

First record of the swordtip squid, *Loligo edulis* Hoyle, 1885 from the north-west coast of India

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Cephalopods are caught mainly as bycatch in the bottom trawl and due to the growing demand for cephalopods in the international market; they are exploited all along the Indian coast and stands second in the all India production. In Maharashtra, cephalopods are mainly exploited by shrimp trawlers and the main fish landing centers for cephalopods at Mumbai are New Ferry Wharf (NFW) and Sassoon Docks. Cephalopods contribute 12.5% towards the total fish catch in Maharashtra (CMFRI, 2010).

With the increased exploitation and expansion of fishing grounds, new records of cephalopods are reported from various places all along the Indian coast. Out of the 60 cephalopod species recorded from Indian waters, only 15 are commercially exploited

(Silas *et al.*, 1985). Indian squid *Loligo duvauceli* is the most commercially exploited cephalopod along Maharashtra coast. A new entrant of squid species, *Loligo edulis* Hoyle, 1885 (Fig. 1 and 2) commonly

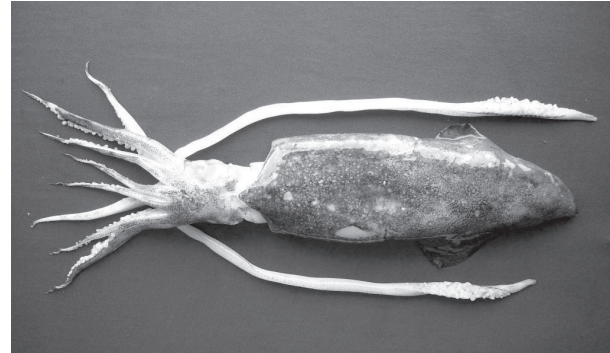


Fig. 1. *Loligo edulis* Hoyle, 1885 (Dorsal view)

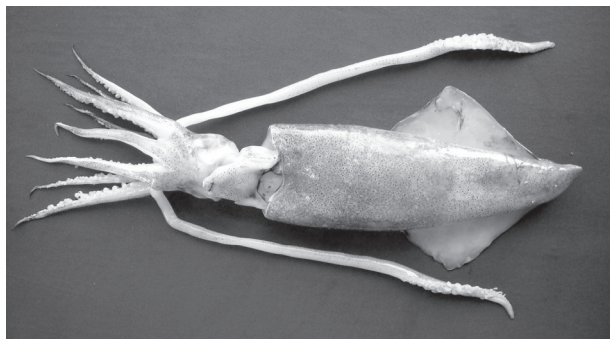


Fig. 2. *Loligo edulis* Hoyle, 1885 (Ventral view)

known as 'swordtip squid', was observed in trawl catches at New Ferry Wharf and Sassoon Docks, Mumbai, Maharashtra. The specimens were brought to the laboratory and identified to species level based on the identification characters as described by Roper *et al.* (1984).

Some of the important distinguishing characters of the species are as follows: the mantle is moderately stout to elongate and mature males may be more slender (Okutani *et al.*, 1987). A cutaneous ridge on the ventral surface is generally present, but they are absent in the specimens collected from Mumbai., which was also not mentioned by Voss (1963), Adam (1973) and Jereb and Roper (2006) in their description of specimens from the Philippines, Red Sea and the Indian Ocean respectively. The fins are rhombic, their posterior margin slightly concave and also the fins become slightly longer than wide in adult specimens. Arms are moderately long forming about 25-45% of mantle length. The arm formula is variable - 3.4.2.1 or 4.3.2.1. Tentacular clubs are expanded with 30 to 40 sharp conical teeth. The gladius is long and moderately narrow.

L. edulis is distributed in the Western Pacific: Northern Australia, Philippine Islands and northern South China Sea to central Japan. It is a neritic species occurring in 30 to 170 m depth. It overwinters in deeper waters, migrating inshore in spring and summer forming large aggregations and spawning in sandy bottoms in 30 to 40 m depth (Jereb *et al.*, 2005).

The occurrence of *L. edulis* is reported for the first time from the north-west coast of India. Mohamed and Nagaraja (1991) have reported similar species of *Doryteuthis* from Mangalore coast.

The species entered the fishery in Mumbai waters probably from the year 2000 onwards but the catch

was very less. Over the years the landings increased in New Ferry Wharf and the peak landings were observed in 2011 (Fig. 3). The species were caught from about 30-40 m at 70-80 km north off Mumbai coast. They were observed in the catch almost throughout the year but were more pronounced during the period October – January. The Occurrence of *Doryteuthis* sp. is highly seasonal and is usually associated with the north flowing coastal current during November-December (Mohammed and Nagaraja, 1991). At Sassoon Docks (new jetty), heavy landing of *Loligo edulis* ranging in length between 90 to 229 mm was observed on 18th February 2011 (Fig. 4). The fishing ground was south of Mumbai in the depth range of 40-50 m. About 2 t was landed by a single trawler. Apart from *L. edulis*, the catch also comprised *L. duvauceli*.



Fig. 3. Landings of *Loligo edulis* at New Ferry Wharf



Fig. 4. Landings of *Loligo edulis* at Sassoon Docks

L. edulis morphologically resembles *L. duvauceli* and is distinguishable essentially by the arm sucker dentition. A comparative morphometric difference observed between the two species is given in Fig. 5 and 6. The arm III sucker ring teeth of *L. duvauceli* is broad and square (Fig. 7) while in *L. edulis* they are distinct, longer and slender square (Fig. 8). *L. edulis* is reddish in colour with concentrated chromatophores compared to *L. duvauceli*. According



Fig. 5. Dorsal view of *Loligo duvauceli* (above) and *Loligo edulis* (below)



Fig. 6. Ventral view of *Loligo duvauceli* (above) and *Loligo edulis* (below)

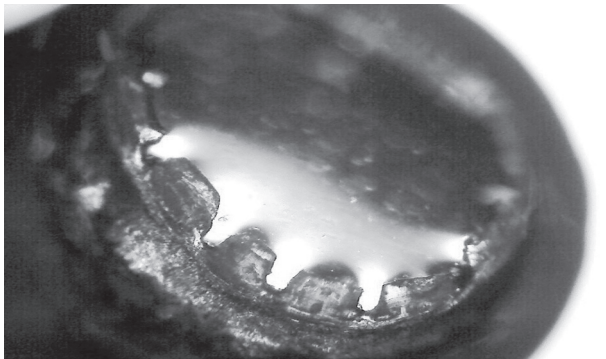


Fig. 7. Arm III sucker ring teeth of *L. duvauceli*



Fig. 8. Arm III sucker ring teeth of *L. edulis*

to Jereb and Roper (2006) there exists different 'forms' within the species, *L. edulis*. The species is characterised by marked polymorphism, both by locality and by season (Okutani *et al.*, 1987; Natsukari and Tashiro, 1991). Three forms were identified for this species by Sasaki (1929) with *L. edulis budo* Wakiya & Ishikawa, 1921 as one of the forms. According to Natsukari *et al.* (1988), they could be different seasonal 'forms' of the same species. Okutani *et al.* (1987) clearly pointed out that *L. edulis* is a species characterised with polymorphism by locality and by season within the range of its distribution. The species also shows the same polymorphism in Mumbai waters with the normal form in the winter months of November to February and the 'budo form' during the rest of the period.

Hundred and eight specimens of *L. edulis* were analysed for biological studies. The dorsal mantle length (DML) was measured using a digital caliper and total weight (± 0.01 g) was determined using an electronic balance after the specimens were dried on blotting paper. The measurements were taken as described in CMFRI manual (1995). The stomach condition was ascertained as per Kore and Joshi (1975). The food items were in well-crushed and macerated condition and therefore they were categorised into groups. The Index of preponderance was estimated as suggested by Natarajan and Jhingran (1961). Maturity studies were carried out as per Silas *et al.* (1985).

The dorsal mantle length of the species ranged from 59 to 251 mm (males 66 - 251 mm and females 70 - 155 mm) with the corresponding weight ranging from 82 to 250 g. As in all squids, for this species also the females are found to be smaller than males. According to Jereb *et al.* (2005) the maximum mantle length of *L. edulis* is 300 mm and in the 'budo form' the maximum mantle length is 250 mm. However, the maximum mantle length of the species landed at Mumbai was 251 mm. The common size in commercial catches is between 150 to 250 mm in Hong Kong (Jereb *et al.*, 2005) but in Mumbai waters they are commonly found in the size group 70 to 80 mm.

Majority of the guts were 'empty' or with 'trace' quantity of food in finely macerated condition. The species seems to mainly feed on 'fish' (90%) followed by 'prawn' (10%). According to Natsukari and Tashiro

(1991), the juveniles feed preferentially on 'crustaceans', whereas the main food for adults was found to be 'fishes'.

This species has a sex-ratio of 1:0.46 and 68.7% of the specimens analysed for the maturity studies were 'gravid' followed by 'mature' (31.3%) specimens. According to Natsukari and Tashiro (1991), the spawning season extends throughout the year, with three detectable peaks in spring, summer and autumn which also seems to be the case in Mumbai waters as gravid specimens are found almost throughout the year. Most specimens from Japanese waters reached full maturity by 150-200 mm. The smallest size recorded for full maturity was 52 mm and 59 mm for males and females respectively. *L. edulis* in the north-western part of the Indian Ocean

reaches sexual maturity at 70-80 mm (Shvetsova, 1974). The same trend was also observed in Mumbai waters with the smallest gravid females recorded at 70 mm. It was observed that *L. edulis* matured at a smaller size than *L. duvauceli* and the ova diameter of the species was also larger (up to 2 mm) than *L. duvauceli* and the fecundity ranged between 580 to 1620.

Some cephalopods are known to make seasonal migrations, which are influenced by breeding activity. It seems that in all probability this species may have come to nearshore waters for breeding. Regional distribution and relative abundance of different species of cephalopods have not been studied extensively along the Indian coast and therefore further efforts need to be taken in this direction.