

Monograph of the Egyptian Squids

Order: Teuthoidea (Cephalopoda: Mollusca) Part II.

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ARTICLE INFO

Article History:

Received: May 2, 2020

Accepted: June 14, 2020

Online: June 19, 2020

Keywords:

Monograph,
Squids,
Red Sea,
Mediterranean Sea,
Teuthoidea,
Mollusca.

ABSTRACT

The cephalopods are known to be commercially and ecologically important around the world. This group constitutes four major groups, Cuttlefishes, Squids, Octopuses, and Nautilii. The first three groups are present in the Egyptian Mediterranean and Red Seas and constitute a main component in the fisheries industry in Egypt. In order to understand the biology and ecology of any species, its identification should be conducted properly to maximize the accuracy of any study. The present monograph is prepared to demonstrate an identification key for the squid species of order Teuthoidea in the Egyptian waters. This is the second publication demonstrating a first-in-kind identification key for the three major cephalopod groups. The first monograph was about the cuttlefishes.

Six Egyptian squid species were recorded; *Loligo vulgaris*, *Loligo forbesi*, *Loligo duvauceli*, *Alloteuthis media*, *Illex coindetii*, and *Sepioteuthis lessoniana*. Four of them; *Loligo vulgaris*, *Loligo forbesi*, *Alloteuthis medi* and *Illex coindetii* were recorded in the Mediterranean waters, while the other 2 species, *Loligo duvauceli* and *Sepioteuthis lessoniana* were recorded in Suez Gulf, Red Sea. Two squid species; *Loligo forbesi* and *Sepioteuthis lessoniana* were recorded in both the Mediterranean and Red Seas. Specimens of each species were collected for the purpose of identification using external morphological features. Body structures were separated and drawn by using a zoom stereoscopic microscope provided with a Camera Lucida drawing tube. The body structures were also photographed by a Canon Digital Camera.

INTRODUCTION

Cuttlefishes, Squids, Octopuses and Nautilii 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). As a group, they 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, Squids represent about 71.8% from the total catch of world cephalopod fishery (Roper *et al.*, 1984).

Many studies at the beginning of the 19th century concentrated on the Northern part of Gulf of Suez fauna. Savigny (1817) was the first who mentioned Cephalopoda in the Red Sea; he also identified 70 species which were not reconfirmed before in the Red Sea waters (Edwards and Head, 1987). In the 20th century, the Red Sea became an exciting direction to many expeditions. Although most of these expeditions aim was oceanographic explorations, they also brought zoogeographical studies with regional details (Edwards and Head, 1987). Robson (1926) recorded 3 cephalopod species from the Cambridge Expedition to the Suez Canal. They are *Ascarosepion singhalensis* (Goodrich), which is synonymous to *Sepia pharaonis* Ehrenberg, 1831; *Lophosepion lefebvrei* d'Orbigny is synonymous to *Sepia gibba* Ehrenberg, 1831, and *Octopus horridus* d'Orbigny (zebra octopus). Robson (1926) recorded six cephalopod species from the Suez Canal. Adam (1959) described 10 cephalopods from Gulf of Suez and another 3 species from Gulf of Aqaba. Adam (1960) recorded 7 cephalopod species from Aqaba Gulf. Eman (1984) recorded 8 cephalopods from Gulfs of Suez and Aqaba. Riad (1993) recorded 4 teuthoidea species; *Loligo vulgaris*, *Loligo forbesi*, *Illex coindetii* and *Alloteuthis media* from Alexandria, Mediterranean waters. Riad (1993) studied the biology and morphometry of the squid *Loligo vulgaris* from the Alexandria, Mediterranean waters. Hassan *et al.* (1994) studied the trophic relations of *Loligo vulgaris* from Alexandria, Mediterranean waters. El-Sayed *et al.* (1996) studied the biochemical composition of *Loligo vulgaris* from the Mediterranean waters of Alexandria, Egypt.

More studies in the 21th century were conducted on cephalopods; Emam and Aly (2000) studied the male reproductive system of the *Sepioteuthis lessoniana* from Suez Gulf, Red Sea. Emam *et al.* (2007) studied the morphology, morphometry, age and growth of *Loligo duvauceli* from the Gulf of Suez, Red Sea Riad (2008a) recorded 10 cephalopod species from Suez Gulf and Red Sea; 2 of them *Loligo forbesi* and *Loligo duvauceli* were Teuthoidea species. Riad (2008b) recorded one new record teuthoidea species; *Sepioteuthis lisoniana* from the Alexandria Mediterranean waters migrated from the Red Sea through Suez Canal. Gabr and Riad (2008) studied the reproductive biology and morphometry of *Loligo forbesi* from Suez Bay. Kilada and Riad (2008) studied the seasonal variation in biochemical composition of *Loligo forbesi* in Mediterranean Sea and Gulf of Suez, Red Sea. Riad and Abdel Hafez (2008) studied the bio economic of squids from Egyptian Red Sea.

Kilada and Riad (2010) studied the seasonal reproductive biology of *Loligo duvauceli* in Northern Red Sea. Emam and Gareb (2010) studied morphology, digestive and reproductive systems of male *Sepioteuthis lessoniana* from Abo Qir Bay, Mediterranean waters. From the previous results 2 squid species; *Loligo forbesi* and *Sepioteuthis lessoniana* were recorded in both Egyptian Mediterranean and Red Sea. Riad and AL Werfaly (2014) studied the reproductive biology of the *Loligo forbesi* in the Egyptian Mediterranean waters. Emam *et al.* (2014) studied the morphometry and length- weight

relationship of the squid *Loligo forbesi* (Cephalopoda: Loliginidae) from the Egyptian Mediterranean waters.

Riad (2020) published the first monograph of the cephalopod identification and focused on the cuttlefishes. The present monograph is the second and was prepared to address the identification of squids in the Egyptian waters, using morphological features. The monograph of the Octopuses will be the third.

MATERIALS AND METHODS

Specimens were obtained from fishing trawlers operating in Egyptian Mediterranean waters and Suez Gulf and from Alexandria and Suez fish markets.

According to Roper *et al.* (1984) the following characters were carefully examined for the identification of the species: External morphology, tentacular club, hectocotyized arm, tentacular club sucker, tentacular club sucker ring, arm sucker, arm sucker ring, radula, gill, shell and funnel (siphon). Specimen parts were drawn by means of a zoom stereoscopic microscope provided with a Camera Lucida drawing tube. The specimen parts were also photographed by a Canon digital Camera.

RESULTS AND DISCUSSION

The following six Egyptian squid species Order: Teuthoidea (Cephalopoda: Mollusca) were illustrated in the present monograph.

Phylum: Mollusca

Class: Cephalopoda Cuvier, 1798.

Subclass: Coleoidea Bather, 1888.

Order: Teuthoidea Naef, 1916.

Suborder: Myopsida d, Orbnigny, 1845.

Family: Loliginidae Steenstrup, 1861.

Genus *Loligo* Schneider, 1784.

1-*Loligo vulgaris* Lamarck, 1798. Alexandria Mediterranean waters.

2-*Loligo forbesi* Steemstrup, 1856. Suez Gulf, Red Sea and Alexandria Mediterranean waters.

3-*Loligo duvauceli* d, Orbnigny, 1848. Suez Gulf, Red Sea.

Genus: *Alloteuthis* Wulker, 1920.

***Alloteuthis media* Linnaeus, 1758.** Alexandria Mediterranean waters.

Genus: *Sepioteuthis*

***Sepioteuthis lessoniana* Lsson, 1830.** Suez Gulf, Red Sea & Alexandria Mediterranean waters.

Suborder: Oegopsida d,Orbigny, 1845

Family: Ommastrephidae Steenstrup, 1857.

Subfamily: Illicinae.

Genus: *Illex* Steenstrup, 1880.

Illex coindetii Verany, 1839. Alexandria Mediterranean waters.

Teuthoidea general structure (PLATE 1).

This description was summarized from Hickman (1973), Juanico (1983) and Roper *et al.* (1984). The body in the Teuthoidea is bilaterally symmetrical. The anterior part of the foot is fused with the head (plate 1A), and the posterior part forms an exit funnel from the mantle cavity head (plate 1A). The mantle is highly muscular and is posterior of the mouth, the appendages and the eyes. It bears two large eyes, sometimes covered with membrane. The mobile appendages surrounding the mouth (plate 1A), consist of eight arms with two rows of suckers. All suckers bear chitinous rings. In addition to the arms there are two longer tentacles, (plate 1A). The mouth has a chitinous beak and a chitinous tongue like radula (plate 1B), a band of teeth. The shell is internal. The body is soft, has a chitinous shell, One pair of gills is present. Teuthoidea have a funnel or siphon which expels water from the body cavity (mantle cavity), which helps for incompressing and for expelling waste products (plate 1B). The funnel has funnel cartilage which joins with mantle cartilage (plate 1B), and in some oegopsids the funnel groove has transverse membranous of skin that forms a pocket name foveola (plate 1C). The funnel groove has transverse membranous. Teuthoidea have coloration phenomenon which resulting from numerous chromatophores (pigment sacs) in the skin. The sexes are separate. In males one or more arms are modified for transferring spermatophores to the female named hectocotylyzed arms. Teuthoidea have an ink sac which plays an important role for defense and hiding. (Roper *et al.*, 1984).

Plate (1) illustrates the basic squid features.

Phylum: Mollusca

Class: Cephalopoda Cuvier, 1798

Subclass: Coleoidea Bather, 1888

The subclass Coleoidea embraces four orders: Sepioidea Naef, 1916; Teuthoidea Naef, 1916; Octopoda Leach, 1818 and vampyromorpha P Pickford, 1939. (Roper *et al.* 1984)

Order: Teuthoidea Naef, 1916

The order Teuthoidea embraces two suborders: Myopsida d'orbigny, 1845 and Oegopsida d'orbigny, 1845. There are ten arms, two of which are longer than the rest. The arms are not joined by a swimming web. The arms bear suckers on stalks with horny rings. Lateral fins are well developed. . An internal, non-chambered, horny shell is present. They are shallow water (*Loligo*) or deep sea pelagic animals (*Architeuthis*). The origin of the order Teuthoidea, or true squids, can be traced to the early Mesozoic (Permian Triassic) with steady proliferation from the Jurassic through the Recent. The two suborders, Myopsida, (covered-eyed) (near shore (neritic) "squids, and Oegopsida, (open-eyed) Oceanic (pelagic) squids occur in the oceans and seas of the world.

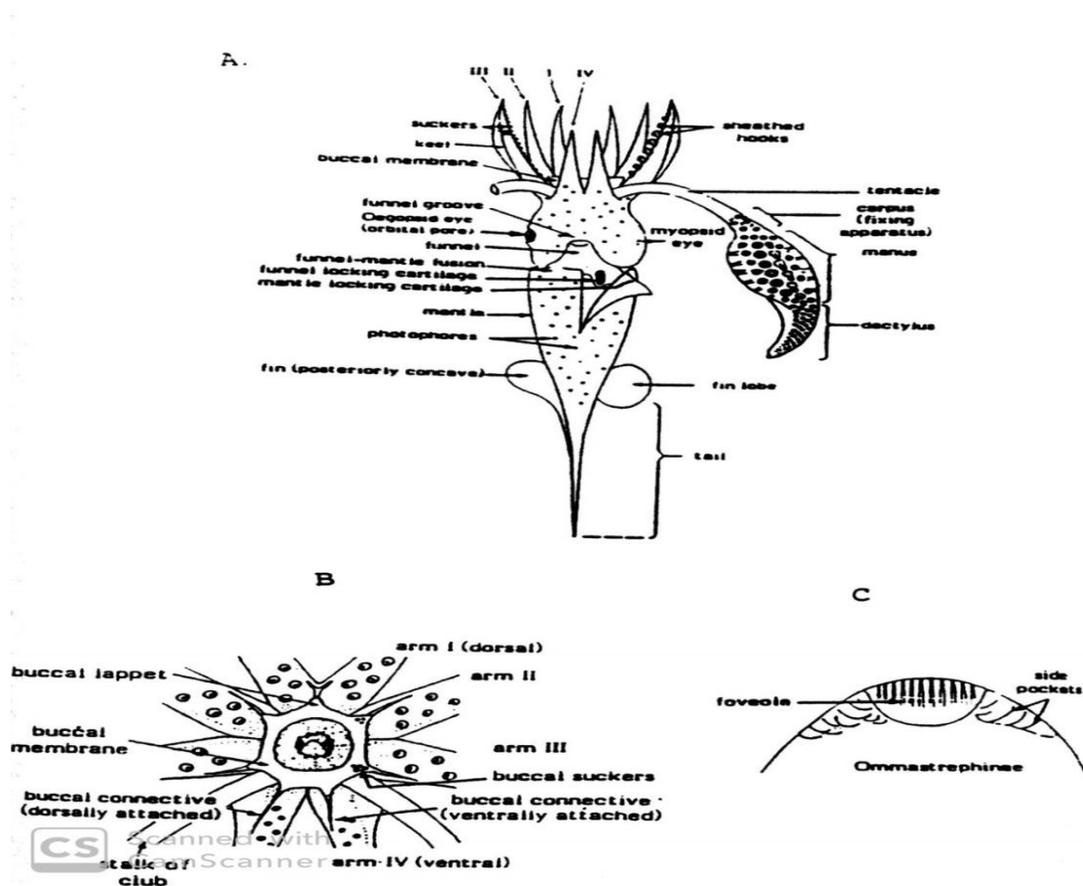


PLATE (1)

A Composite diagram, illustrating basic squid features. A-ventral view B- Oral surface of Brachial crown and Buccal membrane. C- Funnel groove.

(Redrawn from Roper *et al.*, 1984)

Some are demersal or epibenthic at some period of their life cycle, but most occur in the water column. Of the ten circumoral appendages, the fourth pair, the tentacles, contractile, but not retractile into pockets (occasionally tentacles secondarily lost); sucker ornamentation with chitinous rings and/ or hooks. Radula teeth commonly with primary projection and a secondary cusp(s), especially on the median (rachidian) and the first lateral teeth; buccal membrane present. Olfactory organ consists of two projecting papillae; eye without lids covered with a transparent membrane, with a minute pore (Myopsida) or completely open to the sea, without a pore (Oegopsida). Gills with bronchial canal between afferent and efferent branchial blood vessels. Shell internal, simple, rod or feather like, chitinous. (Roper *et al.*, 1984).

Suborder: Myopsida d'Orbigny, 1845.

The suborder Myopsida comprises only two families, the small, non-commercial, Pickfordiateuthidae Voss, 1953 and Loliginidae Steenstrup, 1861. In this study one family is represented: Loliginidae. Corneal membrane covering the eye with minute pore anteriorly. Arms and clubs with suckers, never with hooks. Suckers present on the buccal lappets. Females with a single gonoduct, not paired; with accessory nidamental glands. . (Roper *et al.*, 1984).

Teuthoidea species of the East Mediterranean waters

According to Roper *et al.*(1984) and Katagan & Kocatas(1990) thirteen teuthoidea species are known to extend to the Eastern Mediterranean Basin ,*Loligo forbesi*, *Loligo vulgaris*, *Alloteuthis media*, *Alloteuthis subulata*, *Ancistroteuthis hchiensteini*, *Histioteuthis bennellii*, *Histioteuthis elongate*, *Brochioteuthis riisei*, *Illex Coindeii*,*Todaropsis eblanae*, *Todarodes sagittatus*, *Ommastrephes coroli* and *Ommastrephes pteropus*. (Roper *et al.*, 1984).

Morphology and occurrence of the Teuthoidea species of the Egyptian waters.

Suborder: Myopsida d'Orbigny, 1845.

Family: Loliginidae d,Orbigny, 1848.

Shape variable from short and stout to long and slender. Fins terminal, but always united posteriorly, extending along the entire length of the mantle and quite wide (approx., 18% of the mantle length).Funnel looking apparatus, a simple, straight groove. Eyes covered with transparent skin (corneal membrane); buccal connectives attached to ventral borders of fourth arms; 7 buccal lappets supplied with small suckers (except in Lolliguncula and Alloteuthis); 8 arms and 2 tentacles around mouth; 2 rows of suckers on arms and 4 rows on tentacular clubs, 4 rows of suckers on the manus, hooks never present. Usually the left arm IV (ventral) pair is hectocotylized in males (used to transfer sperm packets from the male to the female), the structure of the modified portion (hectocotylus) of the arm is

useful in most species as a diagnostic character, often, the suckers on the hectocotylus are reduced in size or number, or modified into fleshy papillae or flaps (lamellae), or they disappear altogether. Colour: usually reddish-brown darker dorsally, but quite variable depending on the behavioral situation. This family embraces 8 genera: *Loligo* Schneider, 1784; *Doryteuthis* Naef, 1912; *Lolliguncula* Steenstrup, 1881; *Sepioteuthis* Blainville, 1824; *Alloteuthis* Wülker, 1920; *Uroteuthis* Rehder, 1945; *Loliolus* Steenstrup, 1856; and *Loliolopsis* Berry, 1929. (Roper *et al.* 1984). In this study 3 genera only: *Loligo* Schneider, 1784; *Alloteuthis* Wülker, 1920 and *Sepioteuthis* Blainville, 1824 were represented.

Key to the recorded genera of family Loliginidae in the present monograph

1-Mantle elongate or short, robust, posteriorly pointed, but never produced into an elongated tail; posterior border of fins straight, or only slightly concave, or rounded

Fins lateral, rhombic in outline, with posterior borders straight or slightly concave; relatively long, usually over 60% of mantle length; mantle elongate, bluntly to sharply pointed; left ventral IV hectocotylized in males; buccal arms with about 15 small suckers in two rows*Loligo*

Loligo vulgaris Lamarck, 1798 ; *Loligo forbesi* Steenstrup, 1856 & *Loligo duvauceli* d, Orbigny, 1848.

2-Buccal membrane without suckers; trabeculae on protective membranes of tentacular clubs equal in number to adjacent suckers; posterior end of body often prolonged into "tail"*Alloteuthis*.

Alloteuthis media Linnaeus, 1758.

3-Fins very long, over 90% of mantle length, broad, Sepia-like, but much wider and more muscular; mantle very robust.....*Sepioteuthis*.

Sepioteuthis lessoniana Lesson, 1830.

Genus: *Loligo* Schneider, 1784.

Fins lateral, rhombic in outline, with posterior borders straight or slightly concave; relatively long, usually over 60% of mantle length; mantle elongate, bluntly to sharply pointed; left ventral IV hectocotylized in males; buccal arms with about 15 small suckers in two rows.

Key to the recorded species of genus *Loligo* in the present monograph

1-Tentacular club with suckers the 2 inner rows larger than other suckers with about 20 transverse rows of minute suckers with about 15 teeth in each sucker ring. The distal part is modified hectocotylized arm to about 30-32 papillae. The radula has 7 suckers; each sucker ring has 18 teeth.....*Loligo vulgaris*.

2-Tentacular club with 4 rows of sub equal suckers, each sucker ring has about 16-20 sharp teeth. The distal modified part of the left arm IV hectocotylized occupies about

35% of its length, covered with long papillae (28-30), decreasing in size distally
*Loligo forbesi*.

3-Tentacular club with larger median suckers than marginal with 14 to 17 short, sharp teeth. Left arm IV of male hectocotylyzed for more than half its length, with 2 rows of large papillae the gill with more than 60 gill lamellae.....*Loligo duvauceli*.

***Loligo vulgaris* Lamarck, 1798**
(Plate 2 and Plate 3, A - M)

Synonymy: None.

world distribution: East and West Mediterranean sea including Adriatic Sea (Roper *et al.*, 1984), Turkish waters (Katagan & Kocatas, 1990), Eastern Atlantic from 20 S to 55 N, around the British Isles, North sea (Roper *et al.*, 1984).

Local name: kalimaria not Sobbeit as reported by Roper *et al.*, (1984). . (Riad, 1993)

Local distribution: Abu Qir Bay off shore, at about 72 m. depths. Occurs on Abu Qir and Anfushy Alexandria fish markets. (Riad, 1993)

Description: Body cylindrical anteriorly. For nearly two thirds of its length, it is flanked by sub triangular fins; the angles of the fins are obtuse to the body. The head is short and broad (plate2). The eight arms are stout and rather short, and each arm carries 2 rows of suckers which are supported by a rings, each sucker ring bears about 13 teeth (Plate 3 H). The tentacular arms long, the manus of tentacular club with 4 longitudinal rows of suckers, the eight median suckers are larger(plate3B), with about 15 teeth in each sucker ring (Plate 3f&I) The dactylus of tentacular club (minute suckers) with about 20 transverse rows of minute suckers(plate3B) with about 20 teeth in each sucker ring (Plate 3 g). Left arm IV hectocotylyzed provided with normal suckers, the distal part is modified to about 30 -32 papillae (Plate 3 C). The radula has 7 suckers; each sucker ring has 18 teeth (Plate 3 M). Arm sucker ring has 13 teeth and the tentacular club sucker ring has 15 teeth, which are less reported by Roper *et al.* (1984).

Laterally inserted triangular fins which extend to 1/3 of the body length (plate2), and a relatively broader shell and presence of a cornea on each eye for eye protection. The morphology of *L.vulgaris* from Alexandria waters is in agreement with the literature, except the number of arm sucker ring teeth and tentacular club sucker ring teeth which in this study are less than reported by Roper *et al.* (1984), and except for the following additional characters: the number of papillae of left arm IV of male hectocotylyzed, the number of the radula suckers and the number of radula sucker ring teeth.

Habitat: A pelagic species living on the continental shelf down to about 50 m. (Fischer, 1973).

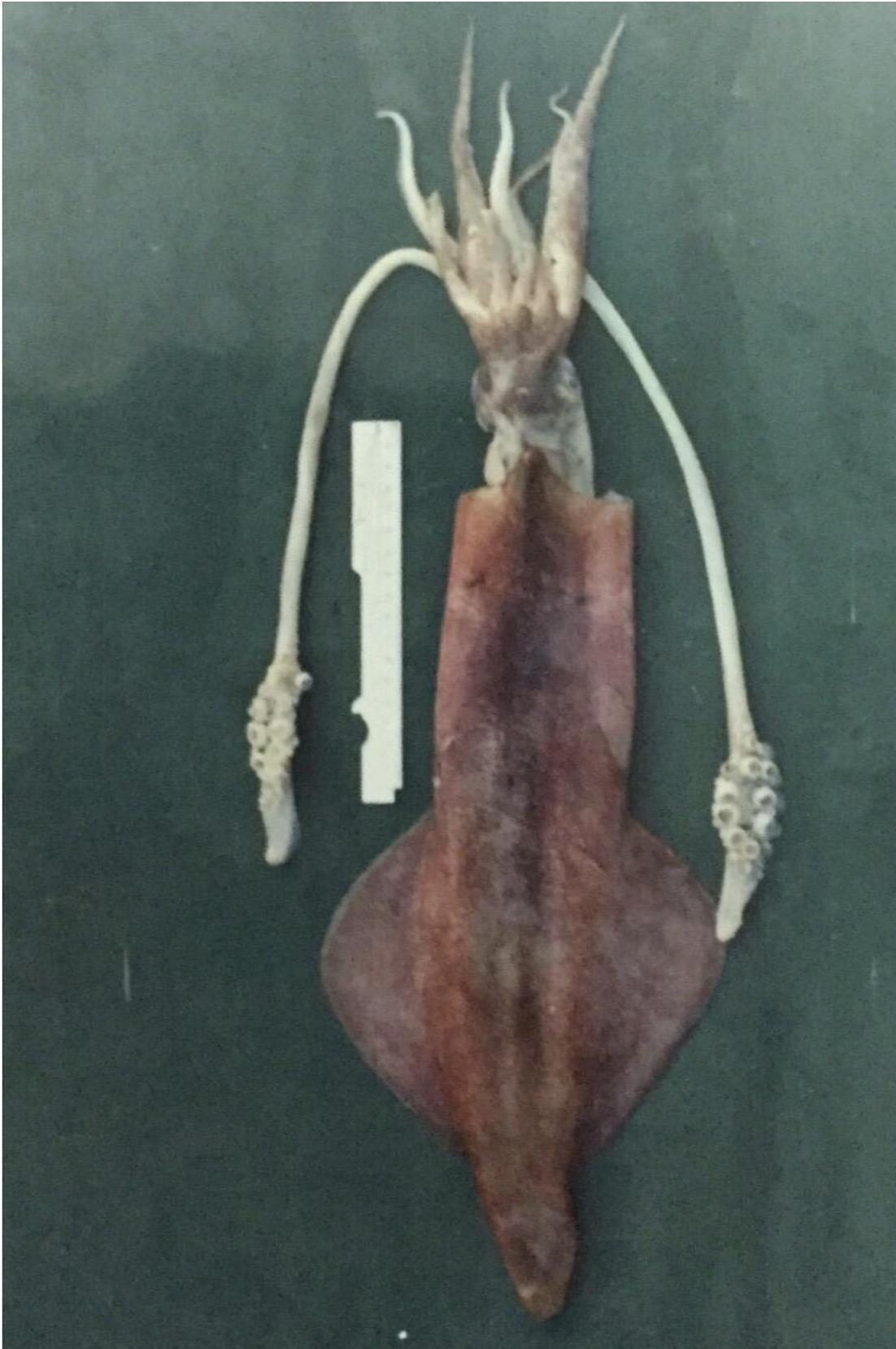


PLATE (2): *Loligo vulgaris*

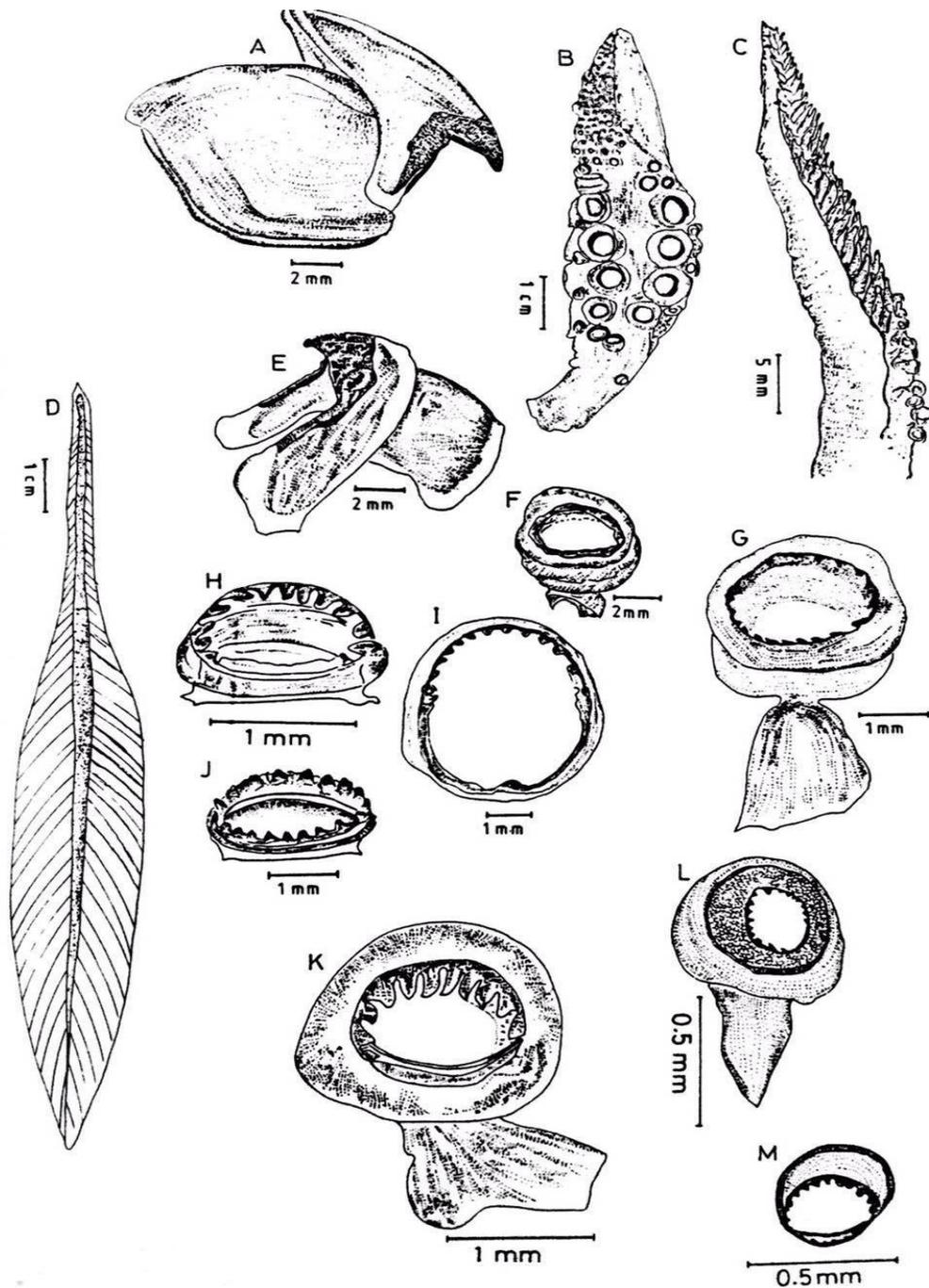


PLATE (3): *Loligo vulgaris*

A-Upper beak. B-Tentacular club. C- Left arm IV of male hectocotyized. D -Shell. E- Lower beak. F- Manus sucker of tentacular club. G- Dactylus sucker of tentacular club. H- Arm sucker ring. I- Sucker ring of manus sucker of tentacular club. J- Sucker ring of dactylus sucker of tentacular club. K- Arm sucker. L- Radula sucker. M- Radula sucker ring.

***Loligo forbesi* Steenstrup, 1856**
(Plate 4, Plate 5, a-I and plate 6, a-m)

Synonymy: None.

world distribution. Mediterranean sea (Roper *et al.*, 1984), North - Western Mediterranean (Boletzky and Mangold, 1985), Red sea and East Africa (Roper *et al.*, 1984), Catalanian Sea (Sanchez, 1985), Eastern Atlantic from 20° N to 60° N (excluding the Baltic Sea) (Roper *et al.*, 1984).

Local name: Kalemaria. not Sobbeit as reported by Roper *et al.*, (1984). (Riad, 1993).

Local distribution: A few specimens (16) were obtained by trawling offshore from Rosetta (2 m. 36 m. depth), and from Alexandria fish markets (Anfushy, Abu Qir, Meadeia and Rosetta). (Riad, 1993). From fish trawl from Suez Gulf (Ataka Harbor) and adjacent area. (Riad, 2008a).

Description: The mantle is slender; the fins are elongated and posteriorly concaved, extending to about 75% of the ML (plate 4 & 5a). The manus of the tentacular club is provided with sub equal suckers (Plate 5 B & 6b), each sucker ring has about 16-20 sharp teeth (Plate 5 f & 6e), but some suckers had less teeth (13). The distal modified part of the left arm IV hectocotylyzed occupies about 35% of its length, covered with long papillae (28-30), decreasing in size distally (Plate 5 c & 6c). The arms have two rows of suckers, each arm sucker ring is provided with 20-30 sharp teeth, largest arm sucker rings with 7 to 8 teeth (plate 5h & 6g). Each gill is provided with about 60 gill lamellae (Plate 5 e & 6h). There are 7 radulae (Plate 6 J), each radula has 5-6 suckers (Plate 6 K & L), and each sucker ring has 20 teeth (Plate 6 M). Differentiation between *L. forbesi* and *L. vulgaris* depends mainly upon the relative size of the suckers on the tentacular club. In *L. forbesi* there are 4 rows of sub equal suckers, while in *L. vulgaris* the suckers on the 2 inner rows are considerably larger than other suckers. Some characters given in the present description have not been reported before in the literature: the number of papillae of left arm IV hectocotylyzed, the number of gill lamellae, the number of radula, and the number of radula suckers and the teeth number of the radula sucker ring.

Of the 16 specimens were collected, the largest had a ML of 28.1 cm. To .L 52.5 cm. TW 180 gm. (for male), ML 17.3 cm. To. L 42.6 cm. TW. 105 gm. (for female). The smallest showed the following measurements: ML 7.5 cm. To. L 20.6 cm. TW. 13.09 gm. (for male), ML 8cm., To. L 21.3 cm. TW. 14.74 gm. (for female). Poper *et al.* (1984) reported larger sizes for the ML.

Habitat: A temperate shelf species found in deeper waters in subtropical areas. Its depth range extending from 100 to 400 m. (Roper *et al.*, 1984).



PLATE (4): *Loligo forbesi*

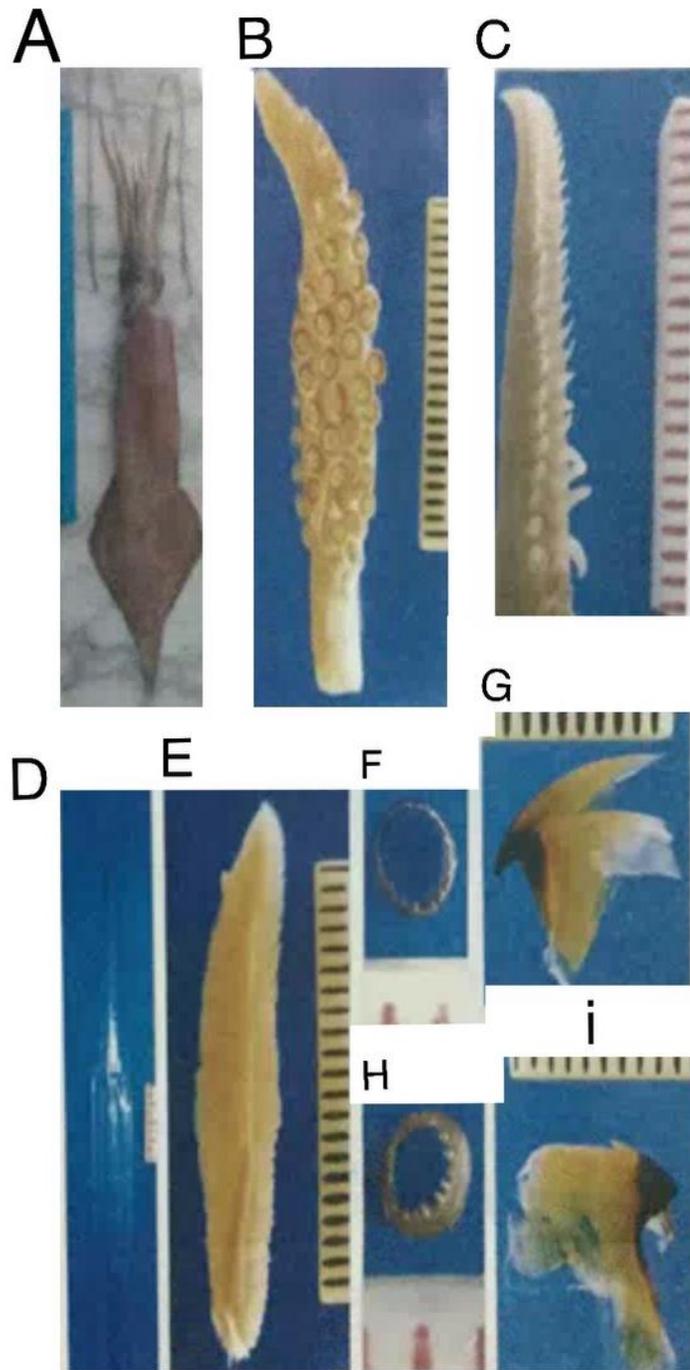


PLATE (5): *Loligo forbesi*

(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.

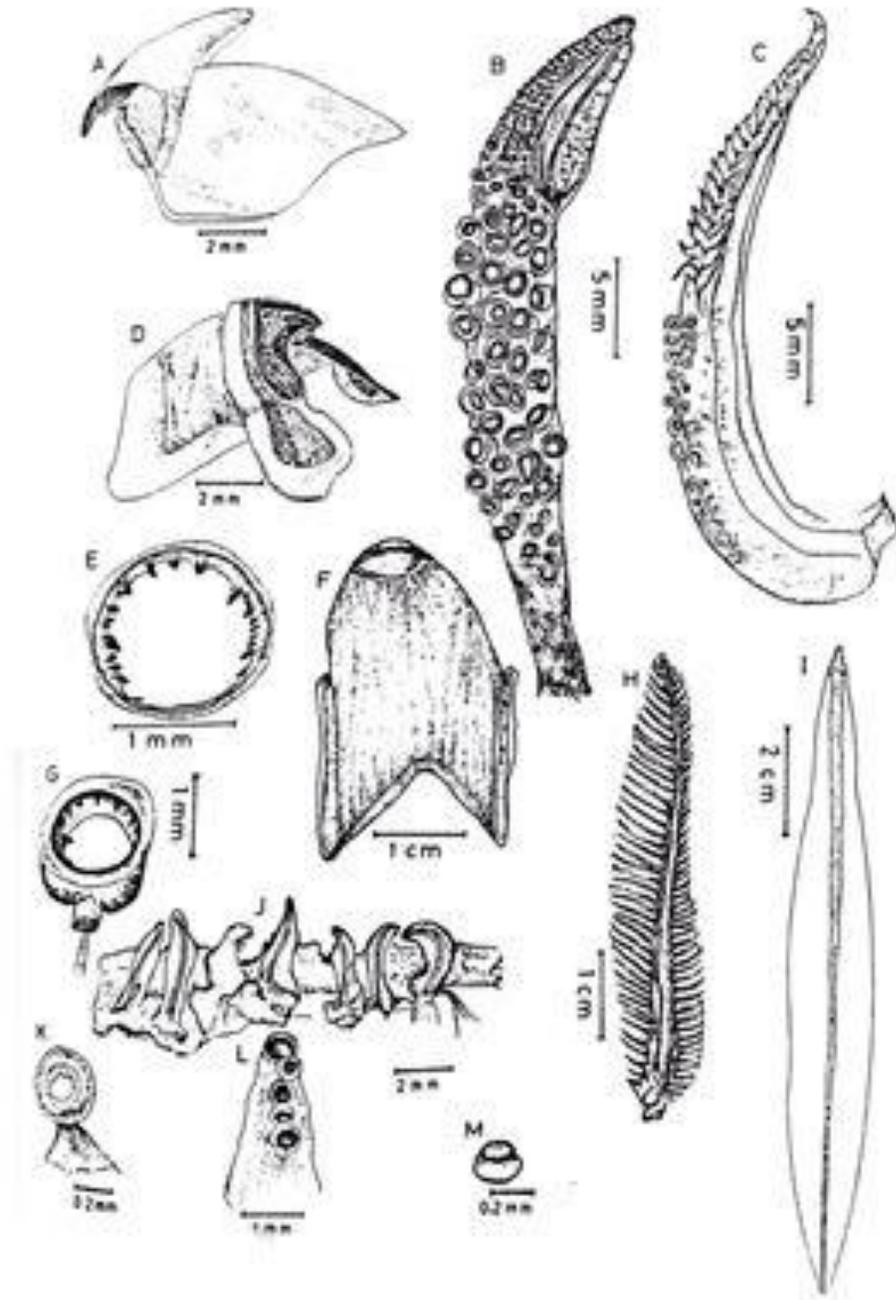


PLATE (6): *Loligo forbesi*

A-Upper beak. B-Tentacular club. C- Left arm IV of male hectocotylized. D - Lower beak.
 E- Tentacular club sucker ring. F- Funnel. G- Tentacular club sucker. H- Gill. I- Shell.
 J- Radula. K- Radula sucker. L- Enlarged part of radula. M- Radula sucker ring.

Loligo duvauceli d, Orbigny, 1848
(Plate 7& plate 8, a-h)

Material: Eleven individuals (6 females and 5males) with dorsal mantle length range from 8.6cm. to 15.2cm. Were collected from Suez Gulf.

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).

Local name: **Kalimaria.** (Riad, 1993).

Local distribution: Suez Gulf, Red Sea.(Emam, *et al.*, 2007 & Riad, 2008a).

Description: Mantle relatively short. Fins rhombic, just over 50 % of mantle length (plate 7&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 hectocotylyzed for more than half its length, with 2 rows of large papillae (plate 8b). The gill has more than 60 gill lamellae (plate 8e). The present description of *Loligo duvauceli* was in agreement with the literature, apart from, the gill with more than 60gill lamellae The morphology of *Loligo duvauceli* 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.

Habitat: A neritic, shallow- water species occurring in depths between 30 and 170m. (Roper *et al.*, 1984).



PLATE (7): *Loligo duvauceli*

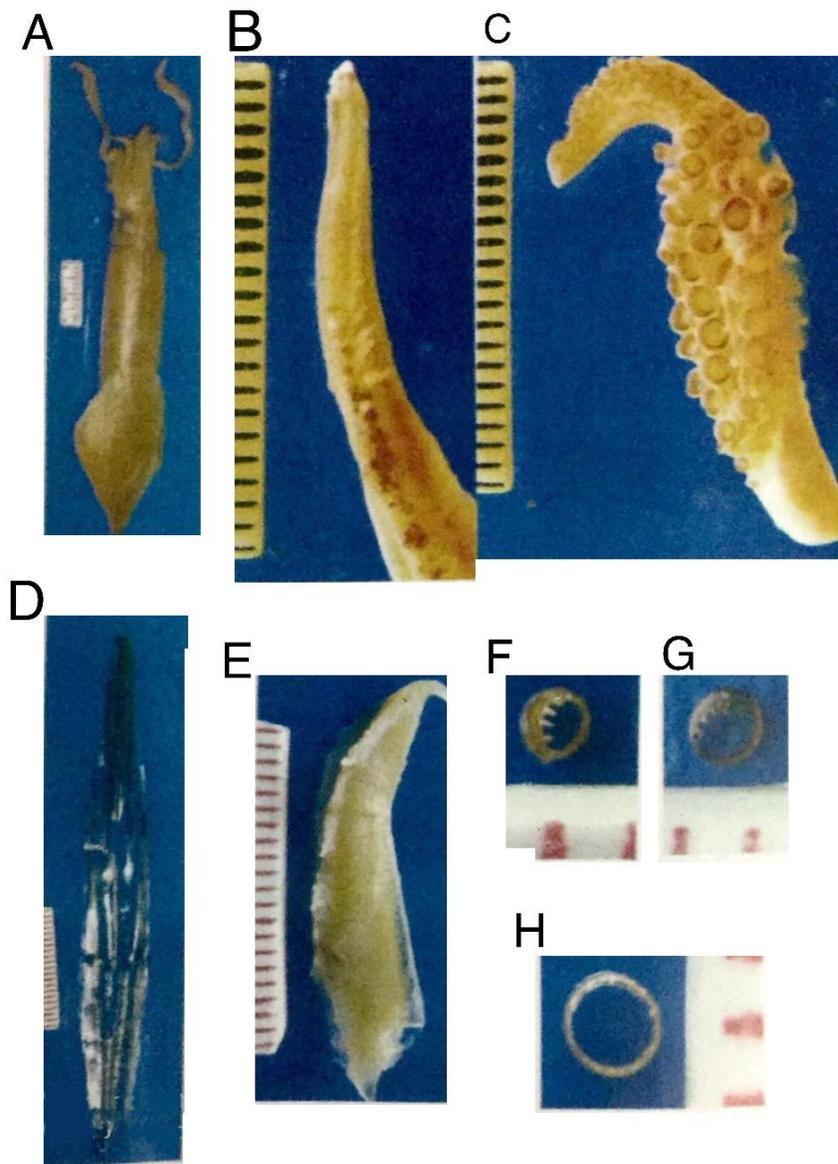


PLATE (8): *Loligo duvauceli*

(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.

Genus: *Alloteuthis* Wülker, 1920

Buccal membrane with suckers; trabeculae on protective membranes of tentacular clubs twice as numerous as adjacent suckers. (Roper *et al.*, 1984).

Alloteuthis media* Linnaeus, 1758*(Plate 9 and Plate 10, A -J)**

Synonymy: *Sepia media*, *Loligo marmorae* Verany, 1977.

world distribution: West Mediterranean, Adriatic sea (Riedle, 1970), Turkish Waters (Katagan & kocatas, 1990), Eastern Atlantic Irish Sea and English Channel (very rare in North Sea) (Roper *et al.*, 1984).

Local name: Kalemaria. (Riad , 1993).

Local distribution: Mediterranean waters (Port Said 10 m. depth and Abu Qir Bay 5 -8 m. depths). (Riad, 1993).

Description:

The head is short and broad, the tail is pointed. The fins appear heart-shaped, and occupy about 40% of the ML (plate9). The mantle is elongated and narrow. The arms are provided with double rows of suckers, the manua of tentacular club carries 4 suckers in each row, 2 median rows of well-developed suckers besides two outer rows of small suckers. (Plate 10 B). Left arm IV hectocotylized with 11 pairs of normal suckers on the proximal 2/3 followed by about 24 pairs of coarse papillae (modified suckers) (Plate 10 C). The sucker ring of the tentacular club is provided with 23-25 teeth (Plate 10 I), while sucker ring of the arms provided with 7-8 teeth only (Plate 10 G). The morphology of *Alloteuthis media* from Alexandria Mediterranean water is in agreement with the literature, except the following additional characters: The number of coarse papillae of left arm IV hectocotylized, number of sucker ring teeth of tentacular club and arms. Of 32 specimens collected, the largest measured 6.1 ML, 12.6 cm. To.L, 5.50 gm. TW (for male), 6.4 cm. and 13 cm. respectively for ML and To.L, 7.73 gm. TW (for female). The smallest specimens measured 3.2 cm. ML, 6.7 cm. To. L, 1.03 gm. TW (for male), 3.5 cm. and 8.3 cm. respectively for ML and To.L, 1.26 gm. TW (for female). Roper *et al.* (1984) report specimens twice as large.

Habitat: Aneritic, demersal species on sandy and muddy grounds occurring from shallow water to 350m. (Roper *et al.* 1984).

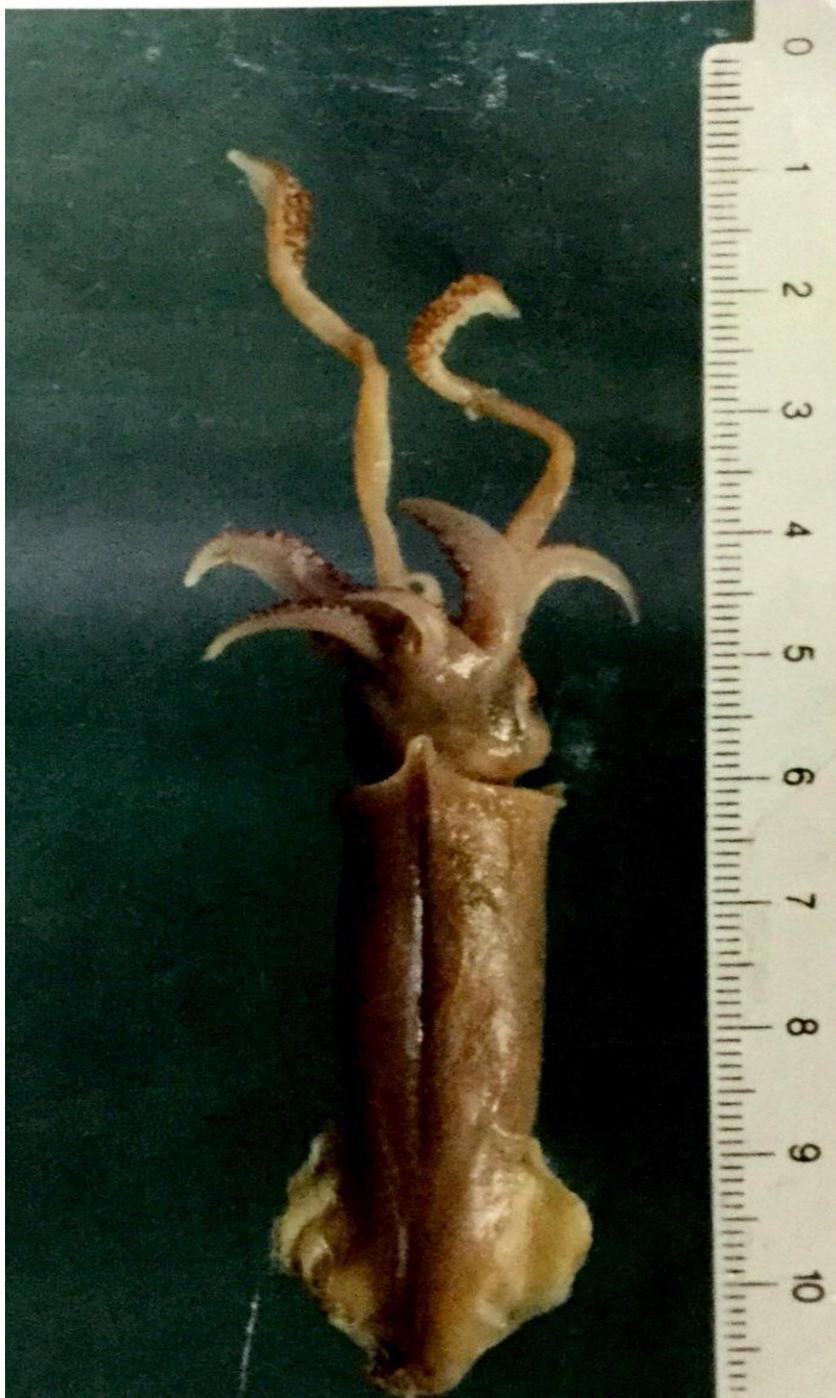


PLATE (9): *Alloteuthis media*

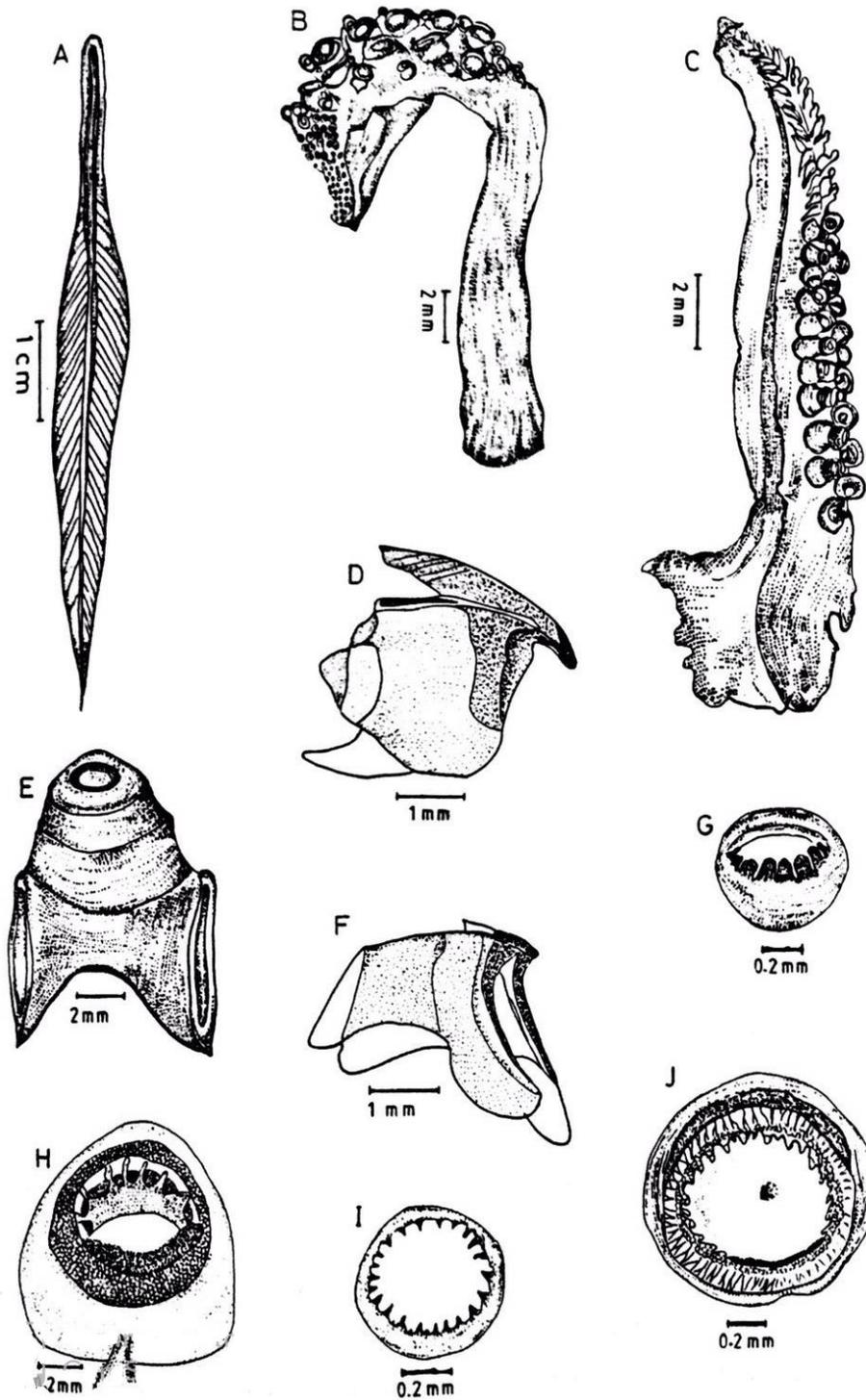


PLATE (10): *Alloteuthis media*

- A- Shell. B- Tentacular club. C- Left arm IV of male hectocotylized.
 D- Upper beak. E- Funnel. F- Lower beak. G- Arm sucker ring.
 H- Arm sucker. I- Tentacular club sucker ring. J- Tentacular club sucker.

Genus:*Sepioteuthis* Blainville, 1824.

Mantle elongate or short, robust, posteriorly pointed or rounded, but never produced into an elongate, pointed tail; posterior border of fins straight or only slightly concave, or rounded. Fins very long, over 90% of mantle length, broad, Sepia-like, but much wider and more muscular; mantle very robust. (Roper *et al.*, 1984)

Sepioteuthis lessoniana Lesson, 1830.**(Plates 11 to 17)**

Material: Two specimens male and female were only available from a commercial fish trammel net of Alexandria Mediterranean waters. The male with dorsal mantle length 19.5 cm. and total weight 300 gm., while the female with dorsal mantle length 20 cm. and total weight 350 gm. The species was available in Suez fish markets.

Synonyms:

Sepioteuthis guinensis Quoy & Gaimard, 1832 *Sepioteuthis lunulata* Quoy & Gaimard, 1832; *Sepioteuthis mauritania* Quoy & Gaimard 1823; *Sepioteuthis sinensis* d. Orbigny 1835-1848; *Sepioteuthis arctipinnis* Gould, 1852; *Sepioteuthis brevis*, Owen 1881; *Sepioteuthis neoguinaica* Pfeffer, 1884; *Sepioteuthis indica* Goodrich, 1896; *Sepioteuthis sieboldi* Joubin, 1898; *Sepioteuthis malayana* Wiiker, 1913; *Sepioteuthis kremphi*, Robson, 1928. (Roper *et al.* 1984).

World Distribution: Widespread in the Indo-Pacific: Red Sea, Arabian Sea east to 160°E, eastward to the Hawaiian Islands, Northern Australia and north to central Japan. (Roper *et al.*, 1984).

Common name: Big fin reef squid. (Roper *et al.* 1984).

Local name: Kalimaria (Riad, 1993).

Local distribution: Suez Gulf, Red Sea (Emam & Aly, 2000). Alexandria, Mediterranean waters (Riad, 2008b).

Description: Mantle long, robust, its width about 43% of mantle length (plate 11 and plate 12a & b) Fins very long, more than 90% of mantle length, broad: Sepia-like but much wider and more muscular; and their width up to 73% of mantle length, greatest width occurs posterior to the midpoint of the fins (plate 12 d and plate 16 f) The head width much larger than the length and bears two lateral oval eyes (plate 11). The tentacular club long, expanded with 4 rows of suckers, median manus suckers enlarged (plate 12 c and plate 16 a). Tentacular club sucker ring with 17-22 sharp teeth (plate 13 f and plate 17 h). Dactylus sucker ring with 14-16 teeth (plate 13 e and plate 17 j). Arm sucker ring with 20-25 long sharp teeth (plate 13 g and plate 17 g & i). Buccal lappets bear a small number of suckers (plate 15 c and plate 17 f). The buccal mass contains two beaks and radula, The upper beak has short blunt, curved rostrum, crest, large wings and large lateral walls with posterior margin slightly indented (plate 13 a and plate 16 e). The lower beak has short blunt rostrum, long hood, crest, large lateral walls and small wings (plate 13 b and plate 16 g). The radula is small and consists of 9 rows of rachidian teeth (plate 14 c & d and

plate 17e). The funnel lies below the head on the ventral side. It opens into the mantle cavity (plate 13 c and plate 17a). The gill consists of about more than 60 pairs of Gill lamellae (plate 12e&f and plate 16d).

Habitat: a neritic species occurring from the surface down to at least 100m. depth. (Roper *et al.* 1984).

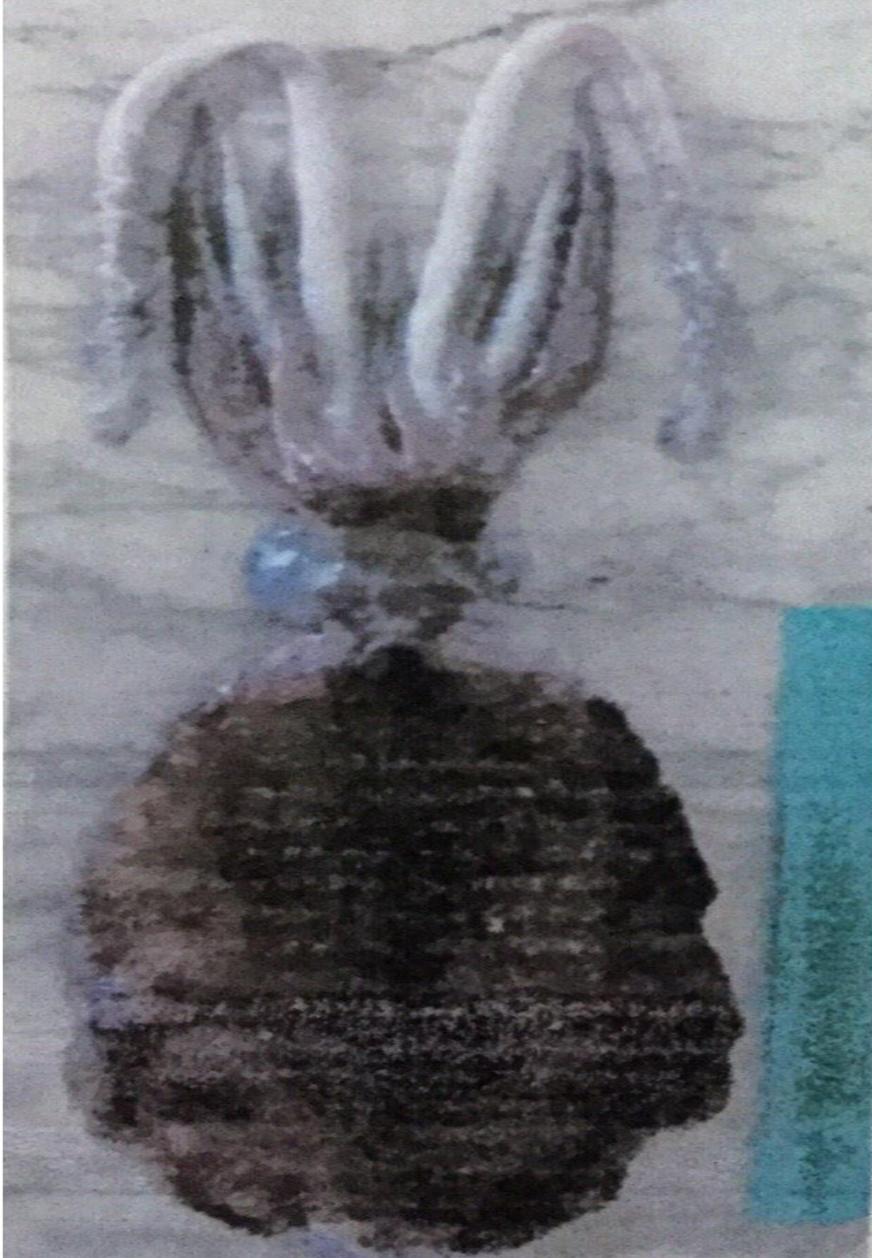


PLATE (11): *Sepioteuthis lessoniana*

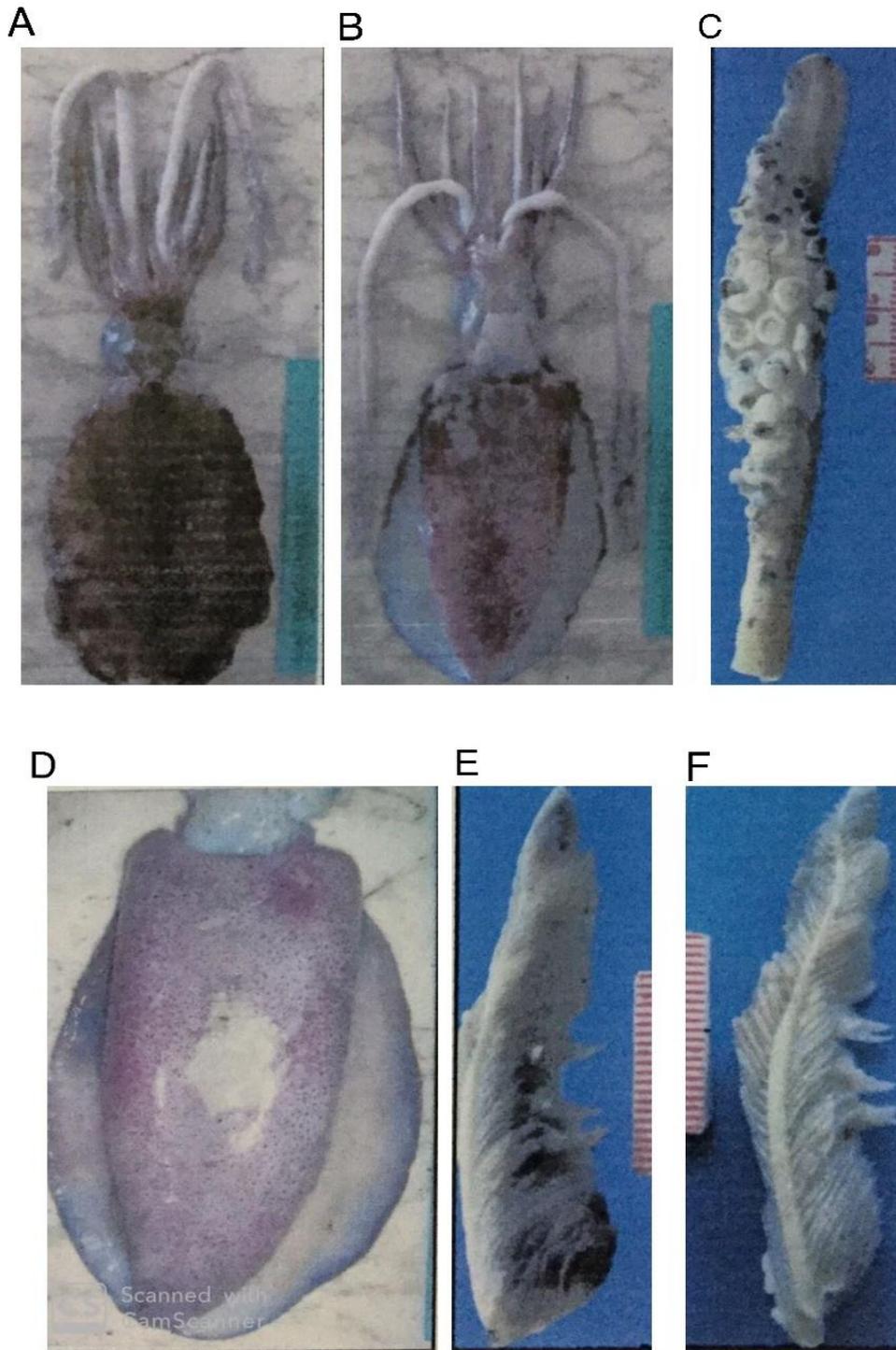


PLATE (12): *Sepioteuthis lessoniana*

- (a) The animal (dorsal view). (b) The animal (ventral view). (c) Tentacular club. (d) Fin. (e) Gill (lateral view). (f) Gill (dorsal view).

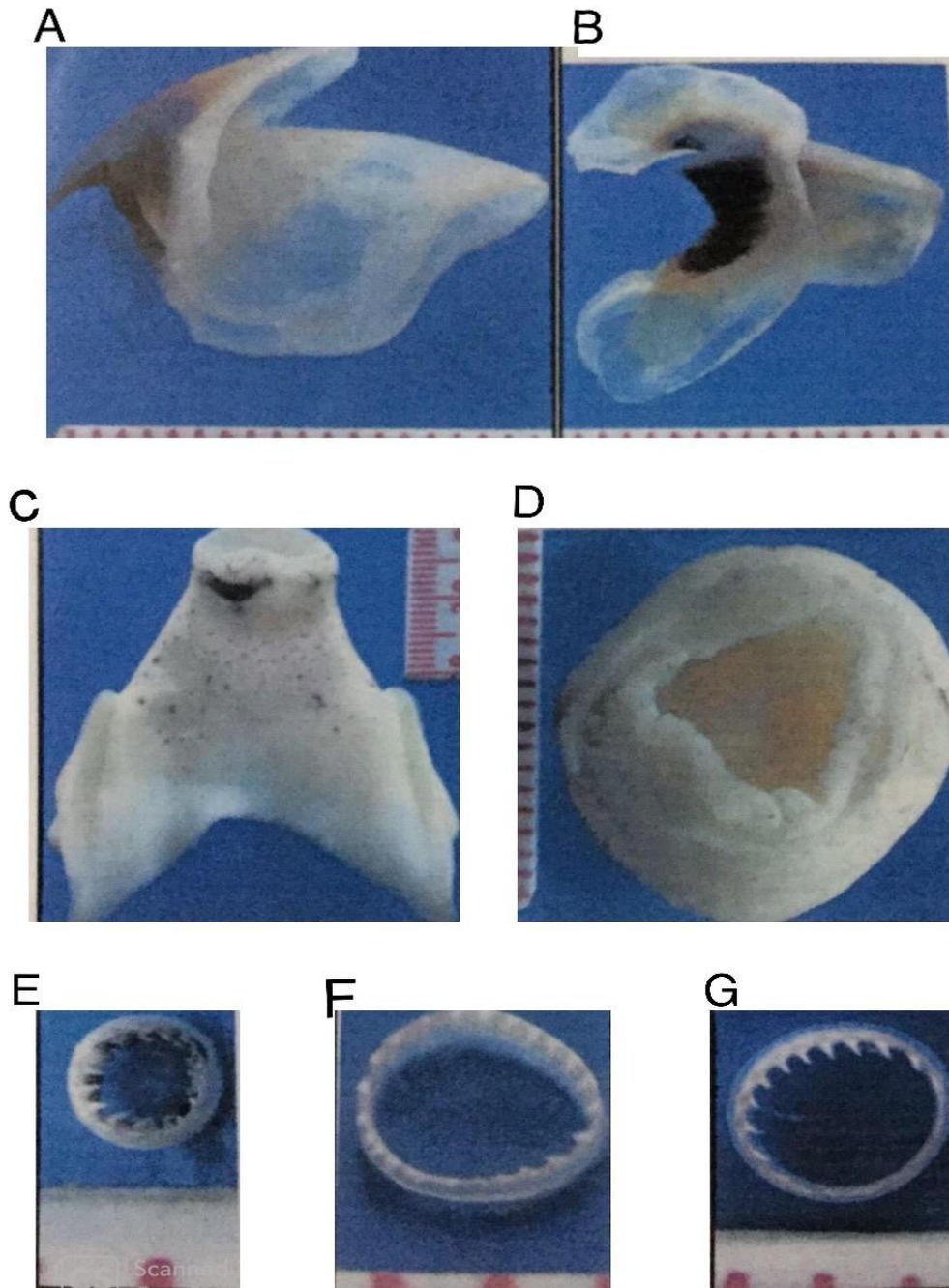


PLATE (13): *Sepioteuthis lessoniana*

- (a) Upper beak. (b) Lower beak. (c) Funnel. (d) Buccal. (e) Dactylus sucker ring. (f) Tentacular club sucker ring. (g) Arm sucker ring.

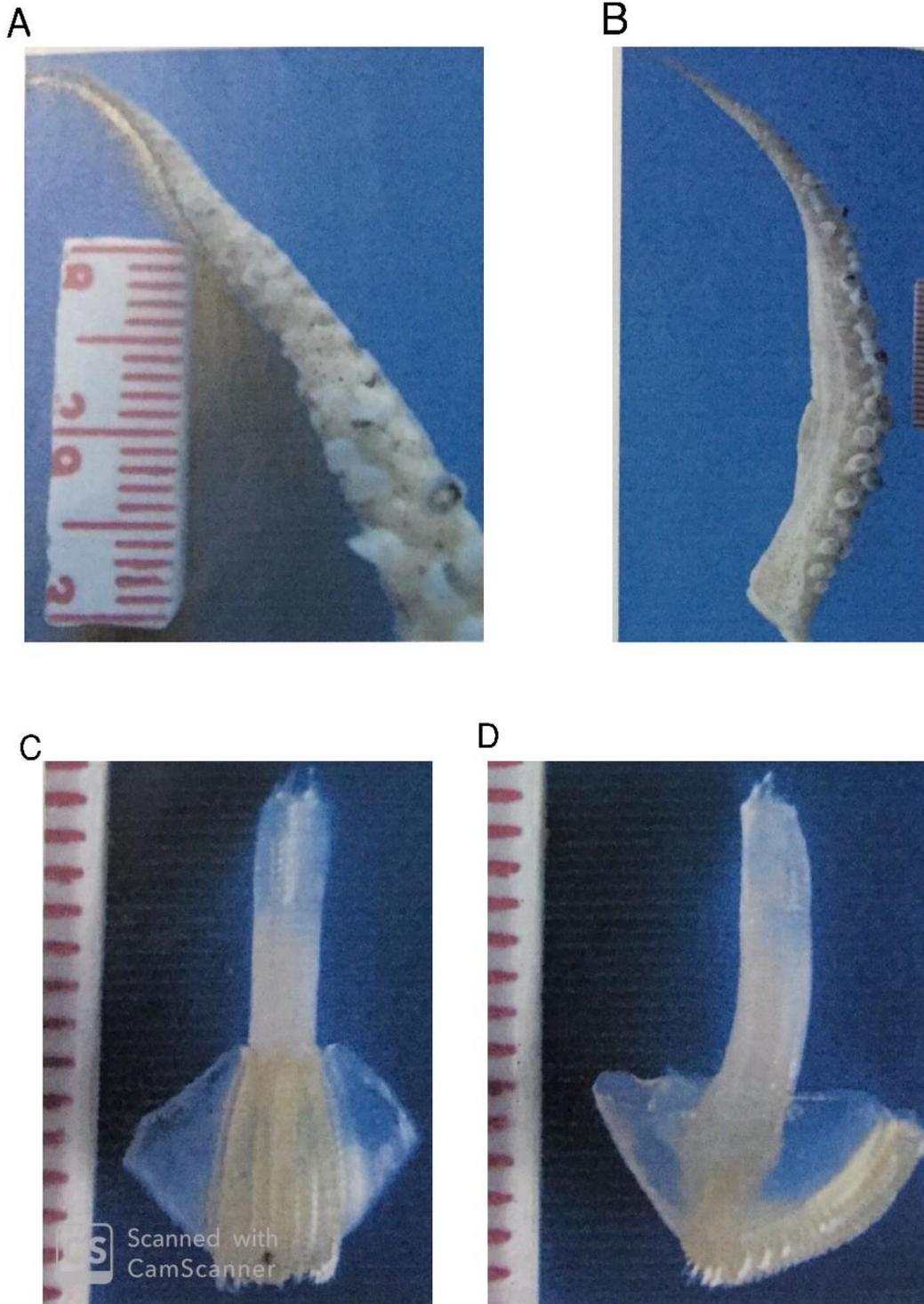


PLATE (14): *Sepioteuthis lessoniana*

(a) Normal arm. (b) Normal arm(lateral view). (c) Radula. (d) Radula (lateral view).

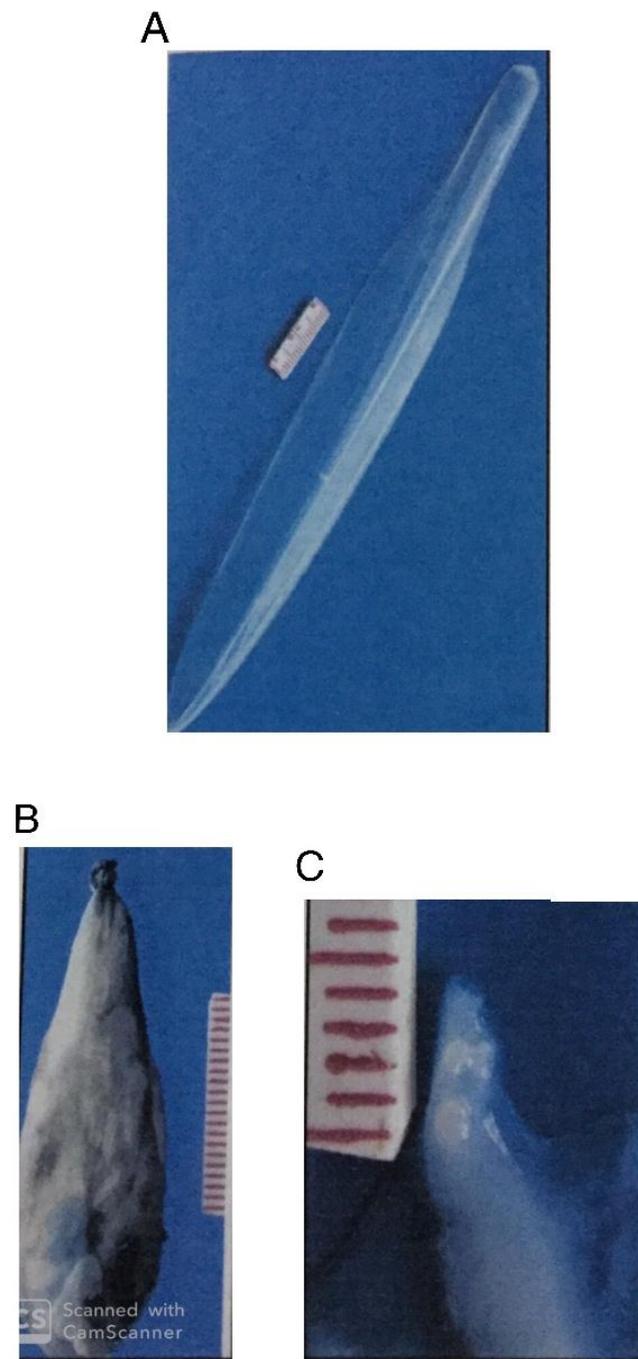


PLATE (15): *Sepioteuthis lessoniana*

(a) Shell (dorsal view). (b) Ink sac. (c) Buccal lappets.

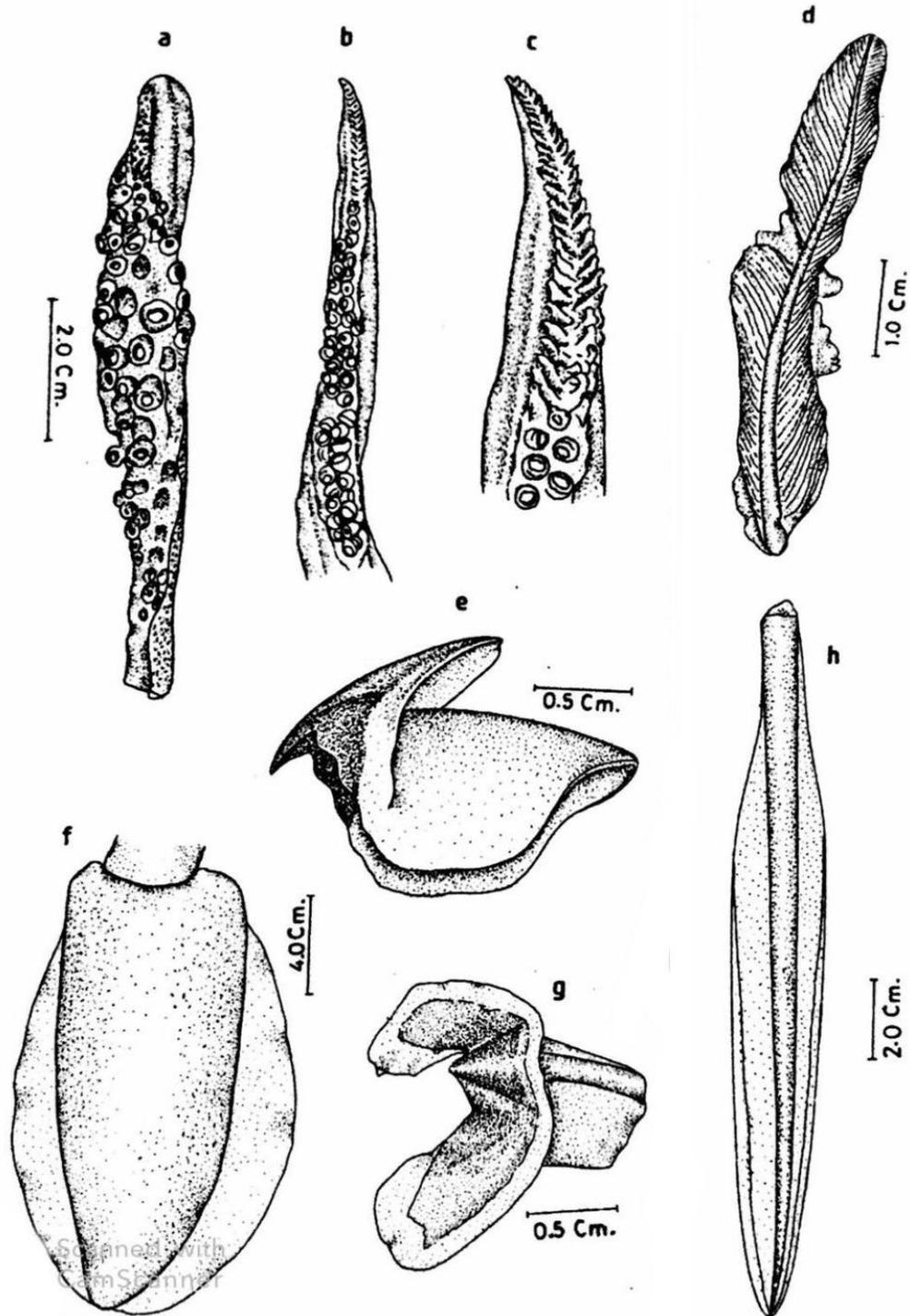


PLATE (16): *Sepioteuthis lessoniana*

(a) Tentacular club. (b) Left arm IV of male hectocotized. (c) Modified part of hectocotized arm. (d) Gill. (e) Upper beak. (f) Fin. (g) Lower beak. (h) Shell.

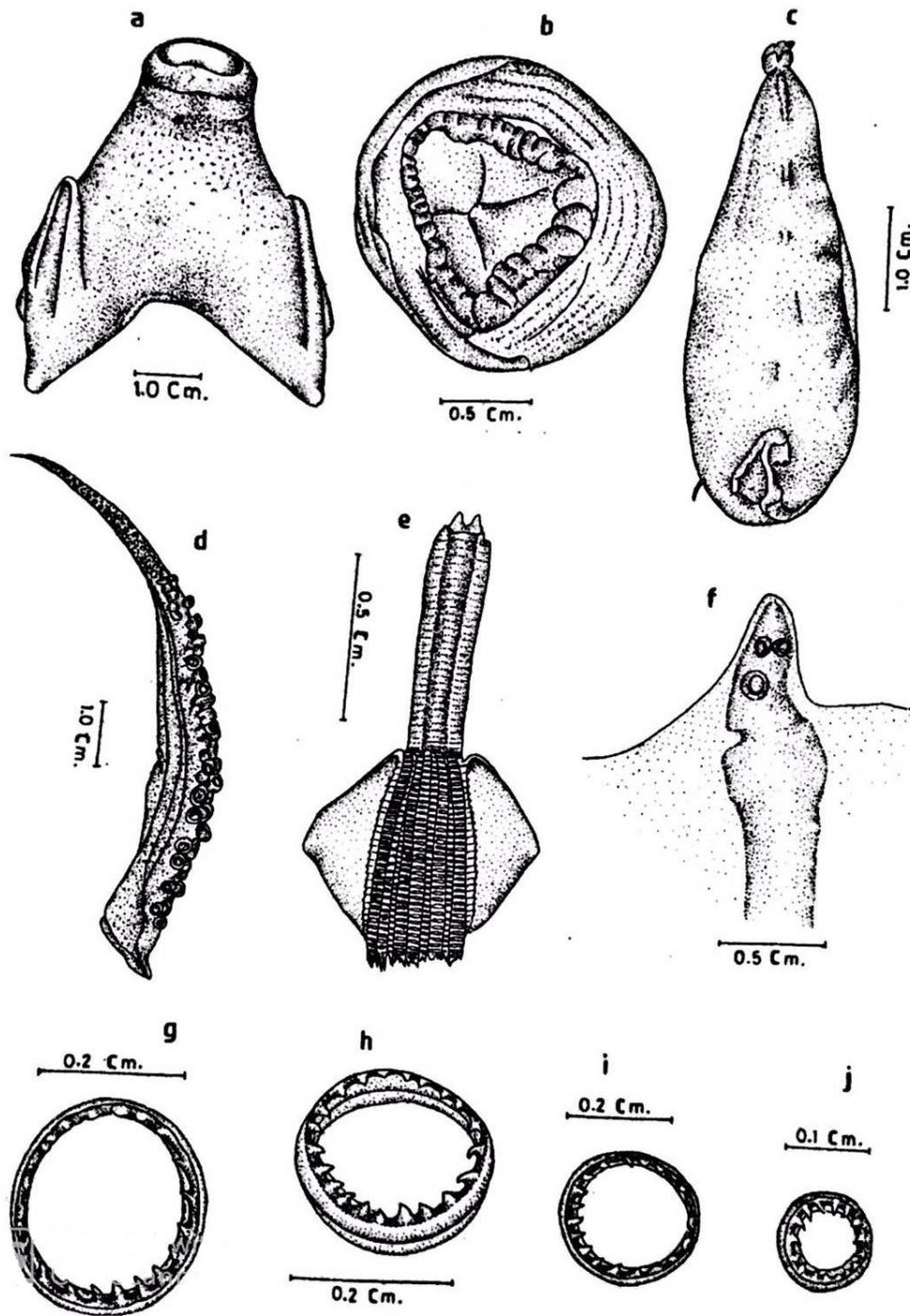


PLATE (17): *Sepioteuthis lessoniana*

- (a) Funnel. (b) Buccal. (c) Ink sac. (d) Normal arm. (e) Radula. (f) Buccal lappets. (g) Arm sucker ring. (h) Tentacular club sucker ring. (i) Arm sucker ring. (j) Dactylus sucker ring.

Suborder : Oegopsida d'Orbigny, 1845.

Oegopsid squids are distinguished from Myopsid squids by their lack of corneal membrane, thus exposing the eyes directly to the sea; suckers are absent on the buccal lappets (except in Bathyteuthidae and Ctenopterygidae); Sucker ornamentation consists of chitinous rings and/or hooks; female gonoducts are paired; accessory nidamental glands are absent. Twenty three families compose the suborder Oegopsida (oceanic squids) (Roper *et al.* 1984).

.In this study one family only is represented: Ommastrephidae Steenstrup, 1857.

Family :Ommastrephidae Steenstrup, 1857

The family is characterized by an inverted T-shaped funnel locking cartilage, biserial suckers on the arms tetraserial suckers on the tentacular clubs (except *Illex* which has 8 rows of suckers on the dactylus), buccal connectives that attach to the dorsal borders of arms IV, photophores in some genera, and a muscular bridge anterior to the funnel locking cartilage which passes from the funnel to the ventral surface of the head. Arms with two rows of suckers. Tentacular club with four rows of suckers, The central suckers being enlarged. Have terminal rhombic fins. This family embraces 3 sub-families: Ommastrephinae, Todarodinae and Illicinae. (Roper *et al.* 1984) In this study one subfamily only is represented:Illicinae.

Sub-Family :Illicinae

The Illicinae sub-family lack both central and size pockets in the funnel groove as well as photophores. Funnel groove, smooth, without foveola. Two genera are known (*Illex* and *Todaropsis*..) (Roper *et al.* 1984). In this study *Illex* only is represented.

Genus:Illex Steenstrup, 1880

Dactylus of tentacular club with 8 longitudinal rows of small suckers. The big suckers of the arms with smooth rings or blunt, rounded teeth.) (Roper *et al.* 1984) .

In the present monograph this genus is represented by one species, *Illex Coindetii* Verany, 1839

***Illex coindetii* Verany, 1839.**

(Plate 18 and Plate 19, A-M.)

Synonymy: *Loligo brogniartii* Blainville, 1823; *Loligo coindetii* Verany, 1839; *Loligo sagittata* Verany, 1851; *Todaropsis veranyi* Jatta. 1896; *illecebrosus coindetii* Pfeffer, 1912.

world distribution: Mediterranean Sea including Adriatic Sea and Black sea, Eastern Atlantic from 15°S. 60°N., Western Atlantic, Caribbean Sea, Gulf of Mexico, Southeast Florida (Roper *et al.*, 1984).

Local name: Kalemaria. (Riad, 1993).

Local distribution: Alexandria Mediterranean waters and from Alexandria fish markets at Abu Qir and Anfushy). (Riad, 1993).

Description: The anterior part of the mantle is wider than the posterior part. The fin width is greater than fin length and the fin angle broad, exceeding 50° (100° in both fins), with pointed tail (plate 18). The funnel groove without foveola or side pockets. The head length and width are more or less equal (plate 18). The arms are very long provided with two rows of suckers, each with 2 large suckers, the arm sucker ring has about 16-18 teeth with an enlarged central tooth (Plate 19 A, E,G). The dactylus of the tentacular club is provided with 8 longitudinal rows of small suckers (Plate 19 B). The tentacular club sucker ring is provided with about 8-11 teeth (Plate 19 J,M). The left arm IV hectocotylized is larger than the opposite ventral IV arm, 1/4 of its length is modified to about 35-40 papillae (Plate 19 C). The gills consist of about 45 gill lamellae (Plate 19i) *I. Coindetii* differs from *Todarodes sagittatus* in having the dactylus of the tentacular club with 8 longitudinal rows of small suckers and no foveola in the funnel groove (Fischer, 1973). It also differs from *L. vulgaris* in the absence of eye cornea and in having triangular shaped fins not extending beyond the last third of the body. The morphology of *Illex coindetii* from Alexandria waters is in agreement with the literature, except for the following additional characters: the number of arm sucker ring teeth, enlarged central teeth in the arm sucker ring, the number of tentacular club sucker ring teeth, the number of papillae in the left arm IV hectocotylized, and the number of gill lamellae.

Of 136 specimens collected the largest had a ML of 21 cm. (for male) and 22.5 cm. (for female) much less than reported by Fischer (1973) (35-40 cm.), but Roper *et al* (1984) gave 26 cm. for male and 22 cm. for female. The smallest specimens showed the following measurements: ML 8 cm. To .L 22 cm. TW. 11.17 gm. (for male) and ML 8.4 cm. To. L 23cm. TW. 14.25gm. (for female).

Habitat: Young specimens live close the bottom, but older individuals are pelagic, effecting diurnal vertical migration, up to the surface at night (Fischer, 1973). A semi demersal, oceanic and neritic species occurring from the surface down to about 1000m. In the Mediterranean between 60 and 400 m. depth. (Roper *et al.* 1984).



PLATE (18): *Illex coindetii*

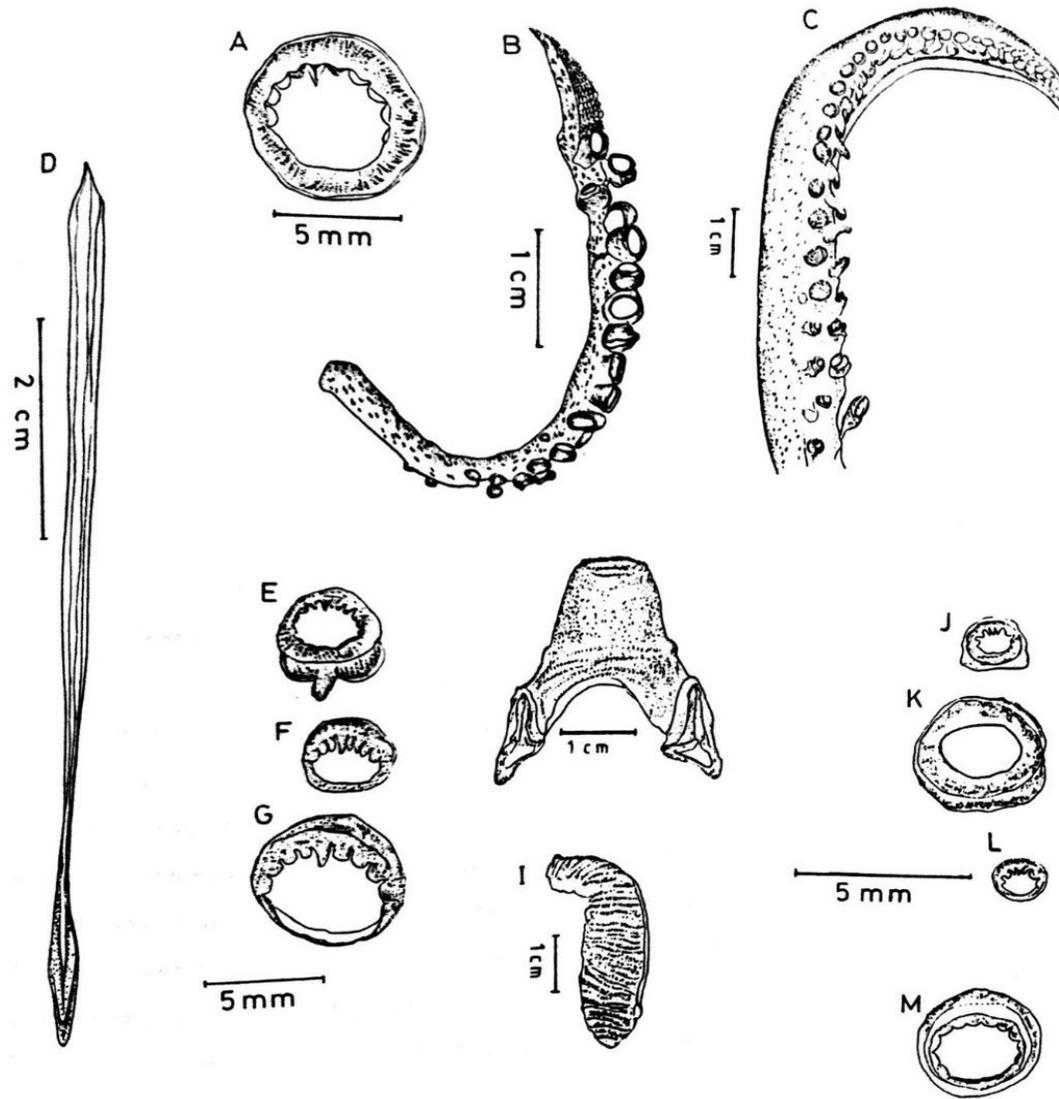


PLATE (19):*Illex coindetii*

- A- Large arm sucker. B- Tentacular club. C- Left arm IV of male hectocotylized. D- Shell. E- Small arm sucker. F- Sucker ring of small arm sucker. G- Sucker ring of large arm sucker. H- Funnel. I- Gill. J-Dactylus tentacular club sucker. K- Manus tentacular club sucker. L-Sucker ring of dactylus tentacular club sucker. M-Sucker ring of manus tentacular club sucker.

ACKNOWLEDGMENT

I thank Dr. Safaa Fahmy, Dr. Marina Rafik and Miss Shery Rafik for their kind cooperation. I am indebted to Dr. Raouf Kilada, Professor of Biological Oceanography, University of New Brunswick, Saint John, for his assistance, he kindly offered. I am grateful to Dr. Magdy Khalil, Professor of Aquatic Ecology Faculty of Science, Ain Shams University for his sound supervision and support and for his helpful.

REFERENCES

- Adam, W. (1959).** Les cephalopods de la mer Rouge Resultats scientifiques. Mission Robert Ph. Dollfus en Egypt. CNRS, Paris, pp. 125-192.
- Adam, W. (1960).** Cephalopoda from the Gulf of Aqaba. Bull. Sea.Fish. Res.Stn. Haifa. 26: 1-27.
- Boletzky, S. V. and Mangold, K.(1985).** *Loligo forbesi* in the North- Western Mediterranean, Rapp. Comm. INnt. Mer Medit., 29 (8):245-246.
- Hassan, A. K. (1974).** Studies on bottom Molluscs (gastropods and bivalves) in Abou Kir Bay. M. Sc. Thesis, Facul. Sci., Alex. Univ., 319 pp.
- Hassan, A.K.; Riad, R.; Atta, M. (1994).** Trophic relations of *Sepia officinalis* and *Loligo vulgaris* (Mollusca: Cephalopoda) in Alexandria Mediterranean waters. Bull. Nat. Inst. Oceanogr. & Fish. A.R.E. 20 (1): 161- 173.
- Hickman, C.P. (1973)** Biology of the invertebrates. Mosby C. V. (Ed) Company. USA. 757 pp.
- Juanico, M. (1983).** Squid maturity scales for population analysis. FAO Fish. Tech. Pap. (231):341-378.
- Edwards, A.J. and Head, S.M. (1987).** Red Sea. Pergamon Press, Oxford, 433 pp.
- Elsayed, A.M.; Riad, R. ; Halim, Y.(1996)** Biochemical composition of *Loligo vulgaris* (Mollusca) from the Mediterranean waters off Alexandria, Egypt. Qatar Univ. Sci.J. 16 (2): 333-337.

- Emam, W. M. (1984).** Biological studies on some cephalopods from the Egyptian waters. M. Sc. thesis, Zoo. Dep., Fac. Sci., Ain Shams Univ., 235 pp.
- Emam, W.M. and Aly, R.A. (2000).** The male reproductive system of the reef squid *Sepioteuthis lessoniana* lesson, 1830 (Mollusca: Cephalopda) from the Gulf of Suez. Egypt. J. Aquat. Biol. & Fish., 4(1): 165-295.
- Emam, W.M. and Ghareb, T. (2010).** A study on the morphology, digestive and reproductive system of male squid *Sepioteuthis lessoniana* (Cephalopoda: Loliginidae) from Abo Qir on the Mediterranean Sea. Afr. J. Biol. Sci., 6(1):125-141.
- Emam, W.M.; Aly R.H.; Ibrahim, A.M.; El-Naggar, M.A. (2007).**Morpholgy, morphometry, age and growth of the coral reef squid *Sepioteuthis lessoniana* (Cephalopoda: Loliginidae) from the Gulf of Suez.J. Egypt. Acad. Soc. Environ. Develop., (D-Environmental Studies) 8(3): 117–131.
- Emam,W.,M;Riad,R;Alwerfaly,H.,A..(2014)** Morphometric study and length- weight relationship on the squid *Loligo forbesi*(Cephalopoda:Loliginidae) from the Egyptian Mediterranean waters.International Journal of Environmental Science and Engineering (IJESE) 5: 1- 16
- Fischer,E.(1973).** FAO species identification sheets for fisheries purp, Mediterranean and Black Sea (Fishing area37). Rom. FAO.
- Gabr, H. and Riad, R. (2008).**Reproductive biology and morphmetric of squid *Loligo forbesi* (Cephalopoda : Loligindae) in the Suez Bay, Rea Sea. Journal Aquatic Biology and Fisheries, 1: 59-73.
- Riad, R. (1993).** Studies on cephalopod Molluscs of the Mediterranean waters of Alexandria. M. Sc. Thesis, Ocean. Dept., Fac. Sci., Alex. Univ., 246 pp.
- Riad,R. (2008a)**Morphological and taxonomical studies on some cephalopods from the Suez Gulf and Red Sea. Egypt. J. Aquatic. Research 34 (1): 176- 201.
- Riad,R. (2008b)** New record genus and species of the squid *Sepioteuthis lessoniana* (Cephalopoda: Loliginidae) from the Egyptian Mediterranean waters.African J. Biol. Sci. 4 (1): 1- 11.
- Riad,R. (2020).** Monograph of the Egyptian cuttlefishes Order: Sepioidea (Cephalopoda: Mollusca) part I. Egyptian Journal of the Aquatic Biology and Fisheries. 24 (2): 555-590.

- Riad and Abdel Hafez (2008).** Bio –Economic study of squid from the Egyptian Red Sea. Egypt, Journal of Aquatic Research 34(2): 216-329.
- Riad and Alwerfaly (2014).** Reproductive biology of the squid *Loligo forbesi* in the Egyptian Mediterranean waters. Egypt. J. Aquat. Biol. And Fish. 18(2):75-87.
- Riedle, R., (1970).** Fauna und flora der Adria. pp.463 – 469.
- Robson, G.C. (1926).** Report on the Mollusca (cephalopoda). Cambri Suez Canal. 321-329 pp.
- Katagan, T. and Kocatas, A. (1990).** Note preliminaire sur les cephalopods des Eaux Torques. Rapp. Comm. Int. Mer. Medit., 32, 1: 242.
- Kilada,R. and Riad,R.(2008).**Seasonal variation in biochemical composition of *Loligo forbesi* in the Mediterranean Sea and the Gulf of Suez, Egypt. J. of shellfish research (27):881-887.
- Kilada, R. and Riad, R.(2010).**The seasonal reproduction biology of *Loligo duvauceli* in Red Sea. J of Shellfish research (4):781-791.
- Roper, C.F.E.; Sweeny, M.J.; Nauen, C.E. (1984).** Cephalopods of the world. FAO Fisheries Synopsi, 3 (125): 51-52.
- Sanchez, P. (1985).**La peche de cephalopods sur la cote catalane. Rapp. Comm. Int. Mer. Maedit. 29, 8:233-236.
- Savigny, J.C. (1817),** Description de l' Egypt. II, Pl. I.