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## Molecular and morphological assessment of *Delma australis* Kluge (Squamata: Pygopodidae), with a description of a new species from the biodiversity ‘hotspot’ of southwestern Western Australia

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### Abstract

The Australian pygopodid lizard genus *Delma* is characterised by morphologically conservative but genetically divergent lineages and species. An initial assessment of molecular and morphological variation in *Delma australis* Kluge, 1974 throughout its main distribution in Western and South Australia reveals at least two undescribed species that are presently included under this epithet. Here we describe the most distinctive and easily diagnosed taxon of these, *D. hebesa* **sp. nov.**, from the proteaceous scrub and mallee heath on the south coast sandplains of southwestern Western Australia. We also foreshadow the need for an expanded genetic framework to assist in unequivocally diagnosing additional candidate species in *D. australis*, which is redescribed herein and shown to be monophyletic for those specimens sampled, albeit displaying geographic variation in a range of molecular and morphological characters. *Delma hebesa* **sp. nov.** differs from all other described *Delma* species, including regional populations of *D. australis*, by a combination of molecular genetic markers, colouration and scalation. Based on phylogenetic affinities and shared morphologies, a *D. australis* species-group is proposed to accommodate *D. australis*, *D. torquata* and the new species described herein. The addition of another new vertebrate species from southwestern Western Australia, recognised globally as a biodiversity ‘hotspot’, underlines our lack of understanding of genetic diversity and evolutionary histories in this biodiverse region.

**Key words:** Esperance Plains, heath, *Delma hebesa* **sp. nov.**, endemism, taxonomy, DNA divergence, allozyme electrophoresis

### Introduction

There are currently 43 described species of pygopodid lizards known from Australia (Wilson & Swan 2013; Maryan *et al.* 2013a, 2013b). The most diverse genus is *Delma* Gray, 1831 which was last comprehensively revised by Kluge (1974) who described eight new species including *D. australis*. Since that time, several additional species and subspecies have been described (Shea 1987; Storr 1987; Shea 1991; Maryan *et al.* 2007), bringing the current tally to 21 species. In addition, a molecular phylogenetic study of pygopodid lizards has also provided an evolutionary framework for the genus and its relatives (Jennings *et al.* 2003). Despite these advances, knowledge of the taxonomy of the morphologically conservative genus *Delma* is far from complete (Shea 1987; Aplin & Smith 2001).

*Delma australis* as currently circumscribed is widespread across southern Australia, inhabiting a variety of semi-arid to arid habitats in Western Australia (W.A.), South Australia (S.A.), Victoria (Vic.) and New South Wales (N.S.W.) (Kluge 1974; Ehmann 1992; Wilson & Swan 2013). Geographic variation has been observed in the

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**APPENDIX.** Additional material examined. Unless otherwise indicated all localities are in Western Australia and South Australia, Australia. Also included in one or more of the molecular analyses are indicated (both \*DNA and ^allozyme analyses; #DNA only; ^^allozymes only).

*Delma australis* WAM: 12604, Wagin, (33°19'S 117°21'E); 30706, 30749, 12 km E of Fraser Range, (32°02'S 122°55'E); 36229, Pine Hill, (33°18'S 123°23'E); 53461, Newman Rock, (32°07'S 123°11'E); 57909, 11.5 km NE of Charlina Rock, (32°33'S 123°26'E); 58045, Clear Streak Well, (32°29'S 122°24'E); 59745, 20 km ESE of Mount Newmont, (32°59'S 123°18'E); 66844, Coragina Rock, (32°55'S 123°30'E); 66999–00, 13 km W of Eyre Homestead, (32°15'S 126°10'E); 67369, 14 km E of Hyden, (32°27'S 119°00'E); 72505, 11.5 km NE of Buningonia Spring, (31°20'30"S 123°37'00"E); 77765, Toolina Rockhole, (32°45'05"S 124°58'50"E); 94091, 25 km NW of Toolina Rockhole, (32°35'S 124°48'E); 94092, 7 km NW of Toolina Rockhole, (32°42'30"S 124°55'00"E); ^^112665 'northern', 11.5 km NE of Buningonia Spring, (31°20'30"S 123°37'00"E); ^^112666 'southern', Ponier Rock, (32°56'S 123°30'E); 112667, Ponier Rock, (32°56'S 123°30'E); \*^116276 'southern', 22 km S of Kalbarri, (27°51'S 114°10'E); 116277, 22 km S of Kalbarri, (27°51'S 114°10'E); 116744, 5 km W of Overlander Roadhouse, (26°24'S 114°25'E); 117102, 23 km ESE of Overlander Roadhouse, (26°36'S 114°32'E); ^^117388 'southern', 25 km S of Woolgangie, (31°23'16"S 120°33'13"E); 117389, Toomey Hills, (31°33'26"S 119°51'38"E); ^^119002 'southern', 4 km SSE of Boorabbin, (31°14'12"S 120°19'50"E); ^^120886 'southern', Nerren Nerren Station, (27°00'21"S 114°47'57"E); 122450, 24 km WSW of Hamelin Homestead, (26°31'21"S 114°00'09"E); ^^122613 'southern', 6 km SW of Meedo Homestead, (25°42'38"S 114°35'58"E); ^^123583 'northern', 53 km NNW of Kalbarri, (27°15'33"S 114°04'03"E); 126345, Aurora Range, (30°21'16"S 119°42'09"E); ^^127370 'southern', Higginsville, (31°45'S 121°45'E); ^^129773–76 'southern', 22 km S of Kalbarri, (27°51'S 114°10'E); ^^131015 'northern', 22 km WSW of Hamelin Homestead, (26°31'S 114°00'E); ^^131778 'southern', 12 km WNW of Wandina Homestead, (27°56'S 115°32'E); #132470, Shothole Canyon, Cape Range National Park, (22°03'S 114°01'E); ^^135108 'southern', Bullabulling, (30°51'59"S 120°54'24"E); 135196, Camel Soak, (29°26'S 116°48'E); ^^136283 'southern', Muggon Station, (26°46'44"S 115°37'40"E); ^^136406–07 'southern', Norseman area, (32°12'S 121°47'E); \*^137675 'northern', 74 km NW of Balladonia Roadhouse, (32°02'S 122°55'E); ^^137676 'northern', 74 km NW of Balladonia Roadhouse, (32°02'S 122°55'E); 144087, 5 km E of Cunderdin, (31°39'S 117°17'E); ^^144587 'southern', Windarling Hill, (29°59'53"S 119°16'05"E); #144732, Bungalbin Hill, (30°19'S 119°29'E); R151125, Eyre Bird Observatory, (32°13'28"S 126°18'10"E); 151210, Salmon Gums area, (32°49'12"S 121°24'36"E); 151218, Salmon Gums area, (32°49'59"S 121°24'50"E); ^^151219 'southern', Salmon Gums area, (32°49'59"S 121°24'50"E); ^^152638 'southern', Middle Island, Houtman Abrolhos Islands, (28°54'35"S 113°54'53"E); ^^156274 'southern', 40 km NE of Holt Rock, (32°24'50"S 119°41'22"E); ^^166866 'southern', Oakajee, (28°34'25"S 114°35'04"E).