

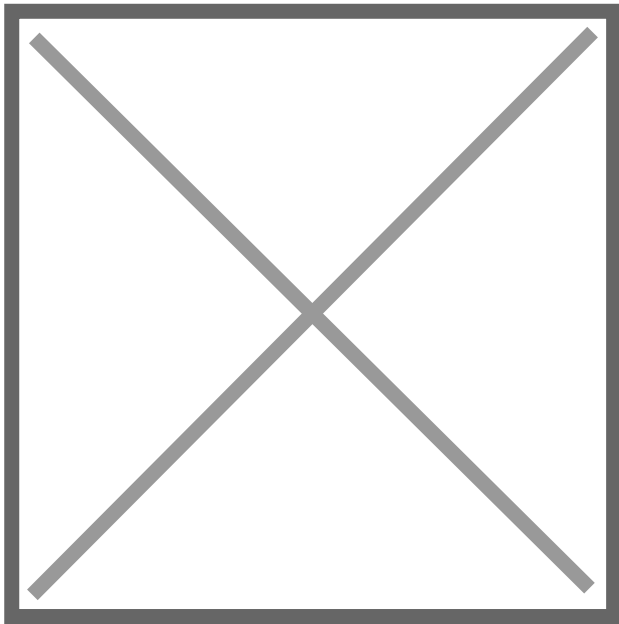
# Pedipalp anatomy of the Australian black rock scorpion, *Urodacus manicatus*, with implications for functional morphology

Pedipalp anatomy of the Australian black

A thorough investigation of the anatomy and morphology of the pedipalps the Australian black rock scorpion, *Urodacus manicatus*

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The pedipalps in scorpions are important for prey capture, defense and reproduction. Russel Bicknell and co-workers recently published a thorough investigation of the anatomy and morphology of the pedipalps the Australian black rock scorpion, *Urodacus manicatus* (Thorell, 1876) (Scorpionidae) and related these to the behavioral use of them.

**Abstract:**

Pedipalps – chelate ‘pincers’ as the second pair of prosomal appendages – are a striking feature of scorpions and are employed in varied biological functions. Despite the distinctive morphology and ecological importance of these appendages, their anatomy remains underexplored. To rectify this, we examined the pedipalps of the Australian black rock scorpion, *Urodacus manicatus*, using a multifaceted approach consisting of microcomputed tomography, scanning electron microscopy, energy dispersive X-ray spectroscopy, and live pinch force measurements. In doing so, we document the following aspects of the pedipalps: (1) the musculature in three dimensions; (2) the cuticular microstructure, focusing on the chelae (tibial and tarsal podomeres); (3) the elemental construction of the chelae teeth; and (4) the chelae pinch force. We recognise 25 muscle groups in *U. manicatus* pedipalps, substantially more than previously documented in scorpions. The cuticular microstructure – endo-, meso-, and exocuticle – of *U. manicatus* pedipalps is shown to be similar to other scorpions and that mesocuticle reinforces the chelae for predation and burrowing. Elemental mapping of the chelae teeth highlights enrichment in calcium, chlorine, nickel, phosphorus, potassium, sodium, vanadium, and zinc, with a marked lack of carbon. These elements reinforce the teeth, increasing robustness to better enable prey capture and incapacitation. Finally, the pinch force data demonstrate that *U. manicatus* can exert high pinch forces (4.1 N), further highlighting

the application of chelae in subduing prey, as opposed to holding prey for envenomation. We demonstrate that *U. manicatus* has an array of adaptations for functioning

**Reference:**

Bicknell RD, Edgecombe GD, Goatley CH, Charlton G, Paterson JR. Pedipalp anatomy of the Australian black rock scorpion, *Urodacus manicatus*, with implications for functional morphology.

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