Ions pattern of desert succulents from the Succulent Karoo, South Africa - Can we link ecophysiology and phylogeny?

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The Succulent Karoo, a winter rainfall desert in north-western South Africa, is a hotspot of biodiversity with a large number of succulent species. The major succulent families are the Aizoaceae, Apocynaceae, Aspodelaceae and Crassulaceae. These succulents have developed various integrated and co-adapted morphological and ecophysiological features that maximise their chances of surviving the detrimental conditions in arid habitats. Crassulaceen Acid Metabolisms (CAM) is a common feature in various southern African succulent plant families. Especially in the Aizoaceae the evolution of photosynthetic pathways can be linked to their phylogeny [1].
From a comprehensive screening programme it can be shown that the species of the Aizoceae shows the highest sodium chloride accumulations [2]. The ions accumulation is closely related to the development of leaf and stem succulence. The most interesting feature is that succulents with high salt accumulation expend less energy and hence carbon to envelope one unit water than succulents with low salt content (e.g. in Aizoaceae, subfamily Mesembryanthemoideae).
From the investigations we can conclude that in the Aizoaceae a correlation between the evolution of plant functional types and ecophysiology within the same family obviously exits. Species of the genus *Brownanthus* (Aizoaceae, subfamily Mesembryanthemoideae) are typical stem succulents with 12 species in the Succulent Karoo and southern Namib. In the Richtersveld *B. pseudoschlichtianus, B. aerenosus, B. pubescens* and *B. marlothii* growing on sandy, loessial and highly saline soils at the coast, respectively [3]. A survey of ion characteristics of the four species growing on different soil types showed a high accumulation of Na and Cl, which is typical also for halophytic species in the Aizoaceae and other plant families. However, the lowest Na and Cl content can be found in *B. marlothii* (Na: 2145, K: 372, Cl: 583 mmol kg^{-1} dw) growing on saline soils at the coast and *B. pubescens* (Na: 3557, K: 179, Cl: 723 mmol kg^{-1} dw). Both are sister species [3]. Surprisingly, the highest accumulation of ions were observed in *B. aerenosus* (Na: 4840, K: 657, Cl: 1275 mmol kg^{-1} dw) growing on sand dunes. The storage of water in the leaves is positivly correlated with the salt accumulation (e.g. water content in *B. marlothii* 4.02 kg water kg^{-1} dw and in *B. aerenosus* 9.11 kg water kg^{-1} dw). In summary, like other succulents from the Aizoaceae, *Brownanthus* develops a genetic fixed ion pattern, which can be related to their phylogeny [3].

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