

1.2 = PLANT ADAPTATION TO DROUGHT: EVIDENCE AND MORPHO-ANATOMICAL DIVERSITY IN *KALI* SPECIES (AMARANTHACEAE) FROM INLAND AND COASTAL SITES

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Plants in their natural environments are exposed to a variety of ecological factors that can act as stressors and constraint plant survival and renewal. Adaptation of a plant to different environment conditions, especially when harsh and fluctuating, involves patterns of functional traits (life cycle, growth rate, morpho-anatomical features, reproductive strategies) that may determine the differential success of any species.

Sandy shorelines, foredunes and salt-marshes represent very selective habitats where only specialized plants having particular morpho-anatomical and functional characteristics can cope with extremely detrimental growth factors, including variations in water availability (physical and physiological drought), soil salinity and fertility, intense heat and radiation, highly alternating temperatures.

The genus *Kali* comprises 21 annual species, previously belonging to *Salsola* sect. *Kali* Dumort. (1). Some of them are autochthonous of the sandy coasts of the Mediterranean and Atlantic European territories where they represent true psammophytes [*Kali turgidum* (Dumort.) Guterm. (previously *Salsola kali* L.), *K. tragus* (L.) Scop., *K. ponticum* (Pall.) Sukhor. *et al.*, *K. dodecanesicum* Brullo *et al.*], other *Kali* species are found in the Asiatic steppes and deserts, as well as in natural and ruderal habitats or infesting the crops [*K. tragus*, *K. australis* (R. Br.) Akhani & Roalson], or also linked to synanthropic stands [*K. basalticum* Brullo *et al.*, *K. ryanii* (Hrusa & Gaskin) Brullo & Hrusa] (2).

These species share common features which are distinctive of the genus, stems rigid, not articulate, cortex green to greenish-red, with longitudinal chlorenchymatous striae, leaves linear-cylindrical, broadened at base, provided with apical spine, bracts similar to the leaves, but smaller, membranaceous perianth of 5 free segments, fruiting perianth usually winged, provide with unequal rudimentary abaxial appendices, membranaceous fruits, above flattened.

Notwithstanding, *Kali* species diverge in different combinations of morphological and anatomical characters, mainly regarding gross habit, stem, leaves and bracts, indumentums and salt glands, shape and size of flowers and fruits, which are proved to represent core plant functional traits because of their importance in eco-physiological responses and reproductive strategies.

This study was performed on 6 species of *Kali* from different habitats and bioclimatic conditions in order to determine the structural differences and variability rate between plant populations from maritime and inland areas, particularly morpho-anatomic functional traits of stem and leaf which allow them to survive under specific environmental conditions. Cross sections of stems, mature leaves and bracts were made from living specimens collected in the field then cultivated in the Botanic Garden of Catania University. Morphometric analysis and statistics were carried out on micro-morphological and anatomical characters calculated from 10 samples for each species and the significance of variation for each trait was tested by ANOVA. Data comparison was made by three multivariate approaches (DFA, PCA, UPGMA).

Both stems and leaves showed the main architecture already outlined for other *Salsola* s.l. species and on other Chenopodiaceae (3-4). Stem cross sections revealed a rounded outline with prominent crests. Significant variations among species regarded the number and prominence of the crests, the cuticle thickness and epidermis hairiness, the relative development of the cortex and its components (chlorenchyma, collenchyma, parenchyma and sclerenchyma tissues), as well as the pith and vascular elements. Leaves have a cylindrical to semicylindrical outline and rather reflect the same indumentum as the stem, with no hypodermis, two concentric layers of chlorenchyma, typical of C4 Kranz anatomy (5), and water storage tissue in the central part with the main vein in the middle. Palisade and Kranz cells are interrupted by longitudinal collenchymatic ridges. Differences among species mainly regarded the size of cells and tissue thickness. Plants of coastal arid sites, in particular, showed a combination of halomorphic and xeromorphic morpho-anatomic features.

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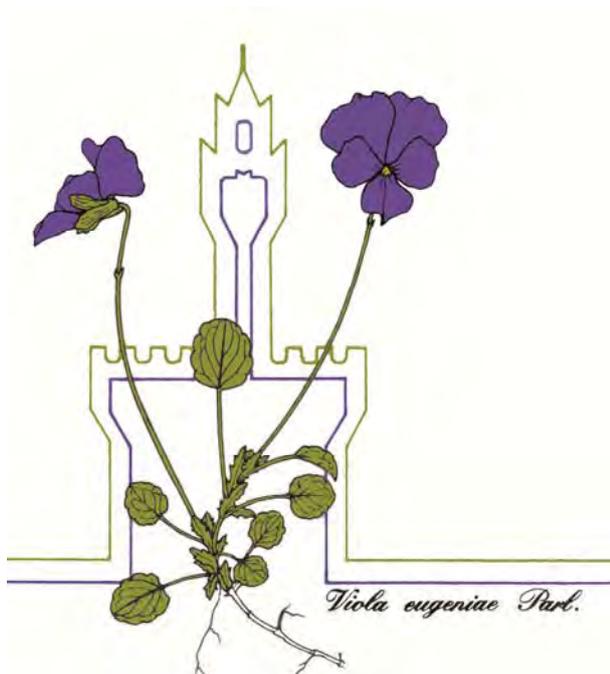
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ABSTRACTS

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