

Sighting of *Thysanoteuthis rhombus* egg mass in Indonesian waters and observations of embryonic development

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The egg mass of the diamond-shaped squid, *Thysanoteuthis rhombus* (Oegopsidae: Thysanoteuthidae) was sighted in surface waters off south-east Sulawesi. It was a sinuous hollow tube-like structure about 2 m long and 0.15 m diameter. It was estimated to contain in the order of 180,000 purple eggs of 1 mm diameter with little or no yolk. Development of the embryos from early differentiation to hatching took between 47 and 57 h at about 28°C.

The egg mass was sighted in the Wakatobi Marine Reserve, Tukangbesi Islands, south-east Sulawesi on 4 April 1998. It was seen just below the surface in the deep water channel between Hoga Island and Kaledupa (005°28.33'S 123°45.34'E). Surface water temperature was 29°C. The species was identified as the diamond-shaped squid, *Thysanoteuthis rhombus* Troschel 1857, by M.R. Clarke from preserved embryos and paralarvae. *Thysanoteuthis rhombus* grows to 1 m in length and is a cosmopolitan species of tropical, subtropical and Mediterranean waters (Clarke, 1966; Nigmatullin et al., 1995).

The egg mass took the form of a hollow tube which moved sinuously in response to small water currents, unlike the firm egg masses described by Nigmatullin et al. (1995) and Guerra & Rocha (1997). The egg mass was at least 2 m long with an average diameter of 0.15 m. It had the appearance of a tightly coiled spring, tapering at one end (Figure 1A). Rows of purple eggs were set in double parallel strings of transparent colourless jelly (Figure 1B). From *in situ* photographs and measurements of live eggs, the egg mass was estimated to contain 180,000 eggs (compared with 35,000–75,000 given by Nigmatullin et al. (1995)).

A section of egg string containing about 30 eggs was collected and returned to land. Observations were made at intervals over an 84 h period at ambient temperature (daytime ~28°C) using a binocular microscope. Each egg measured 1 mm in diameter and was suspended in an individual egg sac. This dimension was maintained throughout development and at hatching the paralarva mantle length measured 1 mm. Observations of development are summarized in Table 1. All embryos developed at a similar rate though hatching was not synchronous.

Embryonic development of this species has been described previously by Sanzo (1929) and Sabirov et al. (1987). Stages of development described by Sabirov et al. (1987) give a time scale of between 3 and 7 d from organogenesis to hatching, compared with 2–2.5 d given in Table 1. Arnold (1965) described development of the yolked eggs of *Loligo pealii* assigning numbers 1–30 to the developmental stages. These stages have been applied where possible to the development of the *T. rhombus* embryos (Table 1). The eggs of *T. rhombus* appeared to contain little or no yolk and development was rapid (stages 16–30 taking 47–57 h) as compared with *L. pealii* (stages 16–30 taking ~200 h (Arnold, 1965)).

Table 1. Development of *Thysanoteuthis rhombus* embryos at intervals after initial observation at 0 h. (Interval between egg laying and initial observations is not known.)

Time (h)	Observations of embryo development	Stages (Arnold, 1965)
0	Purple eggs, undifferentiated, upper third with purple/brown pigment spots	16
6	Each embryo was spinning around its vertical axis, (spinning continued up until hatching)	
12	Some differentiation observed in lower part of embryos; bilateral symmetry evident	
16	Irregular pulsation of upper part (primordial mantle) of embryos was taking place	
20	Three transparent lobes could be seen projecting from below primordial mantle	
27	Primordial mantle pulsating regularly, about once every 5 s; the three transparent lobes were evident as two eye stalks, containing orange pigment, separated by a colourless funnel; four transparent projections observed at lower end of embryos (primordial arms and tentacles)	19/21
36	Eye development continued, pigment was becoming concentrated at distal end of eye stalks	
47	Small fins present, primordial suckers present on tentacles, ink sac and statoliths visible from ventral side; some hatching taking place	30
57	Most embryos had hatched; paralarvae settled to bottom of container, moving actively	30
84	No further development was observed after hatching	

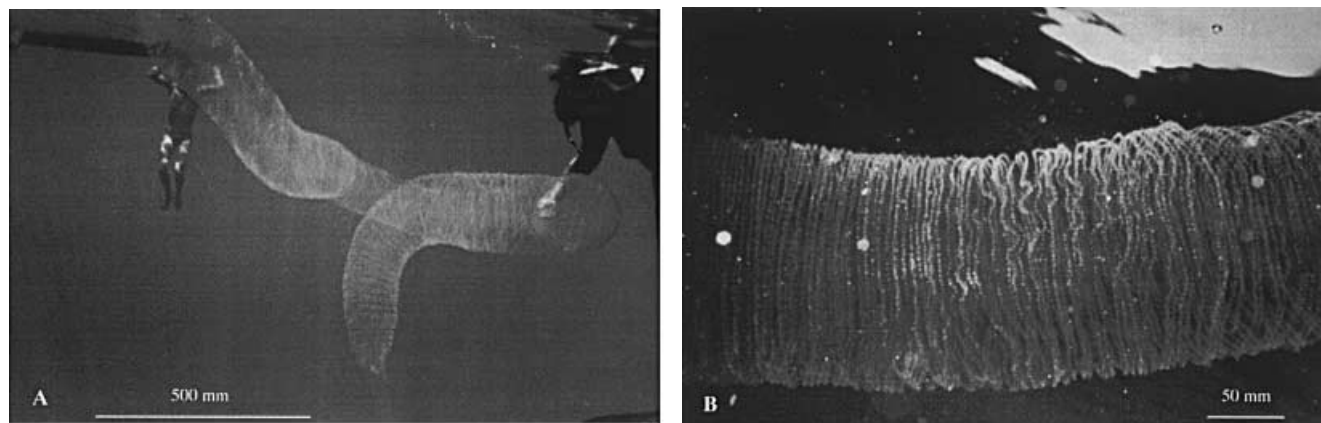


Figure 1. (A) Egg mass of *Thysanoteuthis rhombus* seen floating just beneath the sea surface. Mucus strands can be seen projecting from the tapering end. The faint banding seems to relate to groups of four egg strings (see B). (B) Detail of egg mass, photographed *in situ*, showing eggs set in double parallel strings of transparent jelly. (Photographs: V. Billings.)

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