

Introduced Helicidae Garden Snails in Australia: Morphological and Molecular Diagnostics, Species Distributions and Systematics

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ABSTRACT. There is a large number of Helicidae land snails native to the Western Palearctic, many of which have become invasive species in other parts of the world. In the past, multiple helicid species were introduced to Australia where they can now be major agricultural and horticultural pests. Determining which species have become established is essential for effective biosecurity and pest management. Here we have shown that three helicid species currently occur in Australia: Brown (*Cornu aspersum* Müller), Green (*Cantareus apertus* Born) and White (*Theba pisana* Müller) Garden Snails. A fourth formerly present species, the Chocolate Banded snail (*Eobania vermiculata* Müller) appears currently to be locally extinct. All four of these species are known to be highly invasive worldwide. Our study assessed the effectiveness of employing DNA barcoding for identification of garden snails in Australia through characterising DNA sequences of the mitochondrial Cytochrome Oxidase I and nuclear ITS2 loci. We were able to distinguish all four species, as well as other commonly intercepted Helicidae species. DNA sequences and diagnostic images of the helicid garden snails currently found in Australia have been added to the Barcode of Life Database (BOLD), as project AMPH (Australian Mollusc Pests—Helicidae), to aid in the identification of intercepted specimens, morphologically ambiguous individuals, or small juvenile specimens. We also examined the diagnostic morphological characters (juvenile and adult) that can be used to identify these species (including an illustrated key), and summarize relevant systematic and nomenclatural changes. We also provide the first specimen records for Green Garden Snails in eastern Australia, where they were previously unknown and may become a serious plant pest.

KEYWORDS. Land snails; Helicidae; introduced pests Australia; morphology; DNA barcoding; diagnostics; biosecurity.

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