Cremnophilous succulents of southern Africa: diversity, structure and adaptations

by

Ernst Jacobus van Jaarsveld

Submitted in partial fulfilment of the requirement for the degree

Philosophiae Doctor

in the Faculty of Natural and Agricultural Sciences
(Department of Plant Science)

University of Pretoria

Pretoria

Promoter: Prof. Dr. A.E. van Wyk

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Othonna cremnophila [88], from south-facing cliffs of the Rosyntjieberg, Richtersveld, Northern Cape. Artist: Jeanette Loedolff.

DECLARATION

I, Ernst Jacobus van Jaarsveld, declare that the thesis that I hereby submit for the degree Philosophiae Doctor at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Signature: .....

Date: 9 July 2011

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ABSTRACT

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The vertical cliff-face habitat is renowned for many specifically adapted plant species that exhibit a high degree of local endemism. Over a period of nine years the succulents and bulbous succulents on cliff faces in South Africa and Namibia were systematically surveyed and documented. Distinction was made between succulents growing on cliffs as part of a wider habitat and those found only on cliffs (obligate cremnophytes). Most major cliff-face habitats in the study area were visited and all plants were documented. A check list and descriptions (including adaptive traits) of the 220 obligate cremnophilous taxa are provided.

During the study some 45 new cremnophilous succulent taxa were discovered and named, representing almost 20% of the total and proving that cliff habitats are some of the least studied environments, not only in southern Africa but globally. Among the newly described cremnophilous taxa is the genus *Dewinteria* (Pedaliaceae).

Using stem length, three basic cliff-face growth forms are identified—compact or cluster-forming ‘cliff huggers’, cliff shrublets or ‘cliff squatters’ and pendent ‘cliff hangers’. Compact growth (often tight clusters or mats) is mainly associated with the winter-rainfall

Succulent Karoo and Thicket regions, especially Namaqualand. However, further north the same compact growth forms are associated with an increase in altitude such as the Drakensberg Escarpment and other northern mountains. Most pendent growth forms are associated with the eastern and southeastern summer-rainfall regions; a number of smaller pendent shrublets occur on the high quartzitic sandstone mountains of the Western Cape. The degree of specialisation varies from highly adapted (smaller percentage) to less specialised (often eco-forms), and some taxa have no obvious adaptations.

This study revealed a general increase in succulence in most obligate cremnophilous succulent species (compared to closely related species in other habitats), a reflection of their xeric habitat, and plants tend to be more compact. Also, there is a shift in reproductive output, including an increase in vegetative reproduction (backup), wind-dispersed seed and enriched flowering associated with certain species. Most obligate cremnophilous succulent plants in the study area have cliff-adapted features, ensuring long-term survival.

Keywords: adaptations, biogeography, cliff-adapted features, cliff face, cremnophytes, ecology, evolution, flora, specialisation, succulent plants.