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Observations on the mechanism of egg-capsule deposition in *Melongena corona* (Mollusca: Gastropoda) based on a time-lapse video

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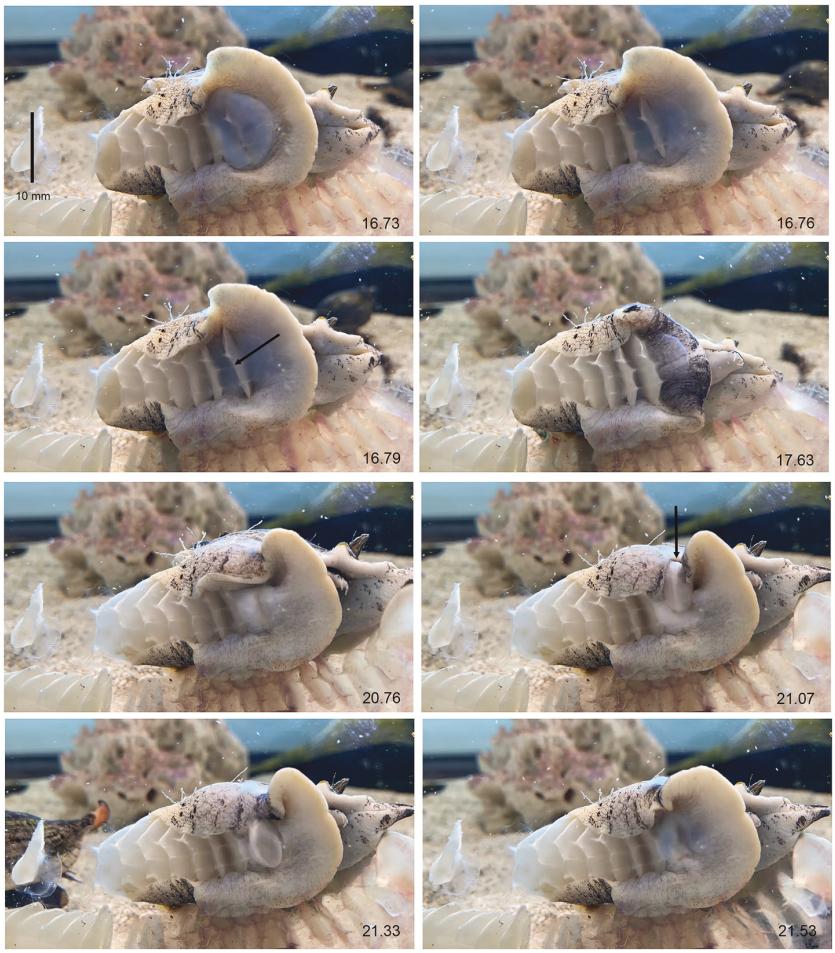

Melongena corona (Gmelin, 1791) is a common mollusk in southwest Florida, where it is found in mangroves, oyster reefs, and brackish water in general (Hathaway and Woodburn 1961). They are generalist predators, feeding on bivalves and gastropods, and may be cannibalistic and opportunistic scavengers (Hathaway and Woodburn 1961, Hayes and Karl 2009). Crown conchs lay their eggs in disk-shaped capsules deployed in strings, with each capsule attached to the hard substrate in succession by a short, ribbon-like peduncle. There are on average 12 capsules per string and 50–150 embryos per egg capsule (Hathaway and Woodburn 1961, Hooks and Burgess 2021). Eggs leave the female genital opening and are carried to the pedal gland via a groove located transversally on

the upper surface of the right side of the foot. The pedal gland is on the anterior part of the foot sole (Bingham and Albertson 1973). Not all hatchlings crawl away from egg capsules after emergence as larval pediveligers; some may retain their velar lobes, which they use to swim (Hooks and Burgess 2021). The egg capsule-deposition process in *M. corona* has been described in the past and illustrated using line drawings (Bingham and Albertson 1973), but that behavior is here recorded and interpreted for the first time using modern digital video resources. At the Bailey-Matthews National Shell Museum (BMNSM) aquarium facility, individuals of the species reside in a 398-gal touch-pool. The observations herein are based upon a time-lapse video of one female *M. corona* while attached to the touch-pool acrylic wall. The time-lapse video was shot via an iPhone 11 Pro Max using the standard Apple time-lapse feature. It is important to note that this video recorded the series of capsule-deposition out of order. First, the individual of *M. corona* is observed completing the end of the sequence for one capsule, then beginning a new sequence.

Time-lapse video allowed us to drastically speed the video up to better visualize and portray the basic mechanism of egg-capsule deposition. The time-lapse segment was recorded for 113 min, or 6780 sec, but plays for a condensed 27.28 sec (units on the image are seconds). Since the whole clip was shot using the phone's time-lapse feature, the playback frame rate (projection frame rate) for that segment is the Apple standard rate of 30 frames per second (fps), which yields a total number of 818 frames for the duration of the segment. To achieve the projection rate of 30 fps at 27.28 sec, the application adjusted the original camera frame rate to the final number of frames divided by the original recording time 818/6780 = 0.12 fps, the equivalent to intervals of 8.29 sec between successive frames. The video is available from: https://youtu.be/xv203ReLupE.

The time markers that follow are indicated on each of the eight images above. In the video clip, first movements occur at 16.73 sec; these comprise the end of the deposition sequence for one capsule. The animal remains motionless while the capsule develops inside its pedal gland. At 16.79 sec, the snail expels the capsule at its final placing distance (arrow) from the capsule that precedes it, thus ending the sequence of that capsule attachment to the acrylic wall. Once the egg capsule is expelled, the animal rests and does a "pedal lick" (Bingham and Albertson 1973), thus signaling, at 17.63 sec, the beginning of a new capsule attachment sequence. The pedal lick prepares the substrate for capsule attachment. The still-soft peduncle portion of the capsule can easily be seen coming out of the pedal gland. At 20.76 sec, the snail's anterior portion of the right side of the foot sole becomes constricted and develops a well-defined egg groove. By 21.07 sec, an oval, soft packet of eggs (arrow) can be seen moving through the groove to enter the pedal gland at 21.33 sec. At 21.53 sec, the egg packet is completely inside the pedal gland. The soft egg capsule is oriented within the pedal gland and its base is pressed against the aquarium wall. After calculation of the playback frame rate, we determined the actual lengths of different phases of the capsule-deposition process. The pedal lick lasts for 184.0 sec, the constriction of well-defined groove to egg packet lasts for 504.8 sec, and the transfer of egg packet through groove into pedal gland lasts at least 181.5 sec.

Based on the interval between the start of the clip and the initial capsule-deposition motions, the time it takes for one egg packet to be encased by a capsule inside the pedal gland is at least 69.3 min. These times are generally consistent with previous observations of egg-capsule deposition in *M. corona* made by Bingham and Albertson (1973).

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