

Movement patterns of the epizoic limpet *Lottia tenuisculpta* on two host snails *Omphalius nigerrimus* and *Reishia clavigera*

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ABSTRACT

The tiny epizoic limpet *Lottia tenuisculpta* lives on rocky surfaces and shells of the snails *Omphalius nigerrimus* and *Reishia clavigera*. The movement patterns of the limpet on host snails was observed during 24 h under controlled laboratory conditions. A specific behaviour, referred to as returning behaviour and reminiscent of homing behaviour, was observed in seven out of 20 individuals, and two out of 15 individuals on *O. nigerrimus* and *R. clavigera*, respectively. Rotation behaviour, in which limpets changed the direction of the body by one hundred and eighty degrees without changing the position on host snails, was also observed very frequently (17 out of 20 individuals on *O. nigerrimus* and 10 out of 15 and *R. clavigera*). This is the first report of such a behaviour. The potential role of this behaviour in creating home scars is discussed.

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Introduction

Patellogastropod limpets are among the most common inhabitants of intertidal rocky shores from tropical to polar regions (Nakano & Sasaki 2011). They play important roles in littoral marine ecosystems (Branch 1985a, 1985b), as they are ecologically diversified and can be found on various substrates, such as limestone (Lindberg & Vermeij 1985; Kiersdale & Meyer 2004), coralline algae (Sasaki & Tanani 1993a, 1993b), sunken wood (Manahan 1995), whale bone (McLean 2008) and other molluscs (Morton 1980; Nakano et al. 2009). Limpets living on other invertebrates are known to be commensal or epizoic, and have evolutionary and ecological interest.

Until the 1990s, epizoic limpets were intensively studied. The most documented epizoic limpets, i.e., *Lottia asini* (Lindbergh, 1847) and *Patelloida mufria* (Hedley, 1901) are distributed in the Northwestern Pacific and Australia, respectively. The former is found almost exclusively on *Tegula funebris* (A. Adams, 1850) (Carlton & Roth 1975; Abbott & Haderlie 1980) and the latter on *Austrocochlea constricta* (Lamarck, 1822) (Mapstone et al. 1984). Various aspects of their ecology have been extensively studied, such as substrate preference (Ekenberry & Wickizer 1964; Allemen 1968), position on host shells (Ekenberry & Wickizer 1964; Mapstone et al. 1984; Evans 1992), food availability (Ekenberry & Wickizer 1964; Mapstone et al. 1984), desiccation and predation (Mapstone et al.

1984). However, the movement behaviour of epizoic limpets on their host snails has been far less studied, and knowledge remains fragmentary. For instance, *Lottia asini* is considered to change host snails relatively frequently, based on evidence that this species rarely spent more than 24 h on the same host snail (Test 1945), changed from host snail at least once during 13 h (Ekenberry & Wickizer 1964), and typically changed host snails 5–20 times over a 27-day period (Lindberg 1990). The position of epizoic limpets on their host shells has also been considered and is likely to be influenced by shell morphology, behaviour and ecology of limpets and host snails. *Patelloida cornus* (Dunker, 1861) is almost always found on the back of the host snail *Stellaria* spp. above the aperture (Morton 1980). *Patelloida nigrosulcata* (Reeve, 1855), which are found on *Haloris rovi* (Gray, 1826) and *Scutellaria latissimata* (Blainville, 1825) (Wells & Keating 1988; Schweibling et al. 1990), sometimes occur in pairs, where larger (primary) individuals form home scars and forage over most of the area on the host shell while smaller (secondary) individuals are essentially restricted to marginal refuges due to intraspecific competition (Schweibling et al. 1990).

Recently, a small (typically less than ~1 cm) Japanese limpet *Lottia tenuisculpta* Sasaki and Okutani, 1994 has attracted notice as an epizoite (Nakano et al. 2020). The species occurs on rocky surfaces as well as on the shells of *Omphalius nigerrimus* (Gmelin, 1791) and *Reishia clavigera* (Küster, 1860) in the