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MORPHOLOGICAL AND TAXONOMICAL STUDIES ON SOME CEPHALOPODS FROM THE SUEZ GULF AND RED SEA

RAFIK RIAD

National institute of Oceanography and Fisheries, Alexandria, Egypt.
Rafik_Riad67@yahoo.com

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ABSTRACT

The cephalopod species were obtained from the Gulf of Suez on the Red Sea. They were belonging to three different Families, Sepiidae, Loligonidae and Octopodidae. Family Sepiidae includes *Sepia dollfusi, Sepia elongate* and *Sepia pharaonis.* family Loligonidae includes *Loligo duvauceli* and *Loligo forbesi.* On the other hand, the family Octopodidae includes *Octopus vulgaris, Octopus macropus, Octopus defilippi, Octopus aegena* and *Octopus membranaceus.* The morphology and taxonomy of these ten cephalopods were studied and compared with the results in other studies.

1. INTRODUCTION

Cuttlefishes, squids, octopuses and nautili are the most important representatives of the class Cephalopoda. The class includes about 1000 known species, which represent about 2.07% from the phylum Mollusca (Hassan, 1974). Cephalopods include the largest species of both modern and fossil invertebrates in both the coastal and the oceanic waters, inhabiting different kinds of grounds. Commercially, they represent a remarkable and significant fishery in many areas of the world. From the total catch of world cephalopod fishery, about 71.8 % were squids, 13.6% cuttlefish and 14.6% octopuses (Roper *et al*., 1984).The cephalopods represent about 9.8% of the total fish catch landing from Egyptian Mediterranean waters of which 6.1% are cuttlefishes, 3.5% octopuses and 0.21% squids and. The Red Sea cuttlefishes represent about 0.69% from the total fish catch (Abdalla, 1993).

The earliest mention from Cephalopoda in the Red Sea goes back to Savigny (1817) in the "Description de l' Egypt". Adam examined a rich collection of Cephalopoda from the Museum national d' Histoire Naturelle of Paris, the collection comprised specimens described earlier by Ferussac and d' Orbigny (1835 – 48) and by Rochebrune (1884) and more recent collection from the mission of Gruvel (1936) and the mission of Dollfus (1959). The collection of Dollfus from the Gulf of Suez and Gulf of Aqaba is the most interesting ever made from the Red Sea. It was investigated by Adam (1959).This author recorded and described eleven species including a new species *Octopus robsoni* and a new Red Sea species *Sepia prashadi*. *Doryteuthis arabica* which had not been seen since Ehrenberg (1831) was represented by several males and females.Robson (1926) recorded six species from the Suez Gulf and Emam (1983) gave list note for six different species of *Sepia*, collected from Gulf of Suez including *Sepia savignyi*; *S. prashadi; S. dollfusi; S. Pharaonis; S. elongata* and *S. Arabica*. In addition to two different species, belonging to the genera *Loligo* and *Doryteuthis* namely; *Loligo duvauceli* and *Doryteuthis arabica.*

Emam (1984), Aboul-Ela and Emam (1993), Khatab *et al*.(1993), Ibrahim *et al*. (1993), Emam (1994), Emam (1996), Gabr *et al*. (1998), Saad and Emam (1998), Emam

and Saad (1998), Emam and Aly (2000), Emam *et al*. (2007), Riad and Gabr (2007), Gabr and Riad (2008) and Riad and Abd El-Hafez (2008). The previous studies were carried out mainly on the biology of some cephalopods from the Gulf of Suez. In the present samples were available from 12 trawling stations from the Suez Gulf.

The aim of this work is to restudy and describes the cephalopod species inhabiting the Suez Gulf. Besides, it is a trial to find out the species which may be new to the area depending on a lot of diagnostic characters such as shape of body, arms, suckers hectocotylized arm, fins and the number of gill lamellae.

2. MATERIALS AND METHODS

Ten cephalopods were identified from a series of trawls during March 2002 at a maximum depth of 86 meters. The duration of the trawling period from the Suez Gulf (Fig. 1) ranged between 45 to 75 minutes with 2 – 2.5 knots ship speed. Cephalopods occurred at 12 stations which defined by longitudes and latitudes as follows:

	Latitude			**Longitude**		
Station 1:	27	58	03	33	41	07
Station 2:	29	44	09	32	36	84
Station 3**:**	27	36	00	33	50	00
Station 4:	27	39	00	33	50	05
Station 5:	29	37	01	32	36	79
Station 6:	27	38	09	33	51	00
Station 7:	27	35	04	33	49	00
Station 8:	29	26	68	32	32	17
Station 9:	29	29	07	32	28	01
Station 10:	29	45	08	32	36	04
Station 11:	29	58	79	32	45	00
Station 12:	28	51	30	32	49	10

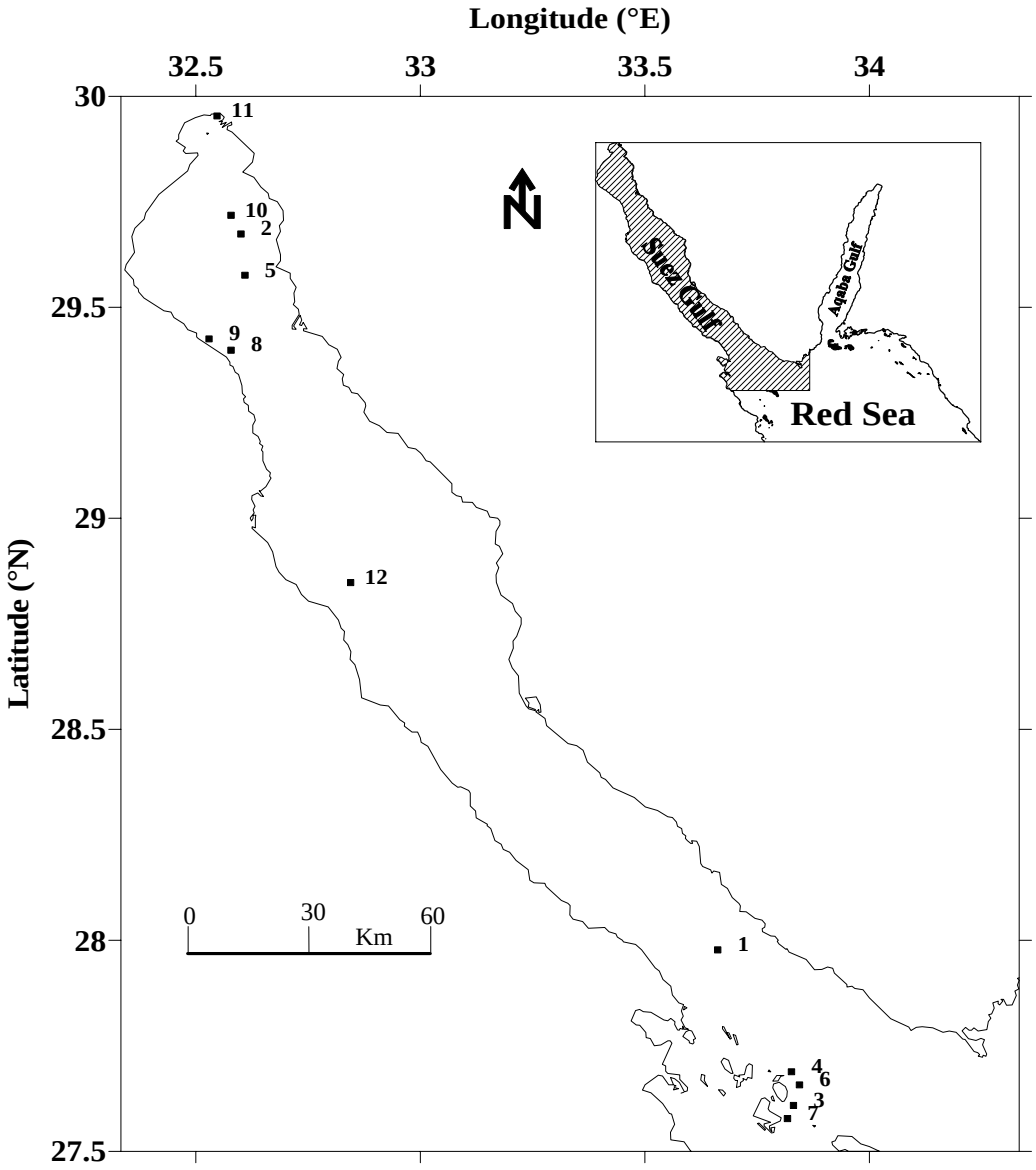


Fig. (1): The area of study and the sampling stations.

After captured, the samples were preserved in 10% formalin sea water solution and kept in the Taxonomy and Aquatic Biodiversity Lab (reference collection center), National Institute of Oceanography & Fisheries, Alexandria under the code number (Riad, R. 54 – 63). External morphology and the structure of tentacular clubs, hectocotylized arms, gills and shells were all studied to attain the species level. Specimens were identified following the guide lines of Adam (1959), Adam (1960), Fischer (1973), Roper *et al*. (1984), Nesis (1987) and Jereb and Rober (2005).

3. RESULTS AND DISCUSSION

In the present ten species of cephalopods were collected from the Gulf of Suez. They include 3 species from Family Sepiidae, 2 from Loliginidae and 5 from Octopodidae. These species and the related ones from the same localities and from Gulf of Aquaba were represented in table (1).

Table (1): Species recorded from Suez Gulf and Gulf of Aqaba from previous studies.

Suez Gulf species Adam, 1959	**Aqaba Gulf species Adam, 1959**	**Aqaba Gulf species Adam, 1960**	**SuezGulf species Emam,1983**	**PresentWork species**
Sepia pharaonis *Sepioteuthis loliginifori* *Sepia prashadi* *Doryteuthis arabica* *Octopus robsoni* *Octopus horridus* *Octopus aegina* *Sepioteuthis lessoniana* *Octopus macropus* *Sepia dollfusi*	*Sepia gibba* *Sepia pharaonis* *Sepia elongata*	*Sepia pharaonis* *Sepioteuthis lessoniana* *Symplecteuthis auataniensis* *Enoploteuthis dubis* *Octopus macropus* *Octopus cyaneus* *Octopus aegina*	*Sepia savignyi* *Sepia prashadi* *Sepia dollfusi* *Sepia elongata* *Sepia pharaonis* *Sepia arabica* *Loligo duvauceli* *Doryteuthis arabica*	*Sepia dollfusi* *Sepia pharaonis* *Sepia elongata* *Loligo duvauceli* *Loligo forbesi* *Octopus aegina* *Octopus membranaceus* *Octopus vulgaris* *Octopus defilippi* *Octopus macropus*

Subclass: Coleoidea Bather, 1888
Superorder: Decapodiformes Young *et al*., 1998
Order: Sepiida Zittel, 1916
Family: Sepiidae Leach, 1817
Genus: *Sepia* Linnaeus, 1758
Sepia dollfusi Adam, 1941b
(Plates: 1 & 2)

Material:

Two individuals were available from station nine from a depth of 60 meters. Trawling lasted for 2 hours. Both sexes were similar, a male of 8.4 cm. dorsal mantle length and a female of 13 cm. dorsal mantle length.

Synonymy: None

Local name: Sobet

World distribution:

Red sea and southern part of the Suez Canal. (Nesis, 1987).

Description:

Mantle large with weak open mantle cavity .Arms are long, carry 4 rows of suckers (plate 2f). Arm sucker ring without teeth. Left arm IV hectocotylized modified in the about half terminal part forward by 12 transversal rows of 4 minute suckers (plate 1c). The shell is oval not rhomboidal, smoothly rounded posteriorly, its length almost equal to mantle length (plate 2 a-b-c). Tentacular club has 5 – 7 suckers in middle row larger than others (plate 1b) .Club suckers are gradually decreasing in size toward the edge of the tentacular club. Club protective membranes are parallel in the carpal part and terminate on tentacular staik without joining. More than 30 gill lamellae (Plate 1d).

The previous description is in good accordance with the morphological description of Adam (1959&1960) from Gulf of Suez and Gulf of Aqaba, apart from, the gill with 30 gill lamellae in our specimens collected from Egyptian Red Sea and in the present work the dorsal mantle length showed the largest specimen to be 13 cm. and the smallest specimen to be 8.4 cm., while according to Jereb & Rober 2005, the dorsal mantle length up to 11cm.

Sepia pharaonis Ehrenberg, 1831
(Plates: 3 & 4)

Material:

Five individuals (2 males and 3 females) with dorsal mantle length range from 9.5cm to 14.7cm were collected from six stations st.1, st.2, st.5, St.6 and st.11 + st.12. The depth ranged between 64.5 meters and 86 meters. Duration of trawling ranged from 45 minutes to 2.15 hours.

Synonymy:

Sepia torosa Ortmann, 1888; *Sepia rouxii* d, Orbigny, 1839 – 1842; *Sepia formosana* Berry, 1912; *Crumenasepia hulliana* Iredale, 1926; *Crumenasepia ursulae* Cotton, 1929; *Sepia rouxi* d, Orbigny, 1841; *Sepia formosana* Sasaki, 1929; *Sepia tigris* Sasaki, 1929. (Jereb and Roper, 2005)*;* *Acanthosepion rouxi* Rochebrune, 1884; *Sepia singalensis* Goodrich, 1896*;* *Ascarosepion singhalensis* Robson, 1927 (Adam, 1960).

Local name: Sobet.

World distribution:

Indo – Pacific: Red sea, Arabian Sea to South China Sea, East China Sea and northern and north Western Australia (Roper *et al*., 1984).

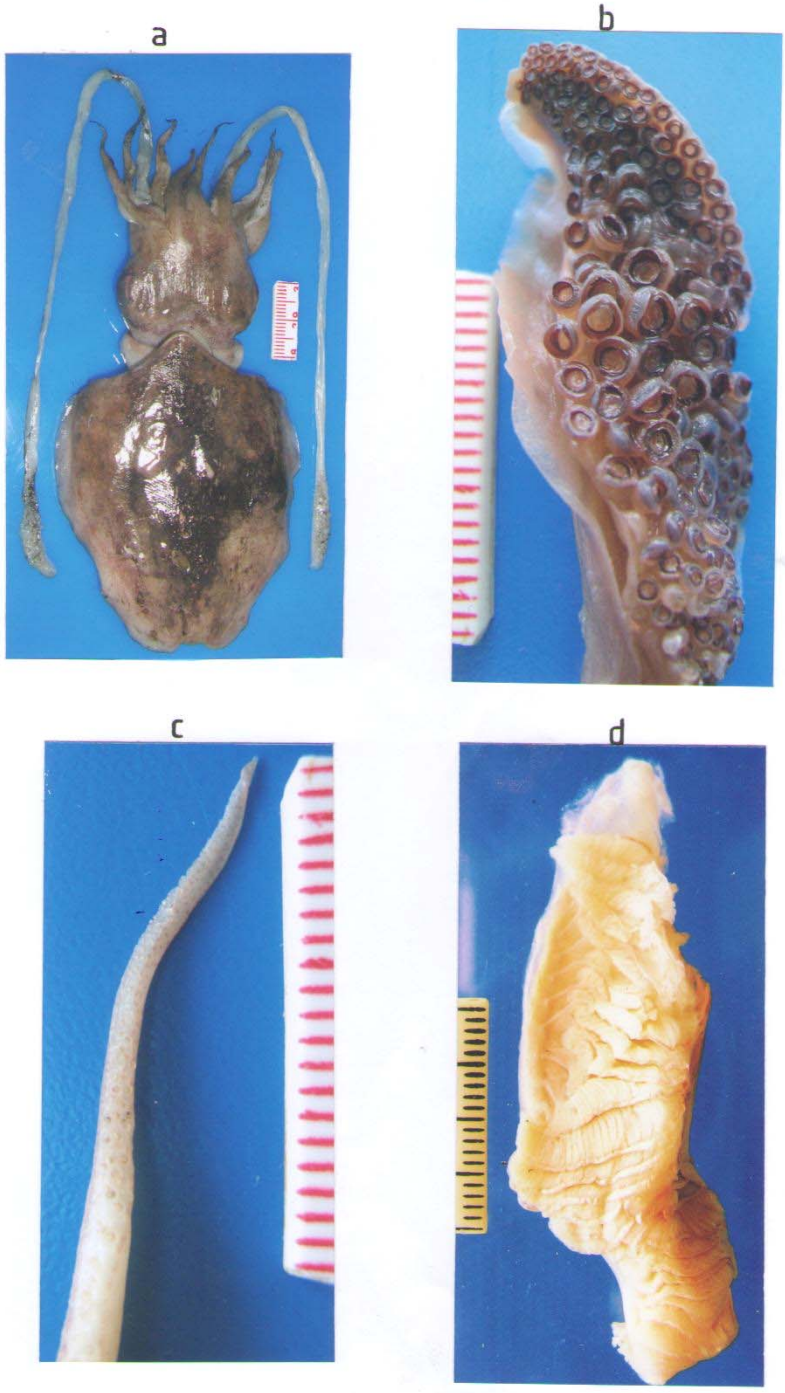
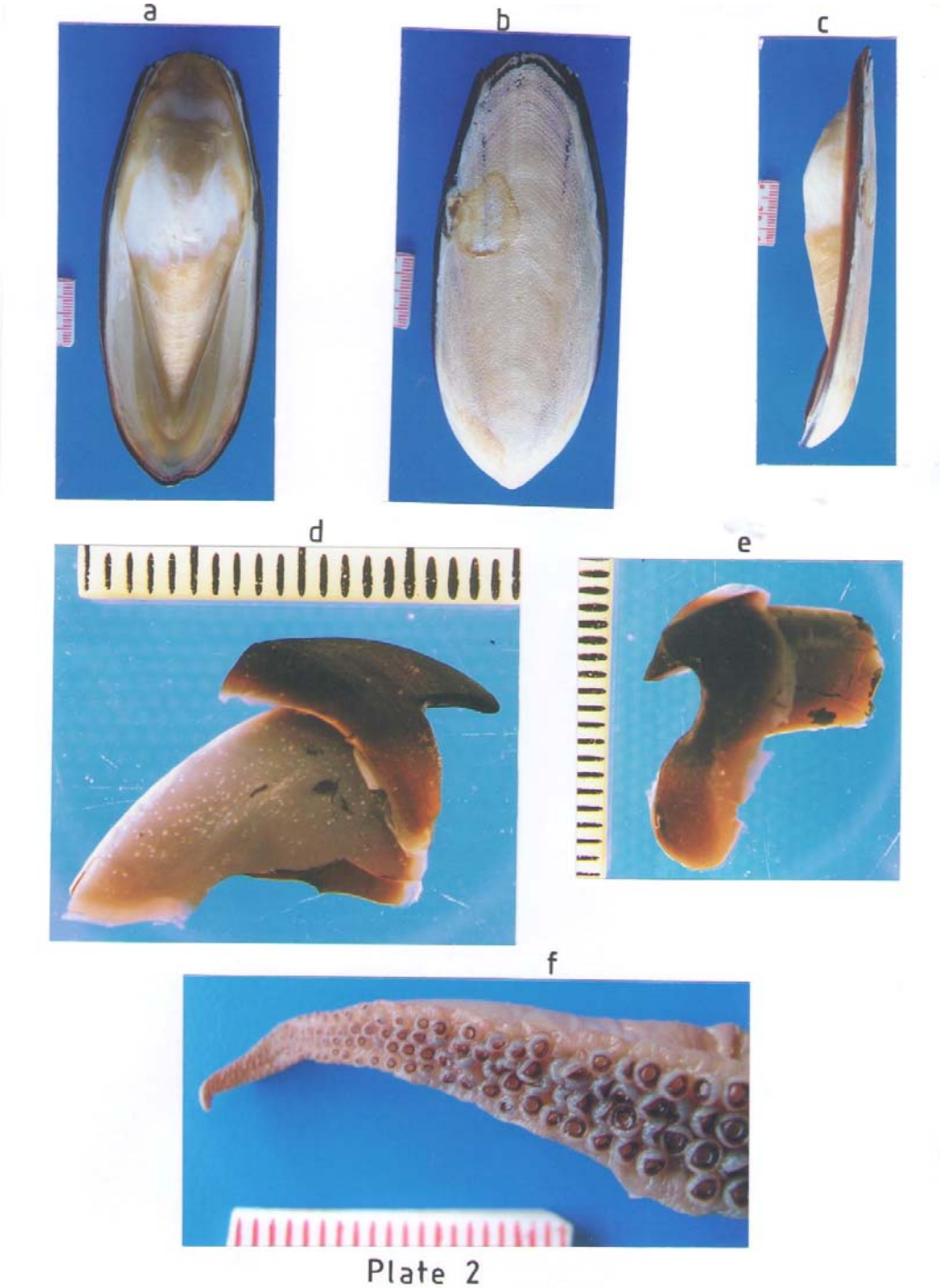


Plate 1



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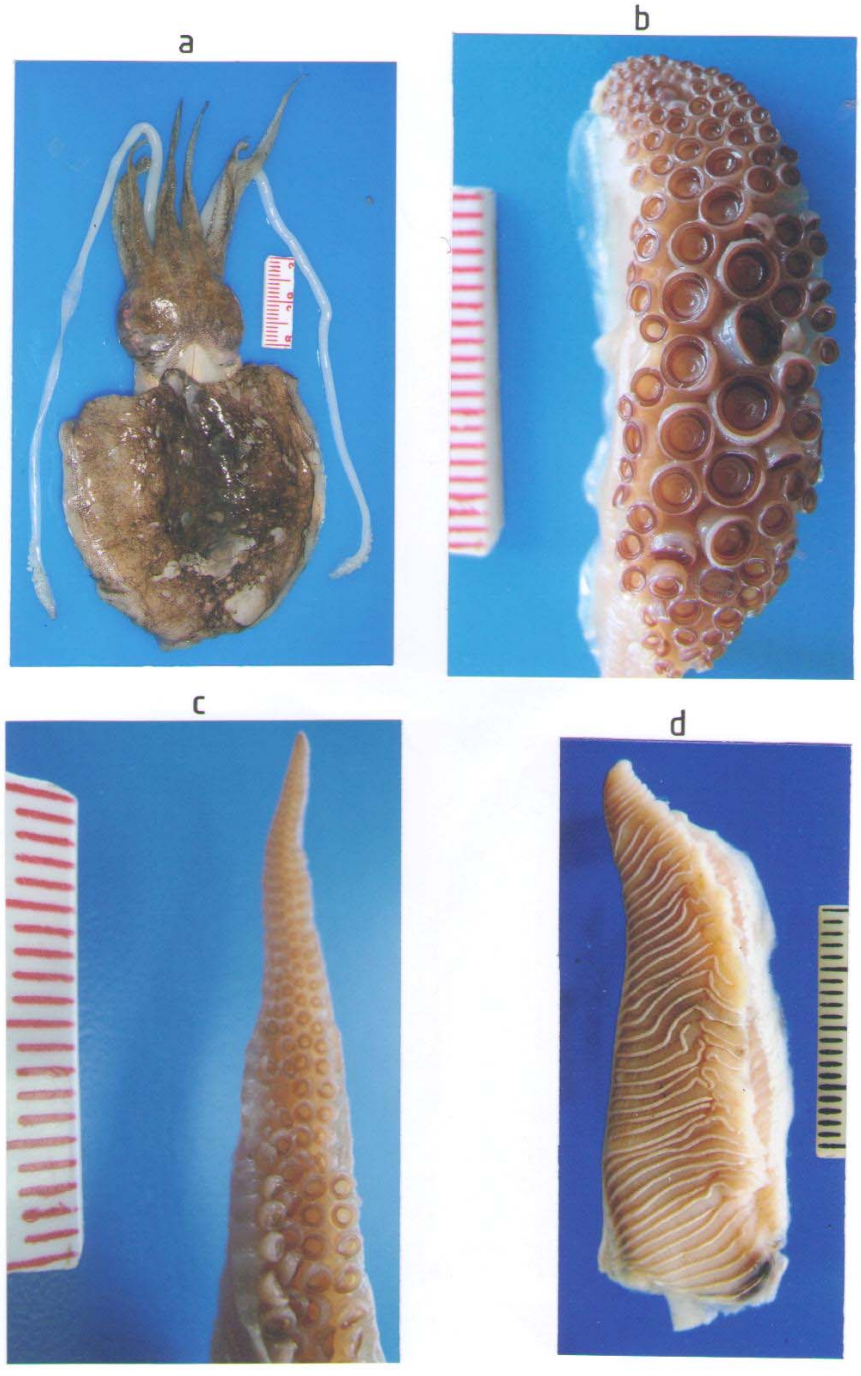

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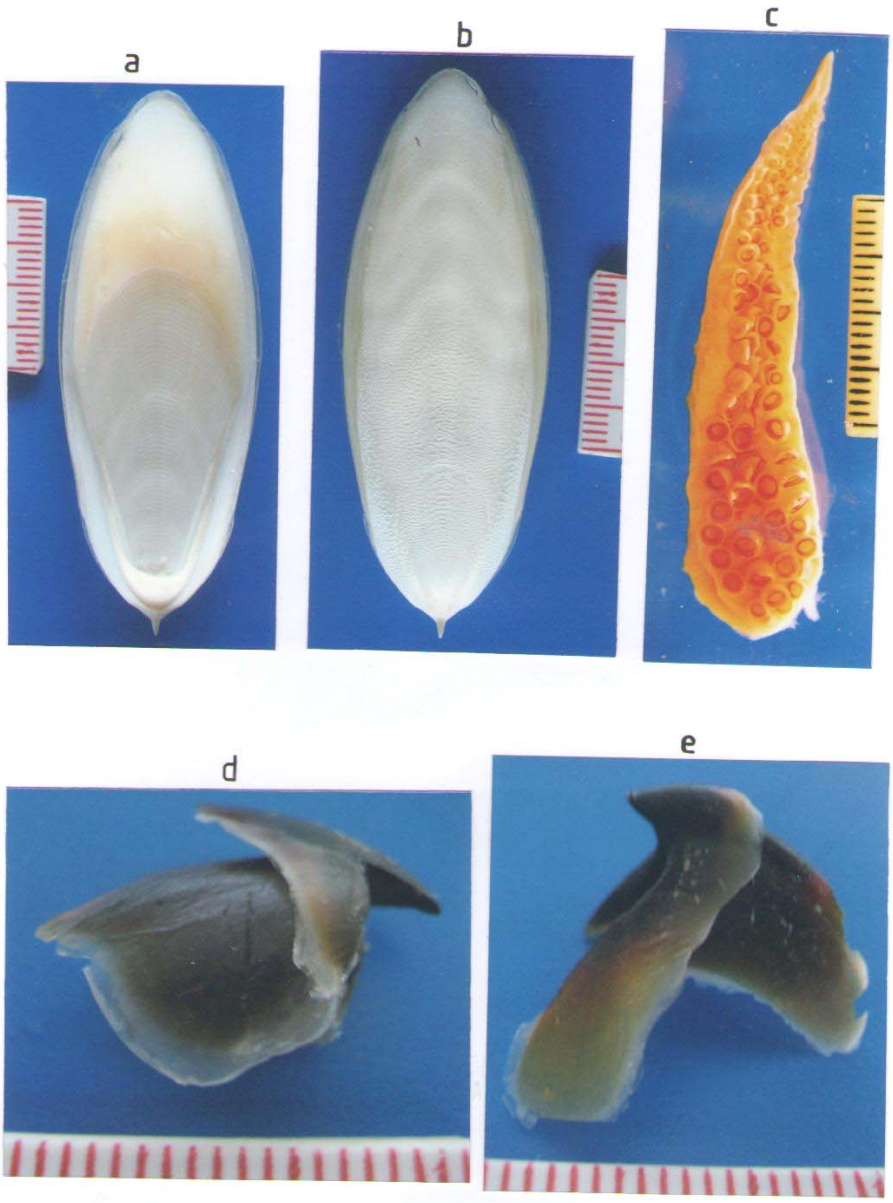

Plate 4

Description:

Mantle broad. Fins wide, nearly as long as mantle. The club is well differentiated and there are no suckers on the stem. The middle part of the tentacular club bearing 8 transverse rows of suckers, 5 or 6 median suckers enlarged. Five longitudinal rows of suckers. The swimming membrane of the tentacular club is well developed but does not extend on to the stem(plate 3b). Protective membranes not meeting at base. Buccal membrane with a few minute suckers. Hectocotylized arm: with 10- 12 quadriserial rows of normal suckers at base followed by 10 rows with ventral suckers (2 rows) normal but those in dorsal 2 rows are minute and separated from ventral rows by a fleshy transversely grooved ridge (plate 3c). Fins with longitudinal white band at base. Shell is flat, it's dorsal surface covered with small granules, the lateral chitinous margins being narrow. Inner cone limbs broaden, thicken posteriorly to form a distinct bulbous swelling, rounded interiorly. The striate zone neatly excavated at its posterior end and limited by the interior cone, while is a narrow rounded ridge. The posterior spine is short, pointed and well developed (Plate 4ab). Gill with about 45 gill lamellae (plate 3d).

The previous description was in agreement with findings of Adam (1959&1960) from Gulf of Suez and Gulf of Aqaba, Roper, *et al*. (1984), and Jereb & Roper, (2005) except the presence of transverse Zebra stripe pattern in males, which may be faded in this study upon preservation in strong formalin solution and except for the additional character in present study, Gill with about 45 gill lamellae. In the present work the dorsal mantle length showed the largest specimen to be 14.7 cm. and the smallest specimen to be 9.5 cm. while according to Rober *et al*. (1984), the common size ranges from 15 to 20 cm. dorsal mantle length. *Sepia pharaonis* and *Sepia ramani* are very similar. *Sepia ramani* differs from *Sepia pharaonis in* having long club with 15 to 24 subequal enlarged suckers. *Sepia pharaonis* has 6 enlarged medial club suckers, 3 or 4 of which are much larger than the rest. *Sepia ramani* has 14 to 16 transverse rows of normal size suckers on the proximal end of the hectocotylized arm,instead of 10 to 12 rows, as in *Sepia pharaonis* (Jereb & Roper, 2005). According to Perera, (1975) this species is easily differentiated from *Sepia aculeate*, by having the suckers of the two middle rows greatly enlarged.

Sepia elongata d' Orbigny, 1839 - 1842
(Plates: 5 & 6)

Material:

One individual with dorsal mantle length 10 cm. was sampled from station three. The depth ranged between 78 to 86 meter. Trawling duration 2hours.

Synonymy: None

Distribution:

Indopacific and Red Sea (Nesis, 1987).

Description:

The body is elongate. Shell swollen on ventral side, its thickness 7-10% and width 20 – 25% of shell length (plate 6a-b), hard puffed out the ventral face and the outside cone with two broad later wings, pointed spin is well developed (plate 6 a&b). Arms are endowed with four series of suckers among which lightly bigger medians than lateral. Suckers in distal parts of arms, 1st and 2nd pairs in males and of 2nd and 3rd pairs in females, disposed in 2 rows. Hectocotylized arm shows a unique structure of hard enlarged wrapped around free edge endowed with seven transverse wrinkles without suckers. Proximal and distal parts of hectocotylized carry erratically normal suckers (plate 5 c&d). Tentacular club is small with well developed keel, of a length about 15% of the tentacle, carries a series of five big suckers and the other tentacular suckers are tiny in comparison with this series of five, anderratically disposed (plate 5b). The gill has 20 gill lamellae (plate 6c).

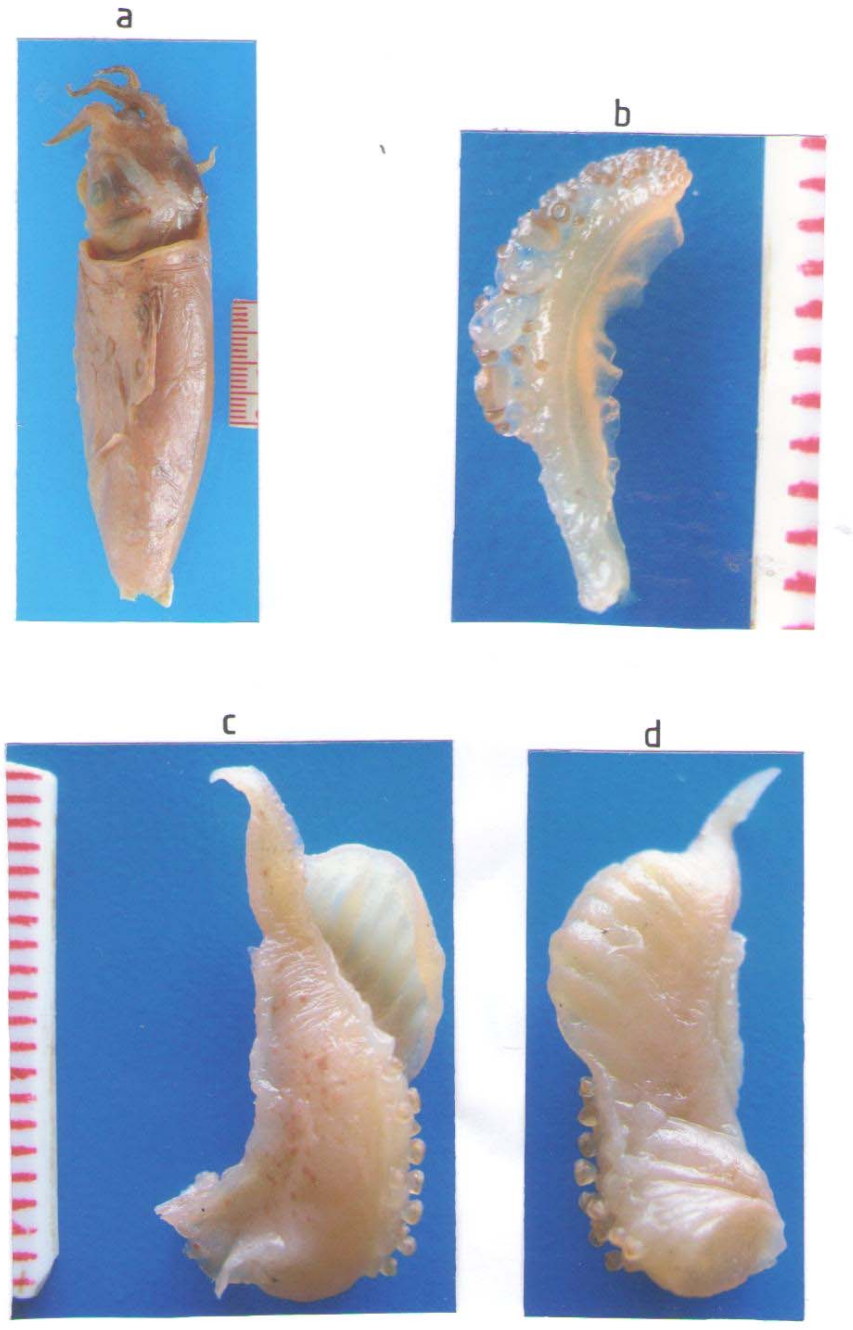

Plate 5

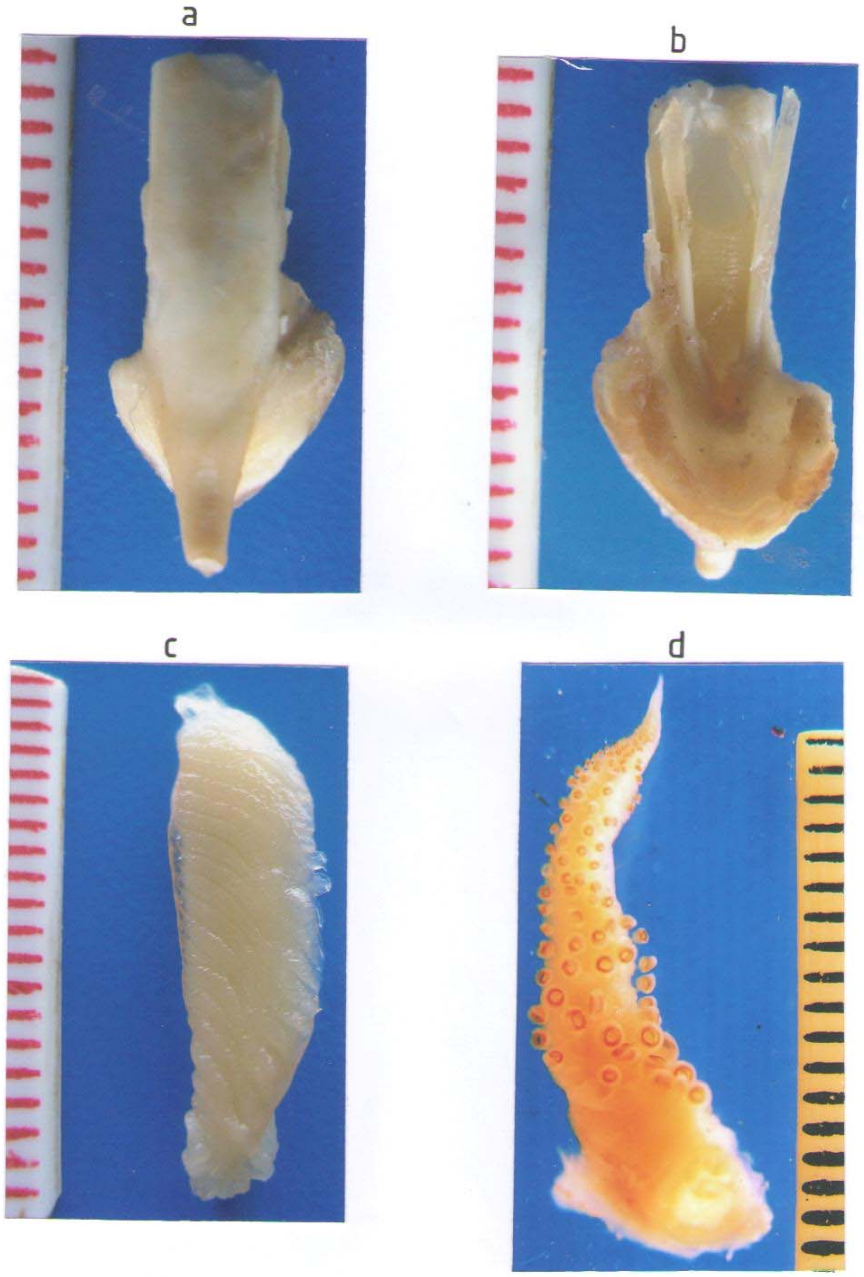

Plate 6

The morphological description of *Sepia elongata* was in agreement with (Adam 1959&1960) from Gulf of Suez and Gulf of Aqaba, apart from, the gill with 45 gill lamellae in our specimens collected from Egyptian Red Sea, and in the present work the dorsal mantle length showed 10 cm., while according to Jereb & Rober 2005, the dorsal mantle length up to 9.7cm. According to Adam, 1959 the species is especially characterized by: His lengthened form, its tentacular club endowed with five suckers much bigger than the others, the remarkable hectocotylized arm and the shell has hard puffed out ventral face and the outside cone with two broad later wings. The club and hectocotylus resemble that of *Sepia trygonina*, but the cuttlebone of *Sepia elongate* is thicker and the inner cone and the striae differ (Jereb & Roper, 2005).

Order: Teuthoidea Naef, 1916
Suborder: Myopsida Orbigny, 1845
Family: Loliginidae Steenstrup, 1861
Genus: *Loligo* Lamarck, 1798
Loligo forbesi Steenstrup, 1856
(Plate: 7)

Material and abundance:

Twenty two individuals (16 females and 6 males) with dorsal mantle length range from 9.9cm to 19cm were collected from 6 stations: st.1, st.5, st.8, st. 9, andst.11+st.12 and from commercial fish trawl from Suez Gulf (Ataka harbor) and adjacent area.

Synonymy: None

World distribution:

Eastern Atlantic, on the Azores Islands, along West Africa south to the Canary Islands, Mediterranean Sea and Red sea (Roper *et al*., 1984).

Description:

The mantle is long, cylindrical. Fin length about 65 % to 75 % of mantle length, their posterior borders slightly concave (plate 7a). Suckers on manus of tentacular club subequal in size (plate 7b), sucker rings of tentacular club with 13 to 18 sharp teeth (plate 7f). Arms sucker ring with 20 to 30 sharp teeth. Largest arm sucker rings with 7 to 8 teeth Plate 7h).

Left arm IV hectocotylized in its distal third modified into long papillae (Plate 7c), the gill has about 60 gill lamellae (plate 7e).

The morphology of *Loligo forbesi* in the present study is in agreement with the literature, apart from, in the present work the dorsal mantle length range from 9.9 to 19 cm. while according to Abdalla, (1993) the largest dorsal mantle length was 28.1, while the smallest was 7.5cm.

Differentiation between *Loligo forbesi* and *Loligo vulgaris* depends mainly upon the relative size of the suckers on the tentacular club.

In *Loligo forbesi* there are 4 rows of subequal suckers, while in *Loligo vulgaris* the suckers on the 2 inner rows are considerably larger than other suckers. (Halim, *et al*., 1991).

Loligo duvauceli d' Orbigny, 1848
(Plate: 8)

Material and abundance:

Eleven individuals (6 females and 5males) with dorsal mantle length range from 8.6cm to 15.2cm were collected from 3 stations: st. 3, st. 4 and st.10.

Synonymy:

Loligo oshimi Sasaki, 1924; *Loligo indica* Pfeffer, 1884.

World distribution:

Indopacific, Indian ocean including Red Sea and the Arabian Sea extending east ward from Mozambique to the South China Sea and the Philippines Sea, North ward to Taiwan (Province of China). (Roper *et al*., 1984).

Description:

Mantle relatively short. Fins rhombic, just over 50 % of mantle length (plate 8a). Tentacular club with larger median suckers than marginal (plate 8c) with 14 to 17 short, sharp teeth (plate 8h). In females:

arm suckers of about equal size on arms II and III with about 7 broad, blunt teeth (the central with one pointed) (plate 8f).In males 9

to 11 broad teeth (plate 8g). Left arm IV of male hectocotylized for more than half its length, with 2 rows of large papillae (plate 8b). The gill has more than 60 gill lamellae.

Emam *et al*. (2007) studied the morphology and morphometry of *Loligo duvauceli.* However, the collection sites of their specimens were not given. The present description of *Loligo duvauceli* was in agreement with that of Emam *et al*. (2007). However, the authors neglect using of gills a taxonomic tool to identify this species.

The morphology of *Loligo duvauceli* in the present study is in agreement with the literature, apart from, the gill with more than 60gill lamellae and in the present work the dorsal mantle length range from 8.6 to 15.2 cm.while according to Rober *et al*., (1984) the maximum dorsal mantle length is 29cm.

Order: Octopoda Leach, 1818
Suborder: Cirrata Grimpe, 1916
Family: Octopodidae Orbigny, 1845
Subfamily: Octopodinae Grimpe, 1921
Genus: *Octopus* Cuvier, 1797
Octopus aegina Gray, 1849
(Plate: 9 a-d-g)

Material and abundance:

32 individuals with dorsal mantle length range from 2.5cm to 4.2cm were collected from 5 stations: st.1, st.3, st.5 st.6, st.7, and st.10

Synonymy: *Octopus kagoshimensis* Ortmann, 1888.

Local name: Okhtaboot

World distribution:

Western Pacific, Indian ocean, Red Sea, Japan to Mozambique from 30 to 120 meter. (Roper *et al*., 1984).

Description:

Mantle rounded to oval, covered with fine papillae arranged in a Reticulate Pattern. Single cirrus over each eye.Arms long, arms I are shortest (plate 9a).The web very shallow between arms I.Right arm III hectocotylized with short ligula,5 to 8 % of arm length and ligula with very shallow groove (plate 9d).Seven gill lamellae per each gill(plate 9g).

The morphological description of *Octopus aegina* was in agreement with Adam (1959&1960) from Gulf of Suez and Gulf of Aqaba.

The morphology of *Octopus aegena* in the present study is in agreement with the literature, except Adam, 1960 which recorded that, the gills have eight filaments in each demibranch and in the present work the dorsal mantle length showed the largest specimen to be 4.2 cm. and the smallest specimen to be 2.5 cm., while according to Rober *et al*., (1984) the maximum dorsal mantle length is 10 cm.

Octopus membranaceus Quoy& Gaimard, 1832
(Plate**: 9 b-c-e-f)**

Materials:

Nine individuals with dorsal mantle length range from 4.2cm to5.5cm were collected from commercial fish trawl from Suez Gulf (Ataka Harbor) and adjacent area.

Synonymy:

Octopus fang- siao Orbigny, 1940; *Octopus ocellatus* Gray, 1849.

World distribution:

Indo – Pacific, Indian Ocean to Japan, China, Philippines and ward South to Australia. (Roper *et al*., 1984).

Description:

Mantle elongate. Two cirri over each eye. Arms moderately long. Web short (plate 9b). Ringed ocellus on web at base of arms II, anteroventral to the eyes (plate 9b&e).Right arm III hectocotylized: ligula slender and long (4 to 6 %) of arm length. (plate 9c). Seven or eight gill lamellae in gill (plate 9f).

The morphology of *Octopus membranaceus* in the present study is in agreement with the literature, apart from, the gill with 7 or 8 gill lamellae and in the present work the dorsal mantle length showed the largest specimen to be 5.5 cm. and the smallest specimen to be 4.2 cm., while

according to Rober *et al*., 1984,the maximum dorsal mantle length is 9cm.

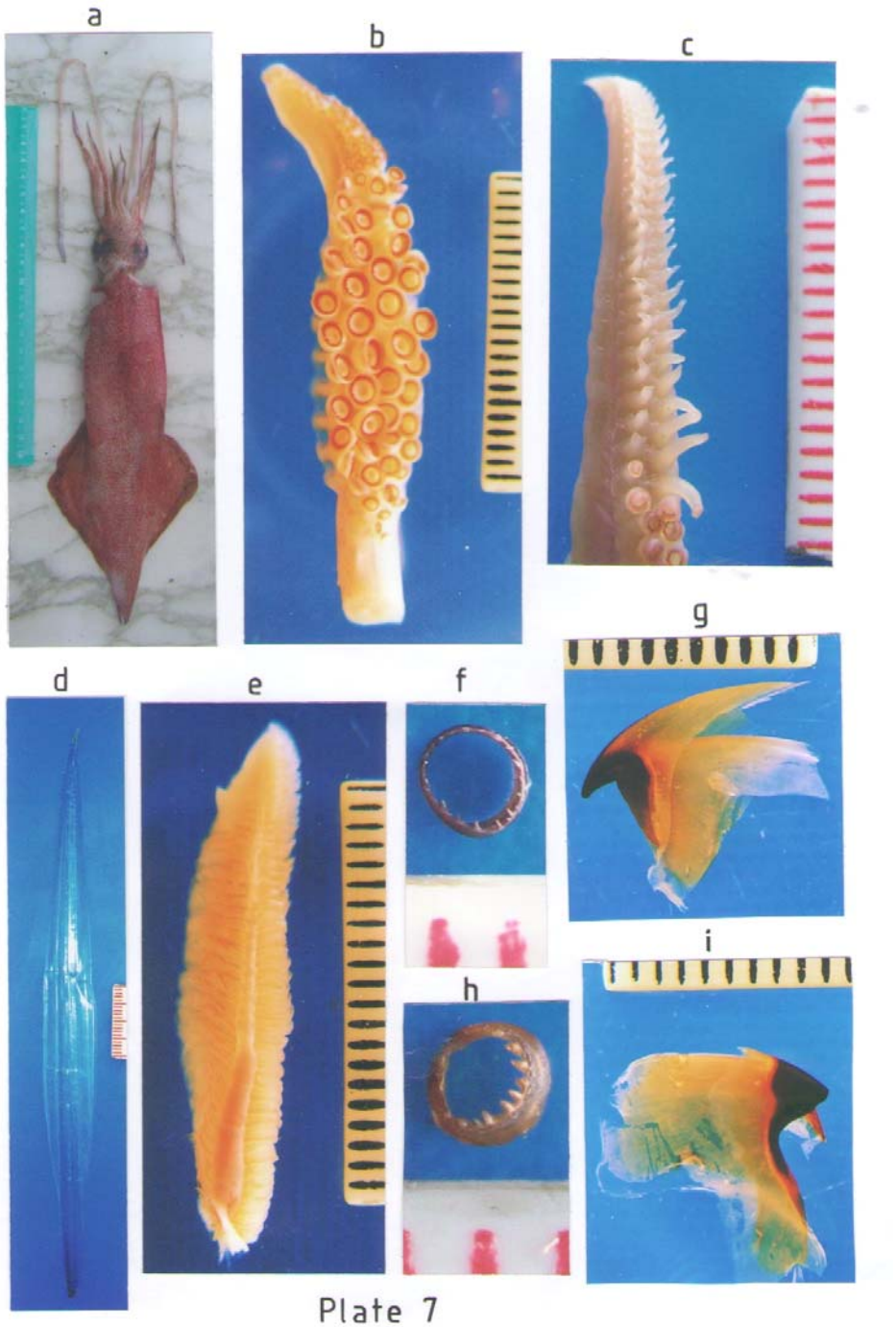

Plate 7

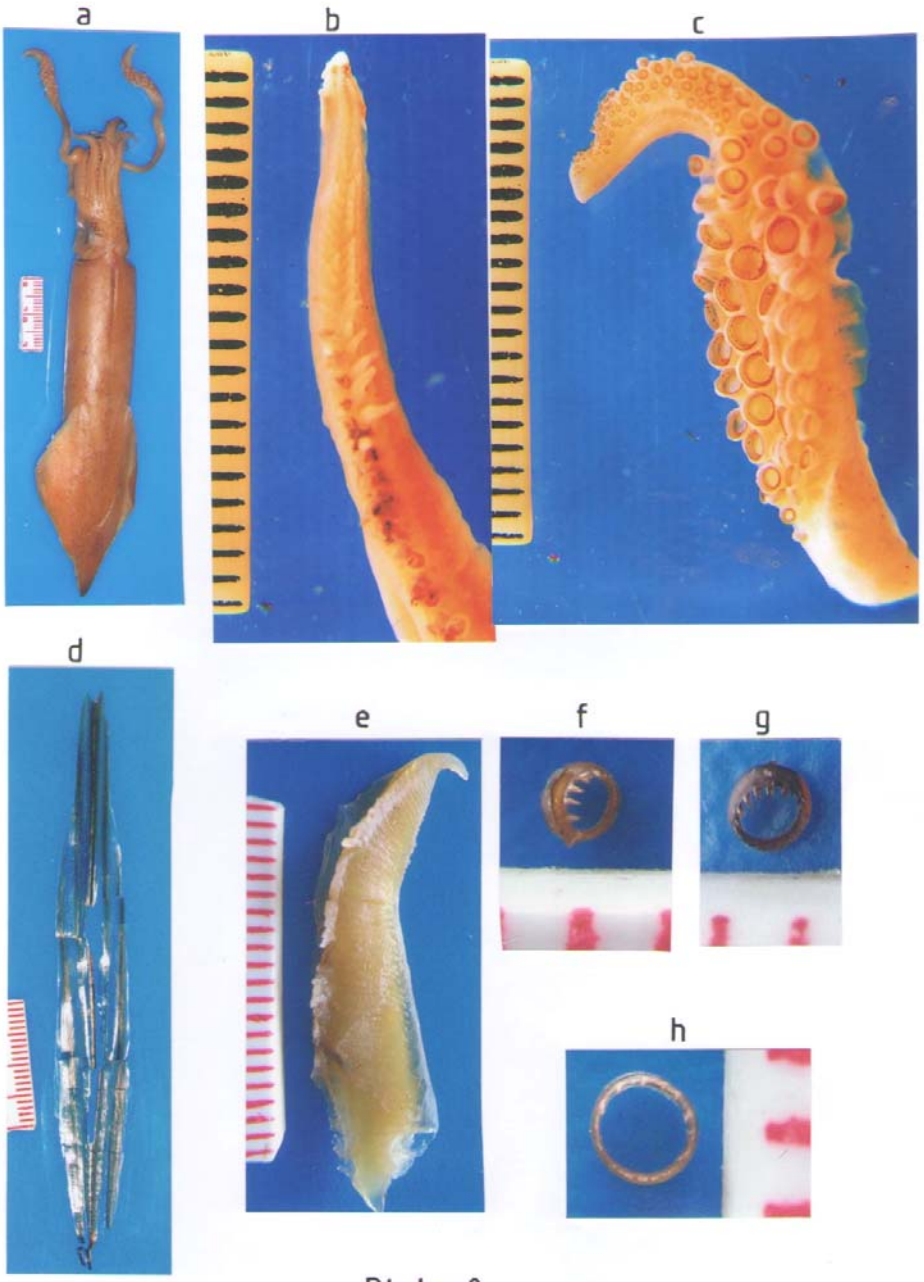

Plate 8

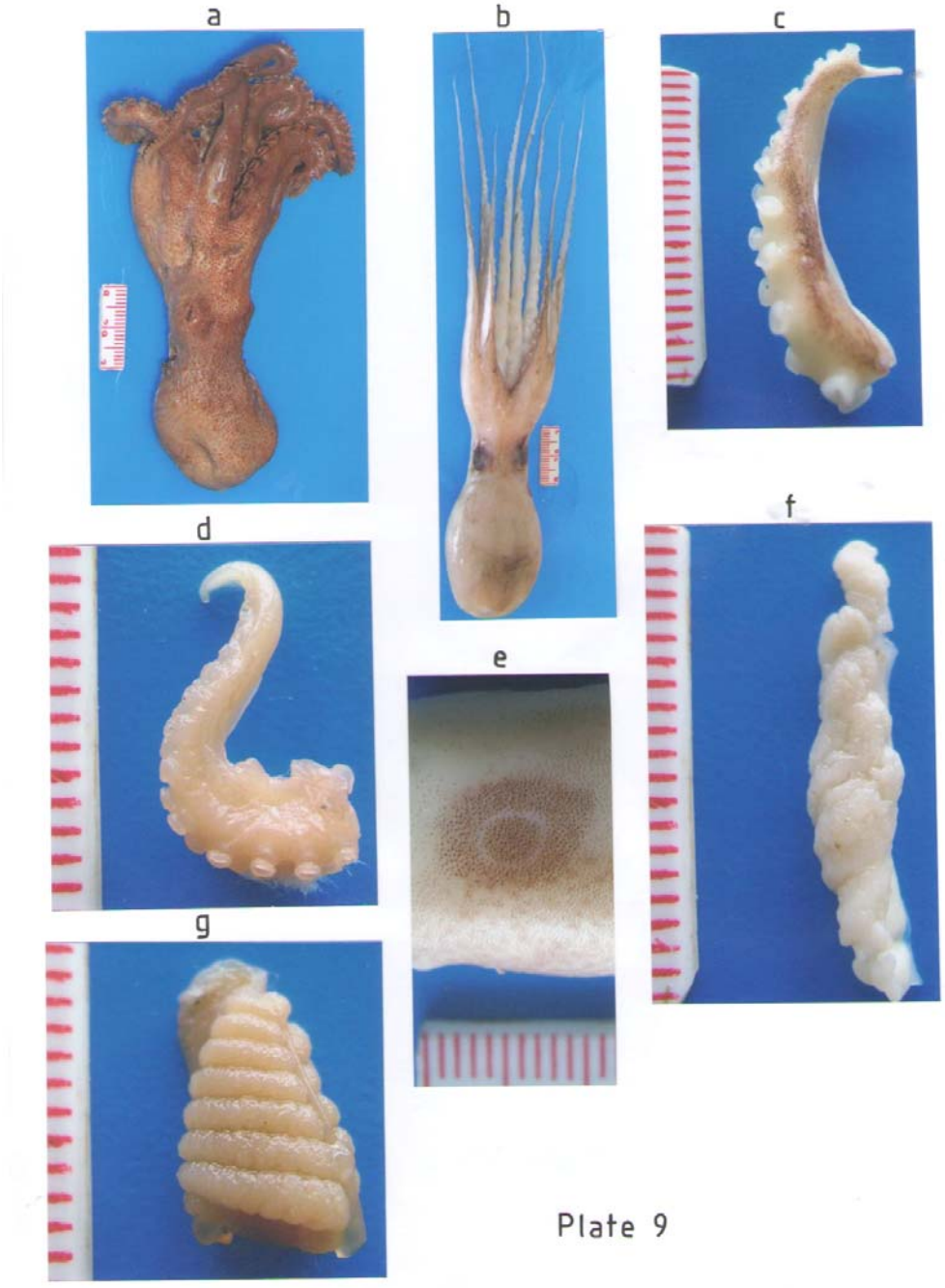

Plate 9

Octopus vulgaris Cuvier, 1797
(Plate: 10)

Material:

Five individuals with dorsal mantle length range from 8.2cm to 13.6cm were collected from commercial fish trawl from Suez Gulf(Ataka Harbor) and adjacent area.

Synonymy: *Octopus vulgaris* Lamarck, 1798, *Octopus vulgaris* Krauses, 1848:1832, *Polypus vulgaris* Thiele, 1920:1936 & *Octopus rugosus* Bosc, 1792.

World distribution:

West Mediterranean Sea, including Adriatic Sea (Roper *et al*., 1984). Turkish waters (Katagan & Kocates, 1990).East Atlantic Ocean, worldwide In temperate and tropical waters, limits unknown (Roper *et al*., 1984).

Description:

Medium to large – sized. The body is oval, covered with flattened tubercles. Arms thick and of about equal length. The dorsal pair of arms is slightly shorter. Suckers arranged in double rows .The head is large, with prominent eye (plate 10a&b), 3 cirri over each eye (plate 10b). Right arm III of males hectocotylized by modification of tip into avery small spoon shaped ligula.The length of ligula is less than 2.5% of the length of the hectocotylized arm (plate 10d-e). The outer side of gill is provided with an 11 gill lamellae (plate 10c).

The morphology of *Octopus vulgaris* in the present study is in agreement with the literature, apart from, three cirri over each eye in our specimens collected from Egyptian Red Sea, which Forbes and Hanley, (1852); Halim, *et al*., (1991) and Abdalla, (1993) only stated this character. In the present work the dorsal mantle length range from 8.2 to 13.6 cm., while according to Abdalla, (2000) the largest dorsal mantle length was 16.5, while the smallest was 4.6cm. *Octopus vulgaris* is differentiated from *Octopus macropus* by its shorter arms, the presence of 3 cirri over each eye. On the other hand, *Eledone moschata* differs from *Octopus vulgaris* by having a single row of suckers on the arms and by the presence of only cirrus over each eye (Abdalla, 1993).

Octopus defilippi Verany, 1851
(Plate: 11)

Material:

Seven individuals with dorsal mantle length range from 3.6 cm to 8 cm were collected from commercial fish trawl from Suez Gulf (Ataka Harbor) and adjacent area.

Synonymy: *Macrotritopus* species.

World distribution:

Mediterranean Sea, Eastern Atlantic from Morocco to Angola, Cap Verde Islands, Western Atlantic, Bahamas, Gulf of Mexico, Caribbean Sea, Brazil, Indian Ocean, Arabian Peninsula to Burma and South Western Pacific (Roper *et al*., 1984; Nesis, 1987 and Mangold, 1998).

Description:

Mantle relatively very small smooth–skinned, head narrower than mantle, No pigmented ocellus spots or rings (plate 11a). Funnel elongate tube. All arms very long, slender, symmetrical, 3rd arms very much longer than other arms. Arm length exceeding 70 – 85% of the total length, arms with delicate tips.Arms formula [III > II > IV > I or III > IV > II > I] (plate 11a). Right arm III of male hectocotylized shorter than opposite arm bearing 60 – 100 suckers. Ligula well differentiated 1.8 to 2.5% of hectocotylized arm length, groove very shallow, and calimus very small (Plate 11c). 8- 11 gill lamellae on outer demibranch (plate 11d). Web depth 20 – 25% of longest arm length. Web formula C > D > B > E > A (Plate 11f). Suckers widely set, of medium size, diameter of largest arm suckers in males on the average 15 – 16% of the dorsal mantle length. One cirrus over each eye (plate 11b). Funnel organ W shaped (plate 11e). The morphology of *Octopus defilippi* in the present study is in agreement with the literature, apart from, in the present work the dorsal mantle length showed the largest specimen to be 8 cm. and the smallest

specimen to be 3.6 cm., while according to Rober *et al*., (1984) the maximum dorsal mantle length is 9cm and according to Mangold, (1998) the animal is small to medium size (3.3 – 5.5 cm.). Riad, (2000) in his samples collected from Egyptian Mediterranean Sea showed the dorsal mantle length of the largest specimen to be 8.8 cm. and in the smallest specimen to be 5 cm.

Octopus macropus Risso, 1826
(Plate: 12)

Material:

Ten individuals with dorsal mantle length range from 4.7cm to 7.3cm were collected from commercial fish trawl from Suez Gulf (Ataka Harbor) and adjacent area.

Synonymy:

Octopus cuvieri Orbigny, 1840; *Octopus longimanus* Orbigny, 1840; *Octopus bermudensis* Hoyle, 1885; *Octopus chromatus* Heilprins, 18

World distribution:

Mediterranean and Eastern Mediterranean, North African coasts (Fischer, 1973). Adriatic Sea (Riedle, 1970). North Atlantic, Gulf of Aqaba and Indian Ocean, central and Western Pacific Ocean (Adam, 1960) World wide in warm to warm temperate waters (Roper *et al*., 1984).

Description:

The dorsal body is ornamented with white spots (plate 12a-b). The arms are very long, about 6-7 times longer than the body length; each has two rows of suckers, the first pair of arms I is much longer (plate 12a). Right arm III of males hectocotylized has a large tubular ligula which extens to about 13–15% of its length (ligula index) (plate 12c-d).The cirri over eyes are absent. The outer side of the gill is provided with 12 gill lamellae (plate 12e).

The morphological description of *Octopus aegina* was in agreement with Adam (1959&1960) from Gulf of Suez and Gulf of Aqaba. The morphology of *Octopus macropus* in the present study is in agreement with the literature, apart from, in the present work the dorsal mantle length showed the largest specimen to be 7.3 cm. and the smallest specimen to be 4.7 cm., while according to Rober *et al*., (1984) the maximum dorsal mantle length is 14cm and according to Abdalla, (1993) the maximum dorsal mantle length is 12cm. and the smallest dorsal mantle length is 6.5. Abdalla, (2000) mentioned that the maximum dorsal mantle length is 16.2cm and the smallest dorsal mantle length is 4.8.

Riad, (2000) differentiated *Octopus macropus* from the other *Octopus* spp. recorded in the Egyptian Mediterranean waters as follows:*Octopus macropus:* Slender and longer arms, poorly developed interbranchial membrane. Cirri absent. *Octopus vulgaris:* shorter arms, a well developed interbranchial membrane, the presence of 3 cirri over each eye. *Octopus defilippi:* the mantle relatively very small. Arms III is the largest arm and there is a cirrus over each eye. *Eledone moschata:* One row of suckers on each arm and clear cirrus over each eye.

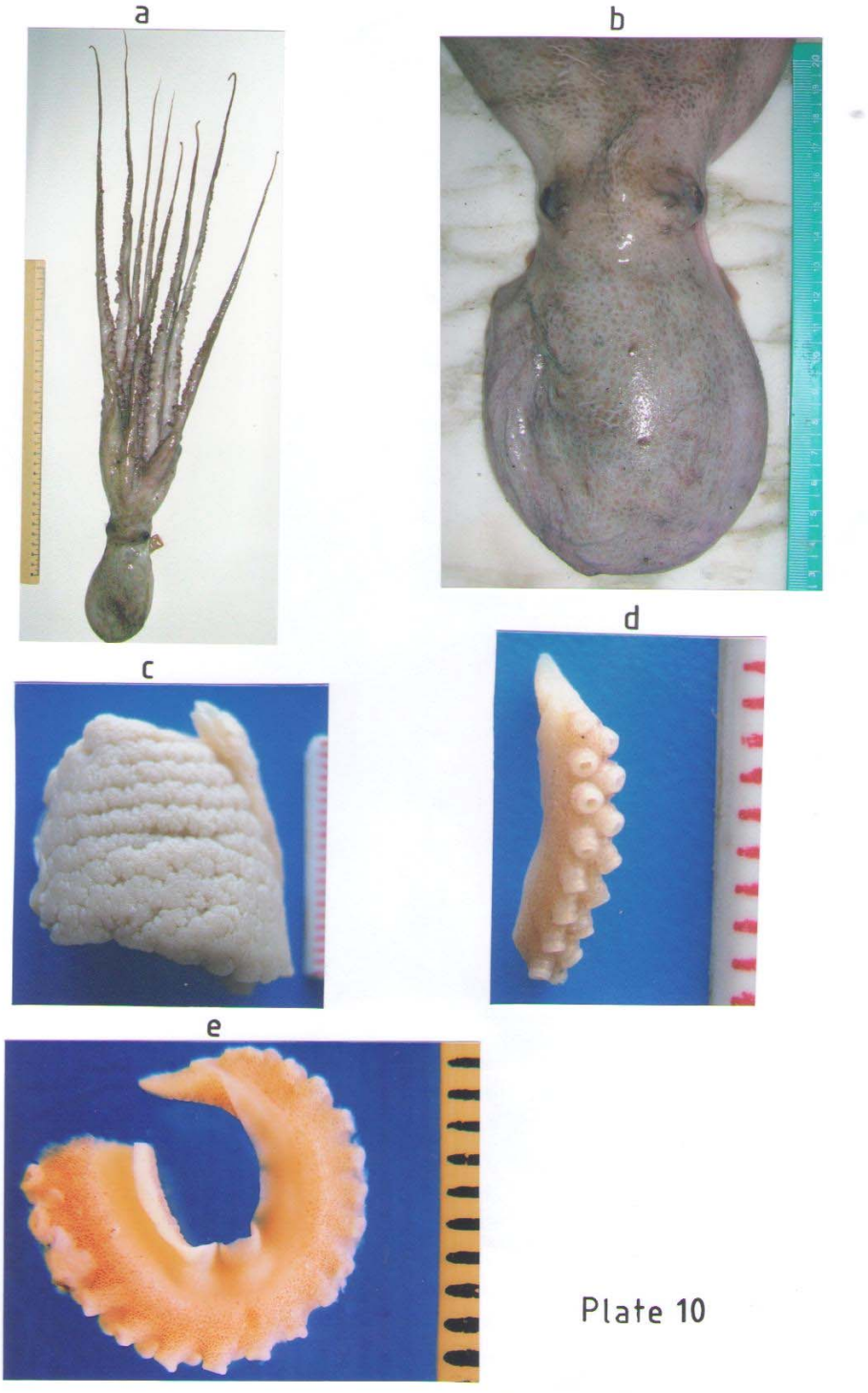

Plate 10

Plate 11

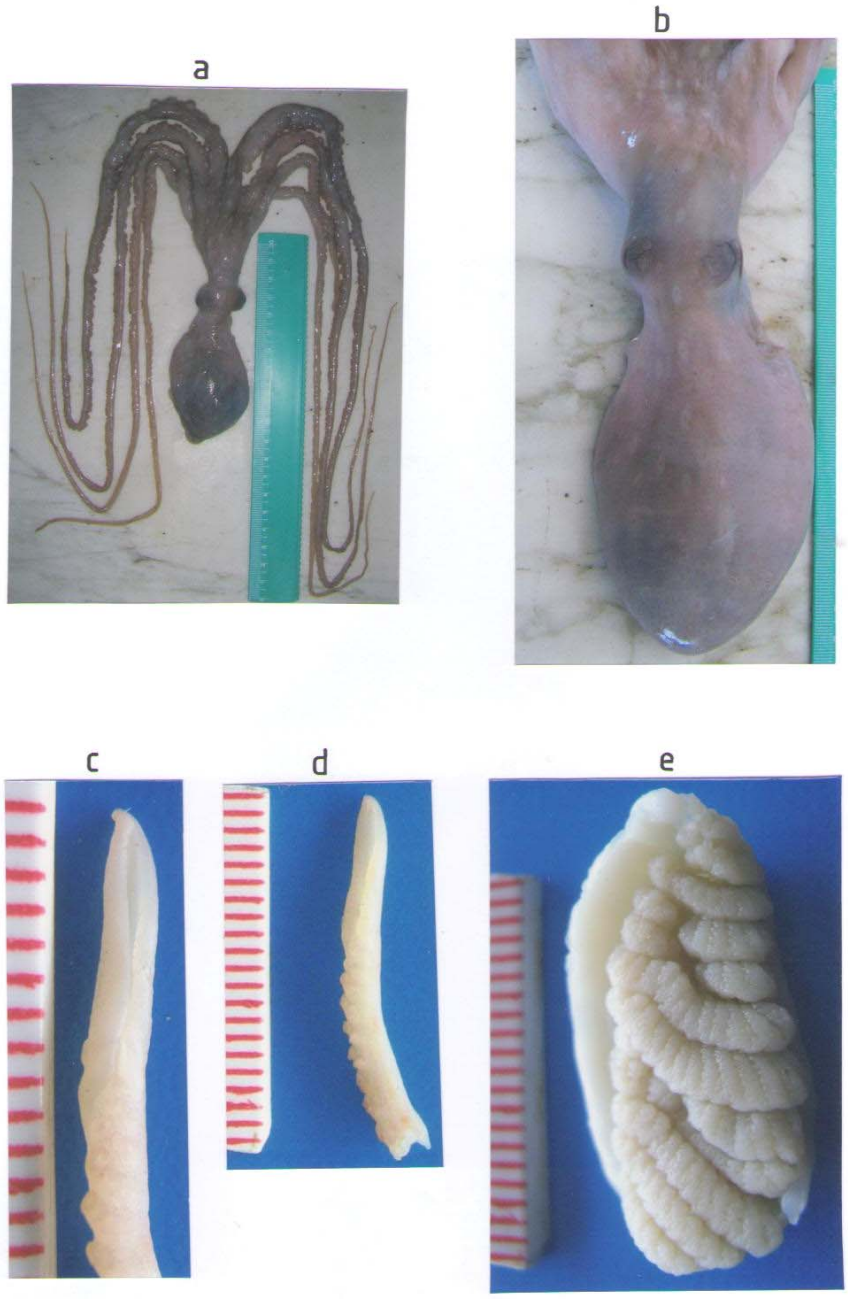

Plate 12

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EXPLANATION OF PLATES

***Sepia dollfusi:* (plate 1)**

(a)the animal, (b) Tentacular club, (c) left arm IV of male hectocotylized, (d) gill.

***Sepia dollfusi:* (plate 2)**

(a) Shell ventral view, (b) shell dorsal view, (c) shell lateral view, (d) upper beak, (e) lower beak, (f) normal arm.

***Sepia pharaonis :* (plate 3)**

(a) the animal, (b)tentacular club, (c) Left arm IV of male hectocotylized, (d) Gill.

***Sepia pharaonis :* (plate 4)**

(a) Shell ventral view,(b) shell dorsal view,(c) normal arm,(d) upper beak,(e) lower beak.

***Sepia elongata:* (plate 5)**

(a) the animal, (b) tentacular club, (c) Left arm IV of male hectocotylized Ventral view, (d) Left arm IV of male hectocotylized dorsal view.

***Sepia elongata:* (plate 6)**

(a) shell dorsal viw (b) ventral viw (c) gill,(d) normal arm.

***Loligo forbesi:* (plate 7)**

(a)the animal, (b)tentacular club, (c)Left arm IV of male hectocotylized, (d) shell, (e) gill, (f) tentacular club sucker ring, (g)upper beak, (h) arm sucker ring,(i) lower beak.

***Loligo duvauceli :* (plate 8)**

(a) the animal, (b) Left arm IV of male hectocotylized,(c) tentacular club, (d) shell, (e) gill, (f) female arms II and III sucker ring, (g) male arm sucker ring, (h) tentacular club sucker ring.

***Octopus aegena:* (plate 9)**

(a) the animal (d) Left arm III of male hectocotylized, (g) Gill.

***Octopus membranaceus:* (plate 9)**

(b) the animal, (c) Left arm III of male hectocotylized, (e) ring ocellus at base of arm III, (f) Gill.

***Octopus vulgaris:* (plate 10)**

(a) the animal, (b) 3 cirri over each eye, (c) gill, (d) Left arm III of male hectocotylized ventral view, (e) Left arm III of male hectocotylized lateral view.

***Octopus defilippi:* (plate 11)**

(a) the animal, (b) one cirri over each eye,(c) Left arm III of male hectocotylized, (d) Gill, (e) funnel, (f) web formula.

***Octopus macropus:* (plate 12)**

(a) the animal, (b) white spots on the body, (c & d) Left arm III of male hectocotylized, (e) Gill.