

One, two, or many species? Morphological and genetic analyses of vent and seep pectinodontid limpets reveal extreme morphological plasticity

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Chemosynthetic ecosystems harbour rich megafauna communities, of which gastropod molluscs comprise a major component and have received considerable taxonomic efforts. Pectinodontid limpets, characterised by a white shell with cancellate sculpture and a radula with a single trifurcating lateral teeth on each side, are a common constituent of vents and seeps in the western Pacific. Thus far, two genera (*Bathyacmaea* and *Serradonta*) totalling eight species have been described based on shell and radula characteristics. However, no data on their intraspecific variation or genetic characterisation have been published. In the present study, numerous pectinodontid specimens from Sagami Bay and Okinawa Trough were investigated morphologically, revealing great disparity in both shell and radula in each locality, rendering existing species and even genera boundaries questionable. Changes in shell form according to substrate shape was confirmed through live-rearing in a controlled aquarium. Furthermore, phylogenetic and population genetic analyses of *Bathyacmaea* and *Serradonta* specimens from Sagami Bay to the South China Sea clearly demonstrated that most specimens belonged to one single molecular operational taxonomic unit regardless of their morphological affinity. Although a number of individuals from Minami-Ensei and Hatoma Knoll fields in Okinawa Trough were found to be genetically divergent, these did not exhibit obviously morphological differences and are likely cryptic. Altogether, these results strongly suggest that most (if not all) currently described vent and seep pectinodontids are actually mere forms of a single extremely morphologically plastic species. As a case study, the present study serves to raise awareness against splitting and describing species solely based on hard part morphology without carefully assessing the reliability of characteristics used.

Keywords: Hydrothermal vent, Cold seep, Mollusca, Morphological plasticity, Taxonomy, Population genetics

