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Registered Office: 3A2 Varadarajulu Nagar, FCI Road, Ganapathy, Coimbatore, Tamil Nadu 641006, India  
Ph: +91 9385339863 | [www.threatenedtaxa.org](http://www.threatenedtaxa.org)  
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Cover: Coromandal Sacred Langur *Semnopithecus priam* - made with acrylic paint. © P. Kritika.



## A novel anti-predatory mechanism in *Indrella ampulla* (Gastropoda: Ariophantidae)

Karunakar Majhi<sup>1</sup> , Maitreya Sil<sup>2</sup> & Aniruddha Datta-Roy<sup>3</sup>

<sup>1,2,3</sup>National Institute of Science Education and Research (NISER), P.O. Jatni, Dist. Khurda, Odisha 752050, India.

<sup>1</sup>karunakar.majhi@niser.ac.in (corresponding author), <sup>2</sup>maitreya.sil@niser.ac.in, <sup>3</sup>datta.roy@niser.ac.in

*Indrella ampulla* (Benson, 1850) is a large-bodied terrestrial air-breathing gastropod mollusc belonging to the family Ariophantidae. It is endemic to the Western Ghats of peninsular India (Benson 1850; Blandford and Godwin-Austen 1908). *Indrella* is a monotypic genus comprising of polymorphic variants spatially separated across the Western Ghats. It is generally found in the wet evergreen forests and different plantations areas of the central and southern Western Ghats (Narayanan & Aravind 2021).

In this note we report the smearing behaviour as a novel anti-predatory strategy followed by these large gastropods as an extension of the frothing behaviour reported earlier. Three individuals of *Indrella ampulla* (two yellow morphs and one orange morph) were observed after agitating them by hand on 25 June 2022 at 12:44 h and 14 July 2022 at 15:41 h. All three individuals were fairly aggressive in terms of their defence mechanism by producing froth along with a slimy secretion to cover their shell. The observations were made in Wayanad in the state of Kerala (11.5144°N and 76.0389°E, 838 m) and in Coorg in the state of Karnataka (12.2283°N and 75.6542°E, 1,088 m) in India. All the observations were made on private properties.

The observations were made while assessing the

microhabitat preference of land snails in the Western Ghats. Two of the individuals (yellow morph of *Indrella ampulla*) were agitated by hand in Lakkidi to observe their behaviour when subjected to stress; these individuals were found on different substrates – one on a rock and the other on a tree trunk. We observed that both individuals secreted foam that was viscous and sticky in nature. Upon detection of physical stress, the individuals stopped their movement and started smearing their slime on their shell with the tail end of their body until the potential threat was over (Figure 1; see Video 1). Such response was only observed upon overstimulating the animal. The source of the secreted foam was observed to be the surface of the mantle mucus cells (Rollo & Wellington 1979) (Image 1; Video 2). A similar behaviour was also observed in case of the orange individual in Coorg. The agitation experiments were performed by KM in all three cases.

Frothing behaviour was earlier reported as a defence mechanism in the red morph of *Indrella ampulla* during an observation of a cane turtle feeding on one of the individuals (Deepak & Vasudevan 2009). Here for the first time, we observed similar occurrences in the yellow and the orange morph as well. Foaming as an anti-predatory strategy was also reported earlier in

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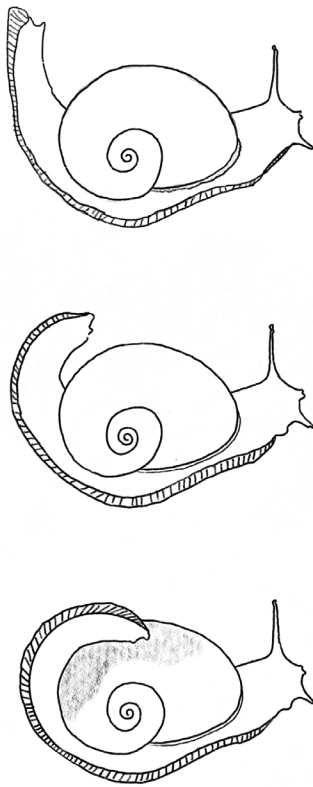


Figure 1. Diagrammatic representation of an Individual of *Indrella ampulla* trying to smear its slime on its shell by using the tail end of the body. © Karunakar Majhi

several other species of terrestrial gastropods such as *Helix pomatia* (Pollard, 1975), which when attacked produced a copious amount of froth. Exudation of slime is also studied in many slugs such as *Arion fasciatus* and *Deroceras reticulatum*, the sticky slime makes slugs a difficult prey (Pakarinen 1994; Mair & Port 2002). Certain other species of terrestrial snails such as *Karftohelix editha* and *Karftohelix gainesi* swing their shells in order to get rid of the predators (Morii et al. 2016). *Ovachlamys fulgens*, also known as the jumping snail, propels (jump) its body when disturbed (Teixeira et al. 2017). *Cantareus apertus* rocks its shell back and forth to produce sound (Wenger 2014).

In case of *Indrella ampulla*, smearing the slime over the shell with the tail also serves as a defence mechanism, potentially covering the animal completely with slime to deter predators. It is a large-bodied semi-slug like animal which requires an effective strategy to avoid predation since it cannot retract its entire body into the shell to protect itself. Similar observation and assessing the nature of the secretion and the trait governing it may also provide important insights to the mechanisms of defence.



Image 1. Two individuals of *Indrella ampulla* producing foam after being disturbed. © Karunakar Majhi





Video 1. An Individual of *Indrella ampulla* spreading its slime on its shell. © Karunakar Majhi.



Video 2. An individual of *Indrella ampulla* secreting foam from the surface of the mantle. © Karunakar Majhi.

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Tamil Nadu 641006, India  
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