



The relationship and different C₄ Kranz anatomy of *Bassia eriantha* and *Bassia eriophora*, two often confused Irano-Turanian and Saharo-Sindian species

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Abstract

The circumscription and generic status of *Bassia eriantha* (\equiv *Londesia eriantha*) and *B. eriophora* have often been confused in the literature. The reason is their extreme superficial similarity and phenology. In a multidisciplinary approach, we investigated both in the field, by cultivation in the laboratory, and performed anatomical, ultra-structural and molecular studies to clarify their taxonomy and relationships. Both species are not only geographically and morphologically distinct by reliable and constant characters, but surprisingly also have different anatomical C₄ Kranz types and occur in different clades using ITS nrDNA sequence analysis. Using the recent broad circumscription of the genus *Bassia* they belong to *Bassia* but in different clades. In spite of their rather well distinct geography, the two species are sympatric in the south-eastern Iran and south Afghanistan. *Bassia eriantha* as an Irano-Turanian species occurs disjunctly as Irano-Turanian enclave in south Sinai, Jordan and W Saudi Arabia as a second sympatric range co-occurring with *B. eriophora*.

Key words: Amaranthaceae, bundle sheath, C₄ photosynthesis, Camphorosmeae, Chenopodiaceae, halophyte, phylogeny

Introduction

The increasing interest in the evolution of C₄ photosynthesis pathway requires taxonomic studies within C₄ taxa and their C₃ relatives. Chenopodiaceae represents one of the major lineage of C₄ diversity among Eudicots having a multiple origin of C₄ photosynthesis and a high morpho-anatomical variability (Akhani *et al.* 1997, Kadereit *et al.* 2003, Sage *et al.* 2011). In Eurasia this family is diversified extensively in the Middle East, Central (uplands) and especially Middle Asia (lowland around the Aral sea and Turan), and to some extent also in North and South African deserts, with a great success in formation of vegetation under harsh, dry and saline conditions and during very hot growing seasons. Camphorosmeae Endlicher (1837: 294), that is alternatively considered as subfamily Camphorosmioideae Scott (1978: 102), is a species-rich group which classification of this lineage has always been controversial in the literature of this family (Scott 1978, Kühn *et al.* 1993). A recent molecular investigation of this tribe (Kadereit & Freitag 2011) proposed a new classification in which *Bassia* Allioni (1766: 177) is widely circumscribed by including several mono- and oligo-specific genera such as *Kochia* Roth (1801: 307), *Londesia* Fischer & Meyer (1835: 40), *Pandertia* Fischer & Meyer (1835: 46), *Kirilowia* Bunge (1843: 7) and *Chenoleoides* (Ulbrich 1934: 530) Botschantzev (1976: 1408). One of the species listed is *Bassia eriophora* (Schrader 1809: 86) Ascherson (in Schweinfurth 1867: 187) which was broadly circumscribed more recently (see below) and includes *L. eriantha* Fischer & Meyer (1835: 40) or *B. eriantha* (Fisch. & C. A. Mey.) Kuntze (1891: 546).

Bassia eriophora was first described based on a cultivated plant under the genus *Kochia* (Schrader 1809). The origin of the seeds was doubtfully mentioned as Spain which, considering its known range, is unlikely. The illustration and description are fully informative and cannot be confused with any other plant. *Kochia*