure 3 mm in length.

The web is well developed between the dorsal arms and between the ventro-lateral and ventral arms. The dorsal arms are laterally compressed with a keel-like swimming-membrane nearly along their whole length. The dorso-lateral arms are rounded

PLATE I



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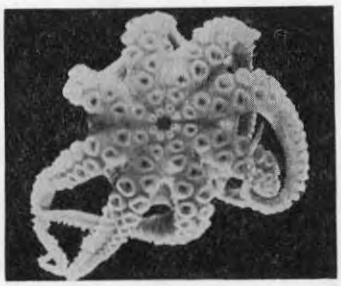

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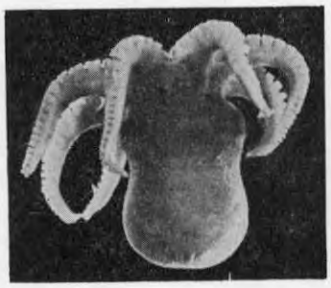

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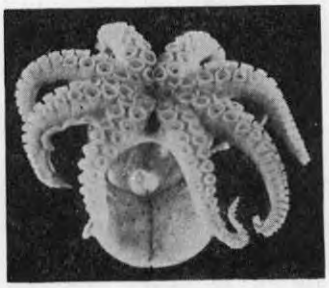

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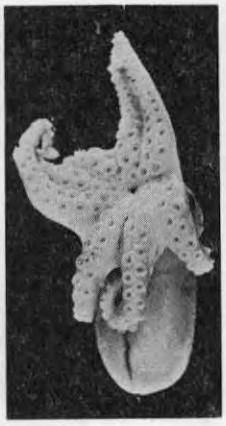

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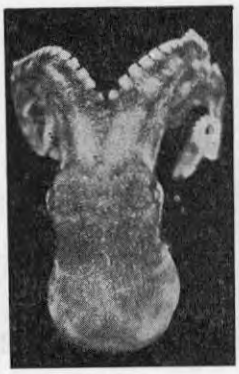

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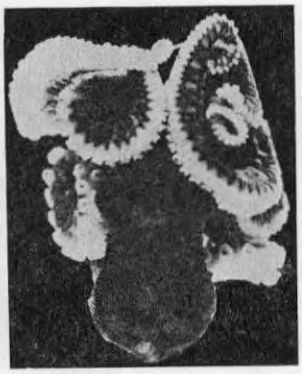


5

8

at the outer side. The ventro-lateral arms are much thicker than the other ones, especially at the base, and possess a keel-like swimming-membrane along their whole length. The ventral arms have a lateral swimming-membrane, the basal part of which forms the interbrachial membrane between the ventro-lateral and ventral arms.

On all the arms the globular suckers, with their rather long peduncles, are biserial, except on the extreme distal part of the ventral arms, where they are quadriserial and minute. The largest suckers on the middle part of each dorso-lateral and ventral arm, attain a diameter of 0,6 mm; those of the other arms do not exceed 0.4 mm.

The left dorsal arm is hectocotylized. Its distal portion differs very little from that of the right arm, except that the suckers of the latter are slightly larger. The basal part of the hectocotylus possesses 3 small suckers and distally of these a small portion devoid of suckers, with a double, rounded lobe, the exterior part of which is also double and larger than the interior one. Opposite this lobe there is a small fleshy expansion. The transformed portion is followed by two series of normal suckers which diminish gradually in size.

The tentacular club has a well-developed swimming-membrane, the length of which exceeds slightly that of the club; it remains large at its base where it is connected with the protective membrane. The suckers are arranged in 5 longitudinal series, those of the two dorsal series being larger than the remaining ones in the middle part of the club. The tentacular stem is rounded at the outer side, the inner side being plane with a median groove.

REMARKS:

In all characters enumerated by A. NAEF (1923, p. 610), the above-described specimen corresponds with *Sepiola steenstrupiana* LEVY, 1912, a mediterranean species.

As far as I know, it is the first time that any *Sepiola* has been collected in the Red Sea. It is unfortunate that the exact locality is unknown, but according to Dr. H. STEINITZ (personal communication) there is no doubt that it has been collected in the Red Sea.

PLATE I, *Explanation*

Fig. 1 *Octopus nanus* sp. nov.: Holotype: E62/2307, Cundabilu, 25–III–1962: ♂ (ML 13 mm), (Tel-Aviv University).

Fig. 2 *Octopus nanus* sp. nov.: Paratype: E62/2382, Landing Bay, Entedebir, 7–IV–1962: ♂ (ML 12 mm) (Institut royal des Sciences naturelles de Belgique, Brussels).

Fig. 3 *Octopus* ? *nanus* sp. nov.: E62/2653, Um Aabak, 5–IV–1962: ♀ (ML 25 mm) (Tel-Aviv University).

Fig. 4 *Octopus aegina* GRAY, 1849: E62/1991, Nocra, 18–III–1962: young spec. (ML 14 mm) (Tel-Aviv University).

Fig. 5 *Octopus horridus* d'ORBIGNY, 1826: E62/2280, Cundabilu, 25–III–1962: ♀ (ML 14 mm) (Tel-Aviv University).

Fig. 6 *Sepiola steenstrupiana* LEVY, 1912: E56/396, Red Sea (exact locality unknown), 2–VIII–1956: ♂ (ML 8,5 mm) (The Hebrew University).

Fig. 7 *Enigmoteuthis dubia* (ADAM, 1960): NS 874, Eilat on beach, 24–II–1965, leg. D. FRIDMAN: ♀ (ML 36 mm) (Tel-Aviv University).

Fig. 8 *Enigmoteuthis dubia* (ADAM, 1960): NS 874, Eilat, beach, 24–II–1965, leg. D. FRIDMAN: ♀ (ML 36 mm), left tentacular club (length of club = 12 mm) (Tel-Aviv University).

LOLIGINIDAE

Loligo duvauceli d'ORBIGNY, 1835
(text fig. 1–3)

Loligo duvauceli ORBIGNY, A. d', 1835, p. 318, pl. XIV, pl. XX, figs. 6–16. -ADAM, W., 1954, p.123–136, figs. 5,6, tabl. I–II; 1962, p.16 -VOSS, G.L., 1963, p. 71, fig. 12.
? *Loligo forbesii* ADAM, W. (non STEENSTRUP), 1942, p. 11; 1959, p. 155, fig. 10bis.
Type localities: Indo-Pacific: Sumatra, coast of Malabar, Bombay, Pondichéry, Batavia, Moluccas.
Distribution: Indo-Pacific.
Material (Hebrew University):
a–E57/404,2: Massawa Channel, South Red Sea, 1957, leg. A. BEN-TUVIA: 2 ♂;
b–E 57/432: North of Massawa Channel, South Red Sea, 9–XII–1957, leg. A. BEN-TUVIA: 1 ♂, 1 ♀.

MEASUREMENTS:

Locality	a		a		b		b	
Sex	♂		♂		♂		♀	
ML (in mm)	100		122		102		110	
VMLI	90		90		88		91	
MWI	21		?29		22		23	
HLI	16		15		14		14	
HWI	19		16		17		18	
FLI	50		56		51		55	
FWI	45		56		47		55	
	l.	r.	l.	r.	l.	r.	l.	r.
A–I	26	25	25	25	26	26	23	23
A–II	31	32	30	30	35	31	31	31
A–III	35	35	26+	32	34	36	31	35
A–IV	28	29	25	26	29	29	29	29
TLI	55	60	65	74	59	—	64	—
CLI	24	25	27	26	23	—	27	—
HcLI	54		58		50			
Nps	12		12		12			
SIs–I	1,3		1,1		1,3		1,0	
SIs–II	1,9		1,4		2,2		1,2	
SIs–III	2,2		1,5		2,2		1,4	
SIs–IV	1,1		1,0		1,0		0,9	
SIt–m	1,8		1,8		1,7		2,0	
SIt–l	1,4		1,5		1,4		1,5	

DESCRIPTION:

The above-mentioned specimens correspond with the detailed descriptions of ADAM (1954, p. 132) and of VOSS (1963, p. 71). In his description of the hectocotylus,

G.L. Voss (p. 72) does not mention the fact that the papillae of the ventral row are largely fused with the ventral protective membrane, as I described in 1954 (p. 135).

According to Voss (1963, p. 72), the larger suckers of the ventro-lateral arms of the female have rings which are smooth on the proximal half, but bear about 7 teeth on the distal half, the central one being broad and pointed, the marginal ones broad and square ended. In the female from the Red Sea, these suckers possess 6–7 broad teeth, the central one of which (or sometimes the two central ones) is often, but not always, pointed and more slender than the remaining teeth, which are very broad, square and bluntly edged. These teeth occupy more than half of the circumference of the ring.

The suckers of the dorsal and ventral arms bear in males only 5–6 square teeth, however the present material does not show the central pointed teeth. The larger suckers of the lateral arms have 9–11 broad teeth, occupying the greater part of the circumference of the ring Sometimes one or two central teeth are more slender and more or less pointed. In addition, the proximal part of the ring often possesses several small denticles.

The Red Sea specimens possess on each side of the ink sac, the light organs mentioned by SASAKI (1929, p.124) for *Loligo oshimai* and by Voss (1963, p. 74) for *Loligo duvauceli*. The latter author states that he could not find any reference to such organs in the literature regarding *Loligo duvauceli* and that perhaps the species had not been thoroughly studied. In my publication of 1954, I did not mention these organs, because, in fact, I had not investigated them. I have clarified this point in specimens of *Loligo duvauceli* in the collections of the Royal Institute of Natural Sciences (Brussels) and as far as the preservation of the specimens allows a verification, these organs are always present.

REMARKS:

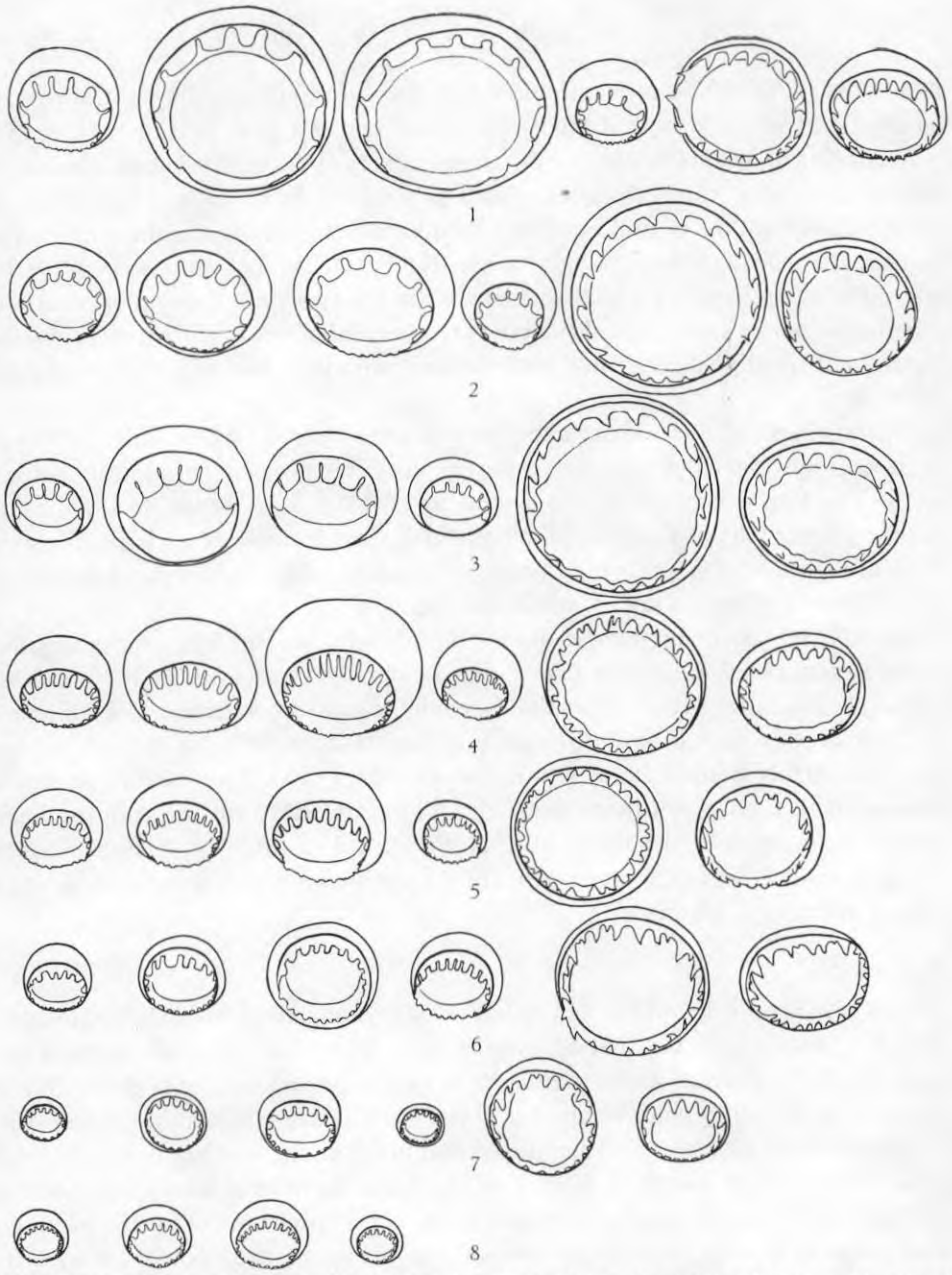
Voss (1963, p.74) mentions that ADAM (1954) synonymized MASSY's *Lolgio indica* with *Loligo duvauceli*, but that MASSY (1916, p. 220) stated "there is no trace of a hectocotylus", whereas *Loligo duvauceli* has a well-developed one. According to Voss, "it seems hardly conceivable that MASSY would have missed it in her analysis".

In fact MASSY (1916, p. 220) mentioned that in the young specimens (M*8174–91*), which had a mantle-length of 12-26 mm, there was no trace of a hectocotylus. This author did not mention the hectocotylus of the other specimens, but if the numerous males among them lacked a hectocotylus, she would have made a point of this general absence, but would not have made a statement specific for young specimens only.

This is the first time that *Loligo duvauceli* is reported with certainty from the Red Sea.

Loligo edulis HOYLE, 1885
(text fig. 4-5)

Loligo edulis HOYLE, W. E., 1885, p. 186; 1886, p. 152, pl. XXIII. -SASAKI, M., 1929, p. 107, figs. 57–59, pl. XIII, figs. 1–4. -VOSS, G.L., 1963, p. 67. figs. 11a-e.
Type locality: Yokohama market.
Distribution: Japan, Formosa, Philippines.



Figs. 1–8 Chitinous rings of the largest arm and tentacular suckers; from left to right: dorsal, dorso-lateral, ventro-lateral and ventral arms, median and marginal tentacular suckers × 14;

Fig.1 *Loligo duvauceli* d'ORBIGNY, 1835: E 57/404, 2, Massawa Channel, South Red Sea, 1957, leg. A. BEN-TUVIA: ♂ (ML=100 mm);

Fig.2 Idem: ♂ (ML=122 mm);

Fig.3 Idem: E 57/432, North of Massaw aChannel, South Red Sea, 9–XII-1957, leg. A. BEN-TUVIA: ♀ (ML=110 mm);

Fig.4 *Loligo edulis* HOYLE, 1885: E 57/404, 2, Massawa Channel, South Red Sea, 1957, leg. A. BEN-TUVIA: ♂ (ML=82 mm);

Fig.5 Idem: ♀ (ML=82 mm);

Fig.6 *Doryteuthis arabica* (EHRENBERG, 1831): ISRSE/65/2476, Red Sea, 15° 05′N–40° 18′E, 17–X–1965, leg. L.FISHELSON: ♂ (ML=144 mm);

Fig.7 Idem: ♀ (ML=85 mm);

Fig.8 Idem: E 57/404, 2, Massawa Channel, South Red Sea, 1957, leg. A. BEN-TUVIA: ♂ (ML=86mm)

Material: (Hebrew University):

a–E 57/404,2: Massawa Channel, South Red Sea, 1957, leg. A. BEN-TUVIA: 7 ♂, 8 ♀;

b–E 57/432: North Massawa Channel, South Red Sea, 9–XII–1957, leg. A. BEN-TUVIA: 1 ♂, 2 ♀;

c–E 57/547: North Massawa Channel, South Red Sea, 40 fms. ,29-XI-1957, leg. A. BEN-TUVIA: 2 ♀;

d–E 58/263,2: South Red Sea, winter 1957/1958, leg. A. BEN-TUVIA and O.H. OREN: 1 ♀ (ML = 70 mm; in bad condition).

MEASUREMENTS:

Locality	b	a	a	a	a	a	a	a	a	b
Sex	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀
ML (in mm)	82	82	76	75	102	92	82	68	65	60
VMLI	88	92	88	87	89	87	88	88	89	87
MWI	27	28	28	28	25	25	28	31	29	30
HLI	20	22	22	23	18	18	21	23	22	25
FLI	56	54	55	51	57	56	55	53	46	50
FWI	49	55	51	56	49	52	56	57	—	58
A–I	32	37	33	28	29	27	29	25	31	27
A–II	34	41	37	36	34	33	36	34	38	32
A–III	40	46	43	44	39	39	41	37	41	38
A–IV	37	41	39	36	33	33	36	34	35	38
TLI	85	98	118	73	98	82	85	88	100	—
CLI	29	30	32	27	28	29	32	29	35	—
HcLI	77	66	83	67						
Nps	7	8	8	8						
SIs–I	1,35	1,45	1,45	1,45	1,10	1,20	1,35	1,20	1,40	1,15
SIs–II	1,70	1,60	1,70	1,60	1,30	1,40	1,45	1,45	1,55	1,50
SIs–III	2,10	2,20	1,85	2,00	1,40	1,50	1,70	1,75	2,00	1,65
SIs–IV	1,35	1,20	1,30	1,20	1,00	1,20	1,20	1,20	1,20	1,15
SIt–m	1,85	2,20	1,85	2,00	1,95	2,05	2,20	2,05	2,15	—
SIt–l	1,45	1,85	1,45	1,75	1,60	1,65	1,80	1,75	1,70	—

DESCRIPTION:

The few specimens, although some of them are sexually mature, are very small in comparison with those mentioned by SASAKI (1929, p. 107) which attain a mantle length up to 40 cm.

The dorsal arms are laterally compressed with a narrow swimming-membrane along their whole length. The dorso-lateral arms are flattened at their outer side, with a narrow swimming-membrane at their ventral side. The ventro-lateral arms are much stouter than the other ones, laterally compressed, with a well-developed swimming-membrane. The ventral arms are flattened at their outer surface, with a narrow membrane at their ventral side and a much more developed swimming-membrane at the dorsal side; at its base, this latter membrane is continuous with the swimming-

membrane of the ventro-lateral arms, forming a sheath around the base of the tentacular stem.

The tentacles are slender with a rather short club, the latter bearing a swimming-membrane along its whole length. The arms and the tentacular clubs are bordered by trabeculate protective membranes.

The suckers are largest on the ventro-lateral arms; their horny rings bear on the distal border up to a dozen elongated, more or less bluntly pointed teeth whose length decreases gradually towards the proximal margin, which bears at each side some small, spaced denticles, whereas the remaining part of this margin is either smooth or irregularly dentate with very low, rounded denticles. The exact number of the teeth is only visible if the chitinous ring is liberated from the fleshy parts, especially the papillate zone, of the suckers.

The median tentacular suckers which are larger than the marginal ones, may attain the same size as the largest arm-suckers in the males, whereas in the females they are larger than the largest arm-suckers. The chitinous rings of the largest tentacular suckers are armed all-around with up to 18 big, sharp, widely-spaced teeth, alternating more or less regularly with small teeth; the total number of teeth on a ring attains sometimes 30.

The seven lobes of the buccal membrane bear each a small number (up to 6) of minute suckers.

The hectocotylus possesses 7–8 pairs of normal suckers at its base; the transformed portion bears about 35 pairs of papillae, the ventral ones of which are longer than the dorsal ones. The former are free and not fused with the ventral protective membrane as in *Loligo duvauceli*.

The fins are rhombiform, their anterior margins slightly convex, the posterior ones slightly concave.

On each side of the ink-sac a light-organ is present as mentioned by SASAKI (1929, p. 108).

REMARKS:

Although the general shape of the animal does not differ essentially from that of *Loligo duvauceli*, these two species can easily be distinguished by the dentition of the chitinous rings of the suckers and by the hectocotylus. The latter may show some variation. In his description of *Loligo edulis*, HOYLE (1886, p. 152) mentions ten rows of suckers at the base of the hectocotylus. SASAKI (1929, p. 108) mentions 20–27 biserial suckers at the base of this arm, which invalidates the difference I mentioned above between *Loligo duvauceli* and *Loligo edulis* concerning these basal suckers. On the other hand SASAKI (1929, p. 108) has described a forma *nagasakiensis* of *Loligo edulis* the hectocotylus of which has only 8 pairs of basal suckers. This author mentions that in the largest of three male specimens "the papillae of the hectocotylus are devoid of any suckers, and their dorsal series extend only half up the length."

VOSS (1963, p. 70) mentions four specimens of *Loligo* from the fish market of Pusan, Korea, which conform to forma *nagasakiensis* as well as to the material

mentioned in his paper on the Cephalopods of the Philippine Islands. The latter author considers *Loligo edulis* to be distinct from *Loligo etheridgei*. In 1954 (p. 136) I mentioned three females of the latter species from Dobo, without having seen any Australian material. At that time I was of the opinion (p. 140) that *Loligo edulis*, *Loligo etheridgei* and *Loligo formosana* represent geographical races of the same species or perhaps are synonyms. After having examined the material from the Red Sea and from the Indian Ocean, I have to revise my opinion on the relationship of these species. *Loligo edulis* differs from the two latter species by its hectocotylus which possesses a smaller number of basal suckers and consequently, a longer transformed portion. The arm-suckers of *Loligo edulis* possess rather blunt teeth, whereas those of the latter species are sharper. As to the big tentacular suckers, those of *Loligo edulis* have a greater number of big teeth, generally alternating with single small teeth, whereas in *Loligo formosana* the big teeth are fewer in number and alternate with groups of 1–4 small teeth. This is also the case in the specimens I identified as *Loligo etheridgei* (ADAM, 1954, p. 138, 139) and in a few specimens from Singapore, which the late R. WINCKWORTH kindly put at my disposal and which he had identified as *Loligo formosana*. As to the type specimen of *Loligo etheridgei*, BERRY (1918, p. 246) states that the larger central suckers of the club are armed with 21–26 acute, well-separated, conical teeth, the large and small teeth as a rule in regular alternation. Australian material is needed to establish the relationship between *Loligo etheridgei* and *Loligo formosana*. *Loligo edulis* is reported here for the first time from the Red Sea.

Sepioteuthis lessoniana LESSON, 1830

Sepioteuthis lessoniana LESSON, R.P., 1830, p. 244. -ADAM, W., 1939, p. 2, figs. 1–3, pl. I, figs. 1,2; 1959, p.155, figs. 11, 12; 1960, p.6, pl.I, figs. 4–8. -VOSS, G.L., 1963, p.77, fig. 13.

Type locality: unknown.

Distribution: Indo-Pacific: from Japan to Australia and New Zealand and from the Red Sea to Hawaii.

Material (Hebrew University):

a–E 49/109-1: Eilat, December 1959, leg. A. BEN-TUVIA: 1 ♀ (ML = 170 mm);

b–E 54/10: Eilat, 10–II–1954, leg. A. BEN-TUVIA: 1 ♂ (ML = 78 mm), 1 ♀ (ML = 65 mm):

c–E 55/705: Eilat, 30–XI–1955, leg. H. STEINITZ: 4 young spec. (ML = 48, 53, 53 and 55 mm);

d–E 55/967: Eilat, 1–V–1955, leg. H. STEINITZ: 1 ♂ (ML = 340 mm);

e–E 55/968: Eilat, 1–V–1955, leg. H. STEINITZ: 1 ♂ (ML = 335 mm);

f–E 55/969: Eilat, 1–V–1955, leg. H. STEINITZ: 1 ♀ (ML = 63 mm);

g–E 56/395: Eilat, December 1956; leg. A. BEN-TUVIA and O.H. OREN: 1 ♀ (ML = 97 mm);

h–E 57/586: South Red Sea, 15°11′N–40°30′E, off Um El Sahrig Island, 13–XII–1957, leg. A. BEN-TUVIA: 3 young spec.

i–E 57/652, 1: Eilat, 26–VI–1957, light catch, artificial light, leg. A. BEN-TUVIA: 1 larva;

j–E 58/157a: Eilat, 8–X–1958, light catch, leg. H. STEINITZ: 1 ♀ (ML = 62 mm).

Doryteuthis arabica (EHRENBERG, 1831)
(text fig. 6–8)

Pteroteuthis arabica EHRENBERG, C. G., 1831, p. (?).
Ommastrephes arabicus, FERUSSAC, A., de & ORBIGNY, A. d', 1835–1848, p. 353.
Doryteuthis arabica, ADAM, W., 1941a, p. 2, pl. I, fig. 2; 1942, p. 3, 12; 1959, p. 159, figs. 13–16.
?*Loligo forbesi* ADAM, W. (non STEENSTRUP, 1856), 1955, p. 188, pl. L, fig. 2.
Type locality: Ketumbal Island, between Gumpuda and Poheca, Red Sea.
Distribution: Red Sea.
Material (Tel-Aviv University):
a–ISRSE/65/2476: Red Sea, 15°05'N–40' 18 E', 17–X–1965, leg. L. FISHELSON: 4 ♂, 1 ♀;
Hebrew University:
b–E 57/404,2: Massawa Channel, South Red Sea, 1957, leg. A. BEN TUVIA: 1 ♂ (in bad condition).

MEASUREMENTS:

Locality	a	a	a	a	a	b
Sex	♂	♂	♂	♂	♀	♂
ML (in mm)	144	127	122	118	85	86
VMLI	93	93	92	91	94	91
MWI	15	17	18	16	19	—
HLI	13	15	15	14	18	—
HWI	12,5	14	13	14	16,5	—
FLI	62	63	59	60	58	52
FWI	44	42	43	43	47	—
A–I	17	20	18	16	21	16
A–II	22	24	21	21	27	23
A–III	28	28	26	27	34	27
A–IV	24	22	22	21	29	23
HcLI	50	54	52	52	—	50
TLI	62	70	61	72	71	—
CLI	17	19	17	20	25	—
SIs–I	0,60	0,65	0,65	0,70	0,70	0,80
SIs–II	0,70	0,70	0,65	0,70	0,95	0,95
SIs–III	0,85	0,80	0,75	0,85	0,95	1,05
SIs–IV	0,60	0,55	0,65	0,60	0,60	0,80
SIt–m	1,25	1,35	1,15	1,30	1,65	—
SIt–l	1,05	1,10	0,90	1,00	1,30	—
GL (in mm)					85	86
GWI					17,6	14,5

DESCRIPTION:

The adult specimens have a more or less elongate mantle, with in the males, a narrow medio-ventral keel. The fins measure about half the mantle length in the smallest examined specimens, but their length may attain two thirds of the mantle length in the largest males. The total width of the fins attains rarely 50% of the mantle length.

The head is relatively small and the arms are short, longest in the small specimens. The ventro-lateral arms are the longest, the dorsal ones the shortest, whereas the dorso-lateral and ventral ones are of medium length. All the arms have distinct but not very wide swimming-membranes; on the ventral arms these are developed on both lateral sides.

The left ventral arm is hectocotylized and bears 13 pairs of normal basal suckers and about 30 pairs of papillae.

The length of the tentacular club varies between 17 and 25 % of the mantle length. On the main part of the club, the median suckers are slightly larger than the marginal ones.

The biggest arm-suckers have their chitinous rings armed with about 20 more or less spaced, generally blunt teeth, which are longest on the distal, and more or less rudimentary on the proximal margin.

The biggest tentacular suckers have their chitinous rings armed with up to 15 big, sharp, wide-spaced teeth, generally irregularly alternating with single small teeth or with groups of 1–3 small denticles.

A pair of oval organs, situated on both sides of the rectum, are partly imbedded in the ink sac. SASAKI (1929, p. 108, 111, 124) mentioned such organs in *Loligo edulis*, *Loligo formosana* and *Loligo oshimai* as being luminous organs, but their structure and function have not been studied.

The male specimen collected in the Massawa Channel (b) is in very bad condition, but I do not doubt that it belongs to *Doryteuthis arabica*.

REMARKS:

The specimen from the Island Abulat, which I considered with doubt (1955, p. 188) as belonging to *Loligo forbesi*, appears to be a young *Doryteuthis arabica*. In the latter species the dentition of the suckers, of the arms and of the tentacles, is about the same as in young *Loligo forbesi*. But the hectocotylus differs by the lesser number of basal suckers in the Red Sea specimens (13 pairs), whereas in *Loligo forbesi* there may be more than 20 pairs. A second difference may be still more important. The above-mentioned specimens of *Doryteuthis arabica* possess a pair of oval organs imbedded in the ink sac; these are absent in *Loligo forbesi*. I have not examined this feature in the specimen from Abulat, but as it seems to be conspecific with the small male from the Massawa Channel (b), there remains little doubt as to the identity of both specimens with *Doryteuthis arabica*.

Consequently *Loligo forbesi* STEENSTRUP, 1856 should be eliminated from the list of Red Sea Cephalopoda.

More material from the Indo-Pacific is needed to decide whether *Doryteuthis arabica* (EHRENBERG, 1831), *Doryteuthis spectrum* PFEFFER, 1884, and *Doryteuthis singhalensis* ORTMANN, 1891, are synonyms or belong to distinct species or sub-species.

ENOPLOTEUTHIDAE

Abralia steindachneri WEINDL, 1912

(text. fig. 9–15)

Abralia steindachneri WEINDL, Th., 1912, p. 271. -ADAM,W., 1942, p. 13; 1955, p. 190, pl. L, figs. 3,4; 1959, p. 164.

Type locality: Shadwan, Red Sea.

Distribution: Red Sea.

Material (Tel-Aviv University):

NS 1121: Eilat, 16–IV–1966, leg. J. DAFNI: 1 ♀.

MEASUREMENTS:

Specimens	NS 1121		Types[1]				0°51′S–56°08′E[2]				Abulat;[3]	
Sex	♀		♀		♀	♀	♀		♀		♀	
ML (in mm)	61		52,5		52	59	37		36		56	
VMLI	87		87		90	90	94		92		94	
MWI	36		29		29	25	30		31		27,5	
HLI	34		23		25	25	23		22		23	
HWI	33		25		29	—	30		25		22,5	
FLI	44		43		40	42	46		42		44,5	
FWI	75		65		62	58	70		67		66	
FWIs	36		30		27	25	27		31		—	
A–I	49		39		42	41	35		36		30	
A–II	57		48		44	42	41		36		32	
A–III	56		48		44	44	41		36		32	
A–IV	59		49		46	44	41		36		36	
TLI	148		80		81	—	67		69		62	
CLI	33		26		30	—	27		24		21,5	
	l.	r.	l.	r.	l.	r.	l.	r.	l.	r.	l.	r.
Hts	7	8	7	—	—	7	7	7	7	6	6	6	7	—
Ha–I	17	17	16	16	17	17	16	16	16	17	14	14	16	17
Ha–II	18	19	17	17	18	18	17	17	17	18	15	15	16	17
Ha–III	18	19	18	18	18	18	17	17	16	16	14	15	16	17
Ha–IV	21	21	19	19	20	20	19	19	18	18	15	16	19	19
SIs	1,0		—		—	—	1,1		1,1		—	
SIt	1,2		—		—	—	1,3		1,1		1,1	

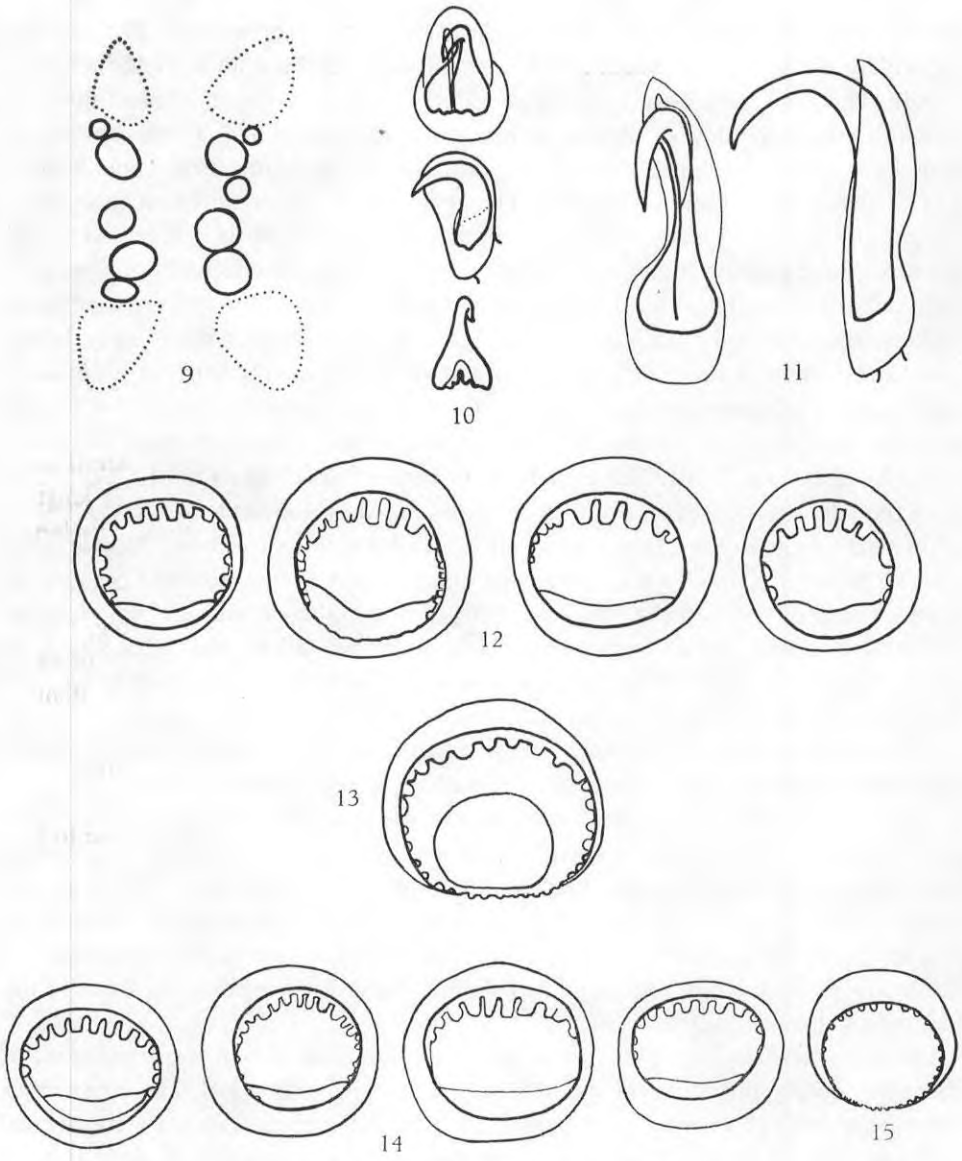
1) I am very much obliged to Dr. O. PAGET (Vienna) who has kindly lent me four type specimens, three of which have been measured.

2) These two specimens, collected near the Seychelles, were kindly put at my disposal by Mrs. J. FILLIPPOVA (Moscow).

3) W. ADAM, 1955, p. 190.

DESCRIPTION:

The specimen from Eilat is the largest one known so far. The mantle is elongate-conical, widest in the anterior third. The mantle margin is slightly angular in the middle of the dorsal side, distinctly concave on the ventral side. The fins are terminal, their length less than half the mantle length, their total width three quarters of the latter. The anterior margin of each fin is slightly convex, the posterior margin weakly concave. The greatest width of the fins is situated about the middle of their length.



Figs. 9–15 *Abralia steindachneri* WEINDL, 1912.

Fig. 9 NS 1121, Eilat, 16–IV–1966, leg. J. DAFNI: ♀ (ML 61 mm); ocular photophores, x 4,5;
Fig. 10 Idem: arm hooks, the two uppermost with their fleshy hoods, x 9, 3;
Fig. 11 Idem: tentacular hook, x 9, 3;
Fig. 12 Idem: chitinous rings of the suckers of the dorsal, dorso-lateral, ventro-lateral and ventral arms, x 37;
Fig. 13 Idem: chitinous ring of a tentacular sucker, x 37;
Fig. 14 0° 51′ S–56°08′ E: ♀ (ML 37 mm): chitinous rings of arm suckers, x 37;
Fig. 15 Idem: chitinous ring of tentacular sucker, x 37.

The head is narrower than the mantle, the large eyes not prominent. The eye lids are widely open, nearly circular, with a small sinus in the middle of the anterior margin. The arms are long and slender, the dorsal and dorso-lateral ones rounded on the outer side, with a low swimming-membrane on their distal half. The ventro-lateral arms have a well-developed swimming-membrane nearly along their whole length; it is widest in the middle of the arm. The ventral arms are rounded on their inner margin and possess a well-developed swimming-membrane at their lateral side. All the arms have narrow protective membranes and two rows of small hooks on the greater part of their length. The distal part of each arm bears two rows of small suckers, the proximal ones having their chitinous rings armed with 6–7 big, blunt, distal teeth (fig. 12) and a varying number of smaller ones; the extreme tip of each arm has very minute suckers, arranged in three or four rows. The tentacular stem is rounded on the outer side, the club narrow with a swimming-membrane extending along its distal two thirds. The carpal cluster consists of 4 suckers on the right club, 5 on the left one; the exact number of carpal papillae is difficult to ascertain. The main part of each club bears a series of 7 or 8 hooks, the third and fourth being largest, measuring up to 4 mm (measured along a straight line from the base to the extreme level of the curb (fig. 11). At the dorsal side of these hooks are two series of small suckers, the chitinous rings of which are armed all around with about 30 small, mostly blunt denticles (fig. 13). The distal portion of each club is covered with four series of minute suckers, in about 15 transverse rows.

The ventral surface of the mantle is covered with numerous minute photophores of two sizes: the smaller, dark ones measuring about 0, 1–0,2 mm, the larger ones, with a white center, 0,2–0,3 mm. The arrangement of these photophores is not sharply defined, except for two indistinct bands separated by a narrow median band devoid of light organs. The photophores become less numerous on the lateral sides of the body, and the dorsal side has only a few scattered, symmetrically arranged pairs of the smaller ones. The dorsal side of the fins bears two pairs of minute photophores not far from the median line. A pair of slightly larger light organs is in front of the base of the fins.

On the ventral surface of the funnel, the photophores are also of two sizes; some of them are deeply imbedded in the skin and not easily discovered. The larger ones measure about 0,4 mm. Starting behind the funnel opening, there are a transversal series of 4 small ones, a pair of small ones, a transversal series of 4 large ones, a transversal series of 4 small ones, one pair of small ones and behind these a curved transversal series of 9 small ones, plus on each side an oblique longitudinal series of 3 small ones, situated behind each outer large one. The lateral sides of the funnel are devoid of photophores, but the muscular ligaments, connecting the funnel with the head, bear on their outer side about a dozen small light organs.

On the ventral side of the head a median series of two large and 8 small photophores are present; the posterior, large one, situated about the mid-level of the eyes, followed by 5 small ones, the second large one and 3 anterior small ones. At the basis of the ventral arms this series divides into two series running along the inner edges of these arms, nearly up to their tips. On each side of the median series, another series starts

at the anterior end of the funnel groove. These admedian series are not single-filed, as the median one, but composed of a narrow band of irregularly arranged photophores. Each of these two series has at the edge of the funnel groove a big photophore and behind this one 4 or 5 small ones; in front of the big one each series continues with 6 small ones, a large one, 4 small ones and again a large one located in front of the large posterior photophore of the median series. From each of these two big photophores goes a single series of smaller ones obliquely to the lateral margins of the funnel groove, up to the ventral nuchal fold. On each side, this latter series is composed of 11 or 12 light organs, the fourth of which, counted from the posterior end, is somewhat larger. Anteriorly the admedian series, each with 6 small and one large photophore, continue up to the middle of the base of the ventral arms and then along the outer part of the ventral side of these arms, almost up to the tip. Each of these arm-series is composed of larger photophores, alternating with groups of generally 3 (sometimes 2 or 4) smaller ones.

Laterally to the admedian series starts at each side, at the base of the subventral nuchal fold, a lateral series of photophores, which continues along the swimming–membrane of the ventral arms. It is interrupted in the area of the ventral window of the eyeball. The latter series do not extend on the arms as far as the two other series. Between the marginal and the lateral series of each arm there are a few, widely spaced photophores forming an intermediate fourth, longitudinal series, which does not extend very far up the arm.

The ventro-lateral arms bear at the ventral side of their outer surface one series of photophores and at the dorsal side of the swimming–membrane a few minute photophores, which are widely spaced and extend rather far up the arm. One small photophore can be found at the base of each of the dorso–lateral arms.

Around the greater part of every eye lid is a circlet of about 30 small photophores which are absent on a small dorsal stretch, but crowded at the ventral side.

The ventral side of each eyeball bears a series of 7 photophores (Fig. 9). At both ends of each series is a whitish, often more or less inconspicuous, long oval or triangular organ and between them 5 circular brownish ones, the one in the middle more separated from the posterior and anterior ones, which are close together. On the right eyeball these round photophores, beginning with the anterior one, measure: 0,5 mm, 1,1–1,2 mm, 0.7 mm, 1,0–1,1 mm and 0.9 mm. On the left eyeball they measure: 0,2 mm, 1,0 mm, 0,5–0,6 mm, 1,2 mm and 1,0 mm.

REMARKS:

Owing to the courtesy of Dr. O. PAGET (Vienna) I had the opportunity to examine four type specimens of *Abralia steindachneri*. I did not study in detail the exact position of all the photophores. Neither did I describe in detail the photophores of the specimen from Abulat (W.ADAM, 1955, p.190). For the latter specimen I mentioned 5 photophores on each eyeball. In fact I only reported the circular light organs, because I had not recognized as photophores the long oval ones at the end of each series. But the general picture of the photophores of these specimens was the same as that found in the above-described specimen from Eilat.

On the other hand, I received from Mrs. J. FILIPPOVA (MOSCOW) two small specimens of *Abralia*, collected near the Seychelles, which apparently belong to *Abralia steindachneri*. Both of them have less photophores, which may be a juvenile character, such as GRIMPE (1931, p. 161) reported for *Abralia veranyi*.

On the ventral side of the mantle is the narrow median area devoid of photophores. The dorsal side shows a small number of pairs of minute photophores. In one of these specimens there is only one pair on the dorsal side of the fins, whereas the other one has two pairs.

On the ventral side of the funnel, the number of photophores is less (22) than in the specimen from Eilat (31). The transverse series of four big photophores is the same, but in the lateral series there are 2 instead of 3 small photophores and the other small ones are also reduced in number.

As to the ventral side of the head, the arrangement of the large photophores is the same as in the specimen from Eilat, but there are less small ones. In one of the Seychelles specimens, the median series is very distinct and composed of 2 large and 7 small photophores, but in the other specimen, the same series consists of only 5–6 small ones near the base of the ventral arms.

The general arrangement of the photophores on the ventral arms is the same, except that the intermediate, fourth series is missing, there being only a single small photophore at the base in one of the specimens and none at all in the second. The ventro-lateral arms possess only a few photophores on the dorsal side of the swimming-membrane, the series at the ventral side being normal. The photophore at the base of the dorso-lateral ar msis present but minute.

As to the photophores on the eyeball, in one of the specimens there are on the right eyeball two oval patches and 6 alternately small and large circular photophores, whereas the left eyeball has also 6 circular ones, the first of them very small. In the second specimen there are 5 circular photophores on both eyeballs.

The specimen from Eilat agrees generally with the original description and with the four type specimens which I have examined. As the arm tips of the former specimen are not very well preserved, it is not possible to verify the statement of WEINDL (1912, p.272) that the superior arms had a reduced number of distinctly larger suckers than the ventral pair. In the two small specimens from the Seychelles, I did not observe any difference in this respect, all the arms having 7 pairs of small suckers and at the tip some minute suckers in 3 or 4 longitudinal rows.

The original description mentions 7 or 8 tentacular hooks; in the types I examined there were 7 on each club.

As to the photophores, WEINDL (1912, p. 274) mentions the fact that one of the specimens showed 4 series on the ventral arms, but the intermediate, incomplete series has its place between the innermost and the lateral series and not between the lateral and marginal ones. The same author mentions only 5 photophores on the eyeball, but it is evident that he did not include the two terminal oval patches. In fact, two of the types I examined in this respect, had 7 photophores on each eyeball. According to GRIMPE (1931, p. 162), *Abralia steindachneri* possesses 6 photophores on each eyeball.

GRIMPE (1931, p. 150) created the subgenus *Stenabralia* for the Indo-Pacific species of *Abralia*, distinguished by short fins and more than 4 hooks on the tentacular club.

According to VOSS (1963, p.111), *Abralia* (*Stenabralia*) *lucens* VOSS, 1963, "is closely allied to *steindachneri*, *renschi* and *spärcki* but can be distinguished from *steindachneri* by the smaller number of club hooks and the larger number of ocular light organs". However, these differences are insignificant since *Abralia lucens* has 5–6 tentacular hooks and 8 ocular light organs. If the above-mentioned specimens from the Seychelles really belong to *Abralia steindachneri*, as I bleieve, these differences become taxonomically invalid, but according to fig. 22d of VOSS (1963, p. 107), the circular photophores of *Abralia lucens* appear very small compared with those of *Abralia steindachneri*.

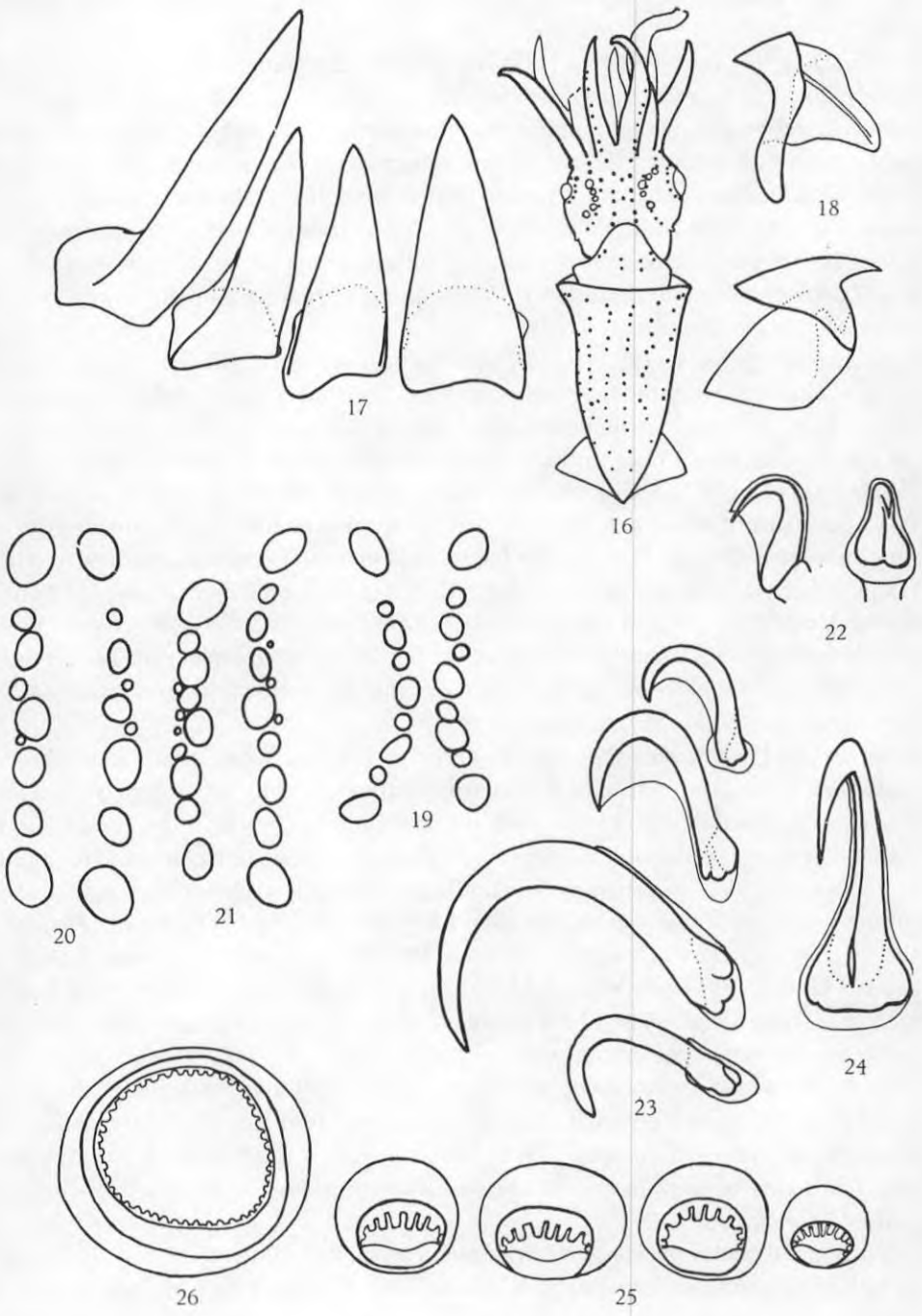
According to VOSS (1963, p.116), *Abralia* (*Stenabralia*) *spärcki* GRIMPE, 1931, is also "closely related to *A. steindachneri* from the Red Sea and *A. lucens* described above. It is, however, distinguished from these by the accessory row of light organs on the base of arm IV and other features mentioned above". As I stated above, WEINDL (1912, p. 272) mentioned this accessory row of light organs in one of the type specimens of *Abralia steindachneri*; in the specimens from Eilat a fourth row of photophores is situated between the lateral and marginal series. According to VOSS (1963, p. 115), *Abralia spärcki* possesses 8 light organs on the eyeball and 6–7 hooks on the tentacular club, but GRIMPE (1931, p. 154) mentioned 5–6 hooks. VOSS (1963, p. 114) describes in *Abralia sparcki* within the funnel groove a single white photophore posterior to and slightly medial to the inner nuchal fold; these photophores appear to be absent in *Abralia steindachneri*.

As to *Abralia* (*Stenabralia*) *renschi* GRIMPE, 1931, it seems that, according to VOSS (1963, p.111), this species is primarily characterized by the regular striping of the mantle photophores. In the original description (GRIMPE, 1931, p. 159), it is stated that the large photophores form on both sides a few distinctly marked longitudinal series, of which two series in the middle are especially visible. I have not seen the original material of this species, but when I compare the original figure 7(p. 159) with the original figures of *Abralia lucens* VOSS, 1963 (fig.22 p.107) and those of *Abralia spärcki* GRIMPE, 1931 (see VOSS, 1963, fig. 24, p. 113) and with the specimens I have seen of *Abralia steindachneri*, I am unable to discover any difference in the arrangement of the large photophores.

As to the tentacular hooks of *Abralia renschi*, the holotype and one of the paratypes have 6–7 hooks on each club; the other paratype has only 5 (which is an anomaly, according to GRIMPE, 1931). The same author (GRIMPE 1932, p. 155) states that the hooks of *Abralia renschi* are smaller than those of *Abralia steindachneri* and of *Abralia spärcki*.

There are 6 ocular photophores in *Abralia renschi* and GRIMPE (1931, p. 162) adds: as in "*A. steindachneri, armata, multihamata*". But I found 7 or 8 of these organs in *Abralia steindachneri*.

It is evident that much more material is needed to establish the real status and the relationship of these species.



Figs. 16–26 *Enigmoteuthis dubia* (ADAM, 1960).

Enigmoteuthis gen. nov.

Type species: *Enoploteuthis dubia* ADAM, 1960.

Enigmoteuthis dubia (ADAM, 1960)

(Pl. I, fig. 7–8; text. fig. 16–26)

? *Enoploteuthis dubia* ADAM, W., 1960, p. 12, fig. 2.

Type locality: Eilat.

Material (Tel-Aviv University):

a–NS 195: Eilat, V-1955, leg. Ch. LEWINSOHN: 1 ♂ (holotype);

b–NS 874: Eilat, on beach, 24–II–1965, leg. D. FRIDMAN: 1 ♀;

c–NS 1119: Eilat, 10–IV–1965, leg. J. DAFNI: 1 ♀;

d–NS 6360: Station 25, Gulf of Aqaba, off Nuweiba, 0–30 m, 8–X–1969, Isaac-Kid midwater trawl, leg. Ch. LEWINSOHN: 1 larva.

DESCRIPTION:

The original description was based on a single male specimen, the tentacles of which were lacking.

The present collection contains a fairly good preserved specimen, possessing the left tentacle, a rather badly preserved female without tentacles, and a larval specimen.

All these specimens show the exceptional attachment of the buccal membrane to the dorsal side of all the arms, which is unique among the Oegopsida.

The arms of the male are longer than those of the female and especially the ventral and ventro-lateral ones are stouter and their hooks much more numerous. The state of

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Fig. 16 NS 6360, Stat. 25,Gulf of Aqaba, off Nuweiba, 0–30m, 8–X–1969, leg. CH. LEWINSOHN: larva (ML 7,5mm) , ventral view, x 4, 5,;

Fig. 17 NS 1119, Eylat, 10–IV–1965, leg. J. DAFNI: ♀ (ML 32 mm): radula, x 214;

Fig. 18 Idem: mandibles, x 4, 5;

Fig. 19 Idem: ocular photophores, x 9, 3;

Fig. 20 NS 195, Eilat, V–1955, leg. CH. LEWINSOHN: ♂ (ML 36 mm): ocular photophores, x 9, 3;

Fig. 21 NS 874, Eilat, on the beach, 24–II–1965, leg. D. FRIDMAN: ♀ (ML 36 mm): ocular photophores, x 9, 3;

Fig. 22 Idem: armhook, x 9, 3;

Fig. 23 Idem: the four tentacular hooks, x 9, 3;

Fig. 24 Idem: largest tentacular hook, x 9, 3;

Fig. 25 Idem: chitinous rings of arm suckers, x 18, 5;

Fig. 26 Idem: chitinous ring of tentacular sucker, x 18, 5;

MEASUREMENTS:

Locality	a[1]		b		c	d
Sex	♂		♀		♀	—
ML (in mm)	36		36		32	7,5
VMLI	92		86		—	77
MWI	44		42		—	53
HLI	44		44		—	33
HWI	35		39		—	49
FLI	58		50		50	27
FLbI	44		44		41	27
FWI	100		—		—	53
	l.	r.				
A–I	—	80	61		—	—
A–II	64	75	69		—	—
A–III	80	80	69		—	—
A–IV	83	83	69		—	—
			l.	r.		
TLI	—	—	195	—	—	—
CLI	—	—	33	—	—	—
Ha–I	—	22	21	21	—	—
Ha–II	20	23	20	21	—	—
Ha–III	28	30	20	21	—	—
Ha–IV	47	32	24	24	—	—
Hts	—	—	4	—	—	—

1) In the original description the measurements of the arms apply to the whole length; here I give the length between the first hook and the tip of the arm.

preservation does not permit the exact count of suckers on the distal ends of the arms; they seem to be biserial and are armed with 6–8 big, blunt, distal teeth (fig. 25). The tentacular club has a single ventral series of 4 hooks, the second of which is very large. Dorsad of each hook there are two suckers, with their chitinous rings armed with 35–40 small denticles (fig. 26). At the base of the club are 5 carpal suckers. The distal part bears small suckers more or less arranged in oblique transversal series of 4. The state of preservation does not permit description of the swimming-membrane and of the protective membranes.

The photophores of the female are generally arranged as in the male. There is a small difference; in the male, the series of small photophores along the interior edge of each ventral arm starts at a short distance from the base of the arm, whereas in the female this series begins at the base itself. The photophores of the eyeball are of the same type, but in one of the females (b) there are on each eyeball three additional minute photophores. All these light organs are circular, the two extreme ones being largest and separated from the other ones which are close together and alternately smaller and larger.

The chitinous gladius has a strong rachis, 1,5 mm wide in the anterior third where the vane starts. The latter is thin, widest at about two-thirds of the length of the whole pen, its greatest width attaining about 25% of the length. The sides of the vane are regularly rounded at its greatest width, the anterior and posterior margins being nearly straight. At both ends, the gladius is bluntly rounded.

The mandibles (fig. 18) resemble those of other species of Enoploteuthidae, but the teeth of the radula (fig. 17) are much stouter and more conical with narrow bases.

The larval specimen (d) differs in many respects from the adult forms, but the characteristic attachment of the buccal membrane to the arms appears to prove that it really belongs to this species. The tentacles are missing and the arms bear only small, widely spaced suckers, no hooks. The dorsal surface is completely devoid of photophores. These are only found on the ventral and lateral sides, where they are nearly all of the same size, although a few are of a lighter colour; their arrangement is given in figure 16. On the eyeball, seen through the transparent skin, there seem to be only 5 photophores.

REMARKS:

In the original description, I placed this species with some doubt in the genus *Enoploteuthis* and in the family Enoploteuthidae, although no other species of this family is known to have the ventro-lateral connective of the buccal membrane attached to the dorsal side of the ventro-lateral arms.

YOUNG and ROPER (1968, p. 200) in their table 3 give a review of the position of the buccal membrane connectives in the families of the Oegopsida. Not a single family presents the attachment DDDD which characterizes our species; all have either DDVV or DDVD, the Enoploteuthidae presenting the latter pattern.

In his study of the genus *Enoploteuthis*, ROPER (1966, pp. 34, 44) states that I questioned the generic position of my species because the tentacles were missing and because of the dorsal attachment of the ventro-lateral buccal connectives. The same author is of the opinion that "other characters, especially the number and arrangement of ocular light organs and the arrangement of light organs on ventral mantle, funnel, head, and arms, indicate that the species is correctly placed in the genus".

Now that the tentacular club is known, I do not think that this species can be maintained in the genus *Enoploteuthis*. In many respects its characters agree with the diagnosis of *Enoploteuthis* as given by ROPER (1966, p. 8), but the tentacular club possesses only one series of hooks, as in *Abralia*, and not two as in *Enoploteuthis*. It differs from *Abralia* by the right ventral arm being hectocotylized and not the left one. In *Enoploteuthis*, the hectocotylus is provided with hooks, suckers and membranes; in our species suckers are absent.

These differences justify in my opinion the creation of a new genus *Enigmoteuthis*, which seems to belong to the family Enoploteuthidae, although the attachment of the buccal membrane connectives is different.

Thelidioteuthis alessandrinii (VERANY, 1851)

Loligo alessandrinii VERANY, J.B., 1851, p. 99, pl. 35 figs f-h.

Thelidioteuthis alessandrinii, CHUN, C., 1910, p. 104, pl. VII. figs 16, 17. –PFEFFER, G., 1912, p. 178, pl. 18 figs. 1–29. –NAEF A., 1923, p. 296, figs. 143, 144. –SASAKI, M., 1929, p. 253, p. XXI, figs. 11–16. –ADAM, W., 1954, p. 153.

Type locality: Messina.

Distribution: Mediterranean, Atlantic, Indo-Pacific.

Material (Tel-Aviv University):

NS 6359: Station 14: Gulf of Aqaba, north of Nuweiba, 0–150 m, 6–X–1969, Isaac-Kid midwater trawl, leg. Ch. LEWINSOHN: 1 spec. (?♀).

MEASUREMENTS:

ML (in mm)	20	A–IV	65	
VMLI	90	TLI	120	
MWI	40	CLI	28	
HLI	40			
HWI	40			
FLI	80		l.	r.
FLbI	65	Ha–I	14	14
FWI	110	Ha–II	17	17
A–I	65	Ha–III	18	17
A–II	70	Ha–IV	15	14
A–III	70	Htp	7,5	7,5

DESCRIPTION:

The specimen is in excellent state of preservation. The mantle is rather plump, bluntly rounded posteriorly. The dorsal mantle margin is nearly straight, the ventral margin slightly emarginate around the funnel. The fins are very long and wide, their total width surpassing the mantle-length. Both the anterior and posterior margins are slightly concave. The fins do not seem to extend up to the posterior end of the mantle, but in fact they continue up to the end as very low membranes. The head is as wide as the mantle, with large, non prominent eyes. The nuchal folds are weakly developed: on each side a small dorso-lateral fold and a stronger ventro-lateral one, which is rather a fleshy protuberance.

The arms are long and slender with low but well-developed protective membranes. All the arms are rounded on their outer sides. Only the ventral arms have a well-developed swimming-membrane on the lateral side; on the other arms there is at the utmost an indication of a swimming-membrane near the tip.

The tentacular club has a well-developed swimming-membrane along its distal half. The tentacular stem is rounded on the outer side, flattened with a median groove on the inner side.

Both tentacles have 4 carpal suckers and probably 4 papillae, which are not easily observed. The tentacular hooks are arranged in two longitudinal series, the dorsal

ones bigger than the ventral ones, the fourth dorsal hook being largest. The distal part of the club bears about 7 transversal rows of 4 minute suckers.

The arms bear small, widely spaced hooks and about 10–15 pairs of distal suckers, which may be uniserial near the tip of the arms.

Mantle photophores are absent from the dorsal side. On the ventral and lateral sides there are 22 photophores of only one type, measuring about 0,4 mm, each photophore being surrounded by a circlet of minute chromatophores. These photophores are arranged in alternating transversal rows of 4 and 2: four rows of 4 and three rows of 2. The funnel is devoid of photophores. On the ventral surface of the head is one pair of photophores just in front of the ventral nuchal folds, and one pair of smaller ones at the anterior level of the eye opening. There seems to be one pair at the base of the ventral arms, but in fact they are situated on the base of the tentacular stem and covered by the swimming-membrane of the ventral arms. In lateral view there is one large photophore behind each eye, and four smaller ones: one above the eye, one in front of and two beneath the eye opening. There is a single photophore at the base of each dorso-lateral arm and a series of photophores on the outer side of the tentacular stem: 16 on the left one and 14 on the right one. These photophores are of different size, alternating irregularly.

The number and the arrangement of the photophores is exactly the same as in the largest specimen described by PFEFFER (1912, p. 181), with only one exception: in the above-described specimen there are a few more photophores on the tentacular stem, but some of these are small and not easily seen.

The buccal membrane exhibits the connectives DDVD characteristic of the Enoploteuthidae.

REMARKS:

SASAKI (1929, p. 253) reported this species from Japan. In addition to the above-described photophores, that author mentions "innumerable minute ones on the ventral surfaces of head, mantle and arms, grouping themselves into several zones". The specimen I examined does not show any trace of these minute photophores, but only small chromatophores.

The species is here reported for the first time from the Red Sea.

OMMASTREPHIDAE

Loligo oualaniensis LESSON, R.P., 1830, p. 240, pl. I, fig. 2.

Symplectoteuthis oualaniensis, ADAM, W., 1960, p. 8, fig. 1. -VOSS, G.L., 1963, p. 134, fig. 29.

Type locality: Oualan (=Kusaie, Caroline Islands).

Distribution: Indo-Pacific, from the Red Sea to Japan and the west coast of South and Central America.

Material (Hebrew University):

E 49/109: Eilat, XII–1959, leg. A. BEN-TUVIA: 1 ♀.

MEASUREMENTS:

			l.	r.
ML (in mm)	165	A–I	36	36
VMLI	94	A–II	45	42
MWI	27	A–III	48	48
HLI	24	A–IV	48	48
HWI	27	TLI	110	—
FLI	40	CLI	45	—
FWI	73	SIs	1,7	
		SIt	2,0	

DESCRIPTION:

As in the previously recorded specimen from Eilat (ADAM, 1960, p .9), the funnel groove has a central pouch with six longitudinal plicae. At each side there are three or four lateral pouches: the first left one and the second right one show each a small accessory membrane, limiting secondary pouches.

OCTOPODIDAE

Octopus aegina GRAY, 1849

(pl. I, fig. 4)

Octopus aegina GRAY, J.E., 1849, p. 7. -ROBSON, G.C., 1928, p. 641, figs. 1–4; 1929, p. 113, figs. 31, 32, pl. V, fig. 1. -ADAM, W., 1954, p. 166, fig. 30, pl. II, figs. 2, 3; 1959, p. 171, fig. 19; 1960, p. 18, figs. 3–10; 1962, p. 55.

Octopus rugosus ADAM, W. (non BOSC), 1942, p. 15.

Type locality: unknown.

Distribution: Indo-Pacific.

Material (Hebrew University):

a–E 54/9: Eilat, 10–II–1954, leg. A. BEN-TUVIA: 1 ♂ (ML = 28 mm);

b–E 57/412: South Red Sea, 1957, leg. A. BEN-TUVIA: 3 ♀ (ML = 33, 40 and 40 mm);

c–E 59/97: Eilat, north beach, 22–IX–1959, leg. H. STEINITZ: 1 ♀ (ML = 42 mm);

Material: (Tel-Aviv University):

d–E 60/62, 1(1): Eilat, 3 ft., 5–IX–1960, leg. E. CLARK: 1 ♀ (ML = 38 mm);

e–E 62/1991: Nocra. 2–8m, 18–III–1962: 1 young spec. (ML 14 mm);

f–NS 875: Eilat, on the beach, I–1965, leg. J. DAFNI: 1 young ♀ (ML 13 mm) (identification somewhat doubtful).

Octopus cyaneus GRAY, 1849

Octopus cyanea GRAY, J.E., 1849, p. 15. -ROBSON, G.C., 1929, p. 94, figs. 21–23. -REES, W.J. & STUCKEY, A., 1952, p. 190, pl. 30.

Octopus cyaneus, ADAM, W., 1954, p. 171; 1955, p. 191; 1959, p. 172; 1960, p. 17.
Type locality: "coasts of New Holland".
Distribution: Indo-Pacific.
Material: (Hebrew University):
E 56/5: Eilat, 5–VI–1956, leg. H. STEINITZ: 1 ♀ (ML = 100 mm).

Octopus horridus d'ORBIGNY, 1826

(pl. I, fig. 5)

Octopus horridus ORBIGNY, A. d', 1826, p. 144. -ROBSON, G.C., 1929, p. 91, figs. 18, 19.
ADAM, W., 1959, p. 176, fig. 21. -VOSS, G.L., 1963, p. 161, pl. 31a.
Type locality: Red Sea.
Distribution: Red Sea, Indian Ocean, ? Pacific.
Material (Tel-Aviv University):
a–E 62/1941: Nocra, 2–8 m, 16–III–1962: 1 ♀ (ML = 9 mm);
b–E 62/2054: Um Aabak, 2–8 m, 22–III–1962: 1 ♀ (ML = 7 mm);
c–E 62/2280: Cundabilu, 2–8 m, 25–III–1962: 2 ♀ (ML = 14 and 15 mm);
d–E 62/2370: Um Aabak, 2–8 m, 5–IV–1962: 2 ♀ (ML = 8 and 8 mm);
e–E 62/2382: David Bay, Entedebir, 2–8 m, 2–IV–1962: 2 young spec. (ML = 5,5 and 6 mm);
f–NS 6205: Station 36, Gulf of Aqaba, off Wadi Marach, about 20 km south of Eilat, 40–45 fms., 9–X–1969, leg. Ch. LEWINSOHN: 1 young spec. (ML = 7 mm).

REMARKS:

All the above-mentioned specimens have the characteristic colour-pattern and ornamentation.

According to REES and STUCKEY (1952, p. 188), *Octopus horridus* has not been reported east of the Andaman Islands. The specimen that I reported (ADAM, 1934, p. 18) from Mansfield Island (New-Guinea) appears nevertheless to belong to this species.

VOSS (1963, p. 161) mentioned the species from the Philippine Islands, although with some hesitation. In fact, the largest specimen of *Octopus horridus* I have seen presents a mantle-length of 25 mm, whereas G.L. VOSS (1963, p. 162) mentions a female of 50 mm and a male of 35 mm. According to that author (p. 163) the two small males (with a mantle length of 22 mm) "show little or no indication of the typical *horridus* coloration and apparently are more rugose and with far more prominent cirri" than he has found in the literature. The only small species I know which has more prominent cirri than *Octopus horridus* is *Octopus aborescens* HOYLE, 1904.

In previous papers (ADAM, 1954, p. 175; 1959; p. 178) I mentioned the fact that some of the young specimens from the Indian Ocean which I identified as *Octopus niveus* LESSON, 1830, resemble *Octopus horridus*. VOSS (1963, p.163) states that "Pickford's unpublished monograph contains a full and detailed consideration of the relationships of *O. horridus* with *O. filamentosus* and *O. niveus*; Dr. Pickford places the

two latter in synonymy". It is not clear from this statement if G. PICKFORD considers the latter species as synonymous with *Octopus horridus*, but I suppose that this is the meaning of the statement. My material is not sufficient for the clarification of the relationship between these species. Among the Red Sea material there were only small specimens which undoubtedly belong to *Octopus horridus*; none was large enough to be identified with *Octopus niveus*. For the moment therefore, it is impossible to solve this problem and to give more details on the distribution of *Octopus horridus*.

Octopus macropus RISSO, 1826
(text fig. 27)

Octopus macropus RISSO, A., 1826, p.3. -ROBSON, G.C., 1929, p.101. -ADAM, W., 1959 p. 174, fig. 20; 1960, p. 16. -VOSS, G.L., 1963, p. 164, pl. 3b.
Type locality: Mediterranean.
Distribution: cosmopolitan in warm and temperate seas.
Material (Tel-Aviv University):
a–E 62/1923: Cundabilu, 2–8m, 14–III–1962: 1 ♀ (ML = 31 mm);
b–E 62/1982: Cundabilu, 2–8 m, 20–III–1962: 1 ♀ (ML = 27 mm);
c–E 62/2384: Landing Bay, Entedebir, 2–8 m, 7–IV–1962: 2 ♀ (ML = 40 and 75 mm);
d–NS 1120: Eilat, 4–VII–1965, leg. J. DAFNI: 1 young spec. (ML = 13 mm).

REMARKS:

One of the specimens from Landing Bay (c) seems to be artificially compressed; hence the body is very long (75 mm) and very narrow (25 mm). The radula of this specimen (fig. 27) shows the characteristic complicated seriation.

Octopus robsoni ADAM, 1941

Octopus robsoni ADAM, W., 1941, p. 1; 1942, p. 4, 16; 1959, p. 178, fig. 22, pl. IX, fig. 1.
Type locality: Gulf of Suez.
Distribution: Red Sea.
Material: (Hebrew University):
a–E 57/412: South Red Sea, 1957, leg. A. BEN-TUVIA: 8 ♂ (ML = 18, 18, 18, 20, 22, 22, 22 and 30 mm), 19 ♀ (ML = 18, 20, 22, 22, 22, 24, 25, 25, 25, 25, 27, 27, 28, 28, 30, 30, 35, 35 and 35 mm);
b–E 57/546: North of Massawa Channel, South Red Sea, 40 fms., 29–XI–1957, leg. A. BEN-TUVIA: 1 ♂ (ML = 26 mm);
c–E 58/260: South Red Sea, Winter 1957/1958, leg. O.H. OREN: 4 ♂ (ML = 21, 25, 25 and 27 mm), 6 ♀ (ML = 22, 25, 27, 30, 30 and 32 mm);
Material (Tel-Aviv University):
d–E 62/2307: Cundabilu, 2–8 m, 25–III–1962: 1 ♀ (ML = 22 mm);
e–E 62/4279: Bay of Archiko, 10–20 fms, 9–IV–1962: 13 spec. (in rather bad condition).

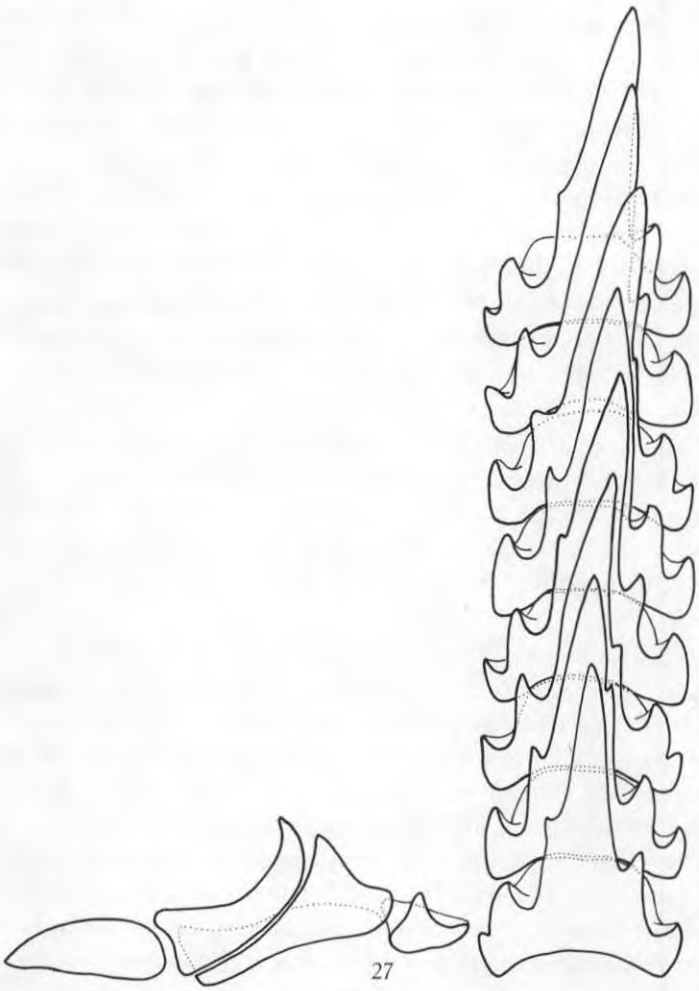

Fig. 27 *Octopus macropus*, RISSO, 1826: E62/2384, Landing Bay, Entedebir, 7–IV–1962: ♀ (ML 75 mm): radula, x 80.

REMARKS:

In an earlier paper (ADAM, 1959, p. 180) I discussed in detail the relationship of this species with other Indo-Pacific species, likewise possessing on each side an ocellus with a well-defined, narrow, slightly elevated, iridescent ring. Only a revision of all the known material and preferably more fresh material of these different species will eventually permit a decision concerning their validity. For this reason, I still maintain *Octopus robsoni* as a separate species. It can not be confused with *Octopus cyaneus*, which also possesses ocelli, but in the latter species they always lack the iridescent ring. In *Octopus cyaneus*, the ocellus is more irregular: in young specimens the dark ocellus sometimes has a lighter center and this may be enclosed by a lighter inner and a darker outer ring, but the light ring is never as wejl-defined as in the

species with an iridescent, elevated ring. In larger specimens of *Octopus cyaneus*, the pale center disappears and the dark outer ring may be confused with the dark reticulation of the skin. In some specimens of *Octopus robsoni*, one of the ocelli seems to be absent, but a close examination always reveals the elevated, iridescent ring, even when the pigmentation of the ocellus has disappeared.

Especially in large specimens of *Octopus cyaneus* it is sometimes difficult to discover the dark ocelli on the dark skin background, but this species always shows the dark patches alternating with the suckers on the ventro-lateral sides of the arms.

In his paper on the Cephalopods of the Philippine Islands, Voss (1963, p. 159) mentions with some doubt a small female of *Octopus membranaceus* QUOY & GAIMARD, 1832. He describes the ocellus as "solid with no indication of a ring or center"; he also figures it (fig. 36) as an indistinct dark patch. He states that his specimen fits the description of *Octopus ovulum* except for the structure of the ocellus. But experience with ocelli makes him disregard this difference "because they are very variable and often change according to the preservative and especially with the length of preservation". I agree with regard to the general pigmentation of the ocellus but in my opinion, the presence or absence of the iridescent ring does not depend on the mode of preservation.

Under the distribution of *Octopus membranaceus*, Voss (1963, p. 161) mentions among others: "Red Sea (Adam)", but without giving reference to a publication. I have never reported *Octopus membranaceus* from the Red Sea, nor of any other region. The two species which I mentioned from the Red Sea as having ocelli are: *Octopus cyaneus* and *Octopus robsoni*, but Voss does not mention either of these two species in the synonymy of *Octopus membranaceus*. According to de FERUSSAC and d'ORBIGNY (1840, p. 43), the latter species possesses the characteristic ring which is also found in *Octopus robsoni*. It is possible that Voss considers the latter species as a synonym of *Octopus membranaceus*, but in case the specimen he identified as such does not possess that ring, it can not belong to *Octopus membranaceus*.

Octopus nanus sp. nov.

(pl. I figs. 1–3; text fig. 28–32)

Holotype: E 62/2307: Cundabilu, 2–8 m, 25–III–1962: 1 ♂ (Tel–Aviv University);
Paratype: E 62/2382: Landing Bay, Entedebir, 2–8 m, 7–IV–1962: 1 ♂ (Institut Royal des Sciences Naturelles de Belgique, Brussels);
Doubtful specimen: E 62/2653: Um Aabak, 2–8 m, 5–IV–1962: 1 ♂ (Tel–Aviv University).

Fig. 28 E 62/2307, Cundabilu, 25–III–1962: ♂ (holotype; ML 13 mm): radula, x 214;
Fig. 29 Idem: mandibles, x 9, 3;
Fig. 30 Idem: spermatophore, x 37;
Fig. 31 E 62/2653, Um Aabak, 5–IV–1962: ♀ (ML 25 mm): radula, x 214;
Fig. 32 Idem: mandibles, x 4, 5.

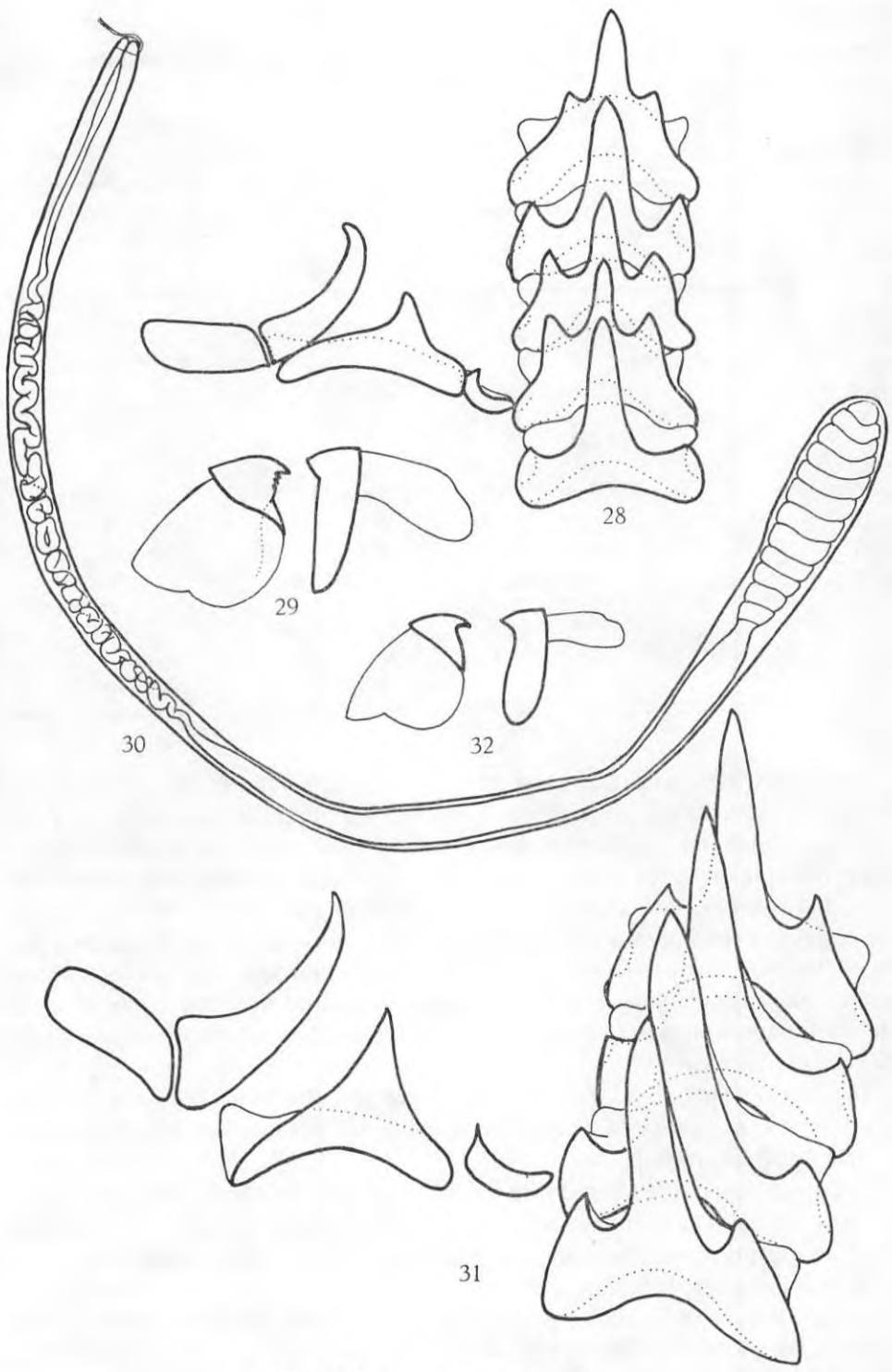

Fig. 28–32 *Octopus nanus* sp. nov.

DESCRIPTION:

The two male specimens are very small but adult, possessing well-developed spermatophores (fig. 30).

MEASUREMENTS:

Specimen	Holotype		Paratype		doubtful specimen	
Sex	♂		♂		♀	
ML (in mm)	13		12		25	
MWI	69		87		52	
HLI	54		58		44	
HWI	84		83		58	
	l.	r.	l.	r.	l.	r.
A–I	192	200	158	158	120	—
A–II	230	245	140+	150	—	120
A–III	230	185	166	133	—	—
A–IV	260	245	175	166	140	—
W. f.	DABCE		DCABE		DCEAB	
WDI	21		28,5		34	
SIs	13		12,5		8	
LLI	6,3		6,2		—	
SpLI	43		65		—	

The holotype (pl. I. fig. 1) has a short, plump body, bluntly rounded posteriorly, not well separated from the head which has very big prominent eyes. The arms are relatively short and the interbrachial membrane shallow, with subequal sectors not continuing along the arms. The suckers are rather large in the basal part of the arms, but there are no particularly enlarged suckers; they increase in size towards the margin of the interbrachial membrane and decrease progressively towards the tip of the arms. The hectocotylus is smaller than the corresponding left arm, with a well-developed membrane and groove along the ventral side. The ligula is small and the calamus measures about 25% of its length. The hectocotylized arm bears 22 pairs of suckers.

The skin of mantle, head and outer side of web and arms is finely granular, with a large cirrus above each eye. The animal is rather pale with darker coloured patches of very small chromatophores.

The funnel organ is W-shaped with the limbs broad at their basis and more slender towards the tip. The gills have only five filaments and are very short. The penis is short, measuring about 2 mm; the spermatophores measure about 5 mm. The radula is figured in fig. 28, it has an A 3–4 seriation.

In the paratype the posterior part of the body (pl. I. fig. 2) is somewhat larger, the eyes are less prominent. The skin shows the same granulation, but the latter is more developed on the dorsal and the ventral sides of the body; the cirri above the eyes are

not visible. The chromatophores are also very small. The hectocotylus is similar but bears only 18 pairs of suckers. The funnel organ has its limbs more slender at the basis than in the holotype. The gills possess five filaments. The spermatophores measure about 7,5 mm.

The female specimen (pl. I. fig. 3) which I include with some doubt in this species is much longer with the body elongate, bluntly rounded posteriorly. The eyes are less prominent. The arms are very short, relatively much shorter than in the male, but unfortunately most of them are incomplete. The suckers are more imbedded in the arm tissue, less prominent than in the males. The web is shallow, with subequal sectors. The animal is pale, with very small chromatophores and no cirri visible above the eyes. The gills have five filaments. The funnel organ is not well preserved. The eggs are very large elongate, measuring up to 3,5–5 mm in length and 1,5 mm in width. The radula has also an A 3–4 seriation (fig. 31).

RELATIONSHIP:

The above-described specimens can not be attributed to any of the octopods known so far from the Red Sea. The only species which as adult is of such a small size, is *Octopus horridus*, which has a quite different general shape, a typical colour-pattern of its own, a different skin sculpture and much longer arms. All the other species from the Red Sea have also much longer arms and other characters which differentiate them easily.

As to the Indo-Pacific octopods, we have to wait for a general review establishing the exact position of the numerous species, before a well-founded comparison is possible. The only species which resembles our new species seems to be *Octopus globosus* APPELLÖF, 1886. This species has also a small size, a globular body, big eyes, a small number of gill filaments and a similar radula, but the arms are relatively much longer, the web continues along the arms and the male possesses enlarged suckers on the lateral arms at the level of the free margin of the web. The female *Octopus globosus* has small ovulae. My descriptions of *Octopus globosus* were based on material from the Indian Ocean and from the South Pacific Islands (W. ADAM, 1934, p. 20; 1938, p. 3; 1939, p. 75; 1945, p. 2; 1954, p. 170) and I mentioned (1939 p. 78) the differences between these specimens and those described from Japan (M. SASAKI, p. 97). Without having seen the type specimens of *Octopus globosus*, I was not in a position to decide whether the Indian Ocean specimens really belong to this species.

For the moment I feel justified to describe the above-mentioned specimens as a new species: *Octopu nanus*, characterized by its small size, short arms, rather shallow web not continuing along the arms, the finely granular skin, the small number of gill filaments and the absence of enlarged suckers on the lateral arms of the male. In case the female specimen really belongs to ths species, the latter would be distinguished by very large ovulae.

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