



## Morphological characterization of seeds in Portulacaceae

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### Abstract

Portulacaceae is a monogeneric family with around 100 species distributed around the world. Seed morphology is diverse in this group, and its variation has been used for taxonomic and identification purposes. However, documentation of seed morphology has focused on a few species complexes or has been limited to specific countries and geographic areas. Moreover, the terminology employed in different investigations is heterogeneous, thus complicating analyses of seed morphological diversity in Portulacaceae. In this study, the seed morphology of 58 samples representing 49 species, 9 subspecies, and 2 cultivars of *Portulaca* was documented with the use of scanning electron microscopy (SEM). Based on the examination of the resulting images, a set of morphological features for describing the general shape of the seeds and their individual cell features is proposed; in addition, morphological descriptions for all taxa included in this study are provided. The results indicate that the shape of the seeds was constant within species, contrary to the characters that describe individual cell features, which showed important variation even within the same seed sample. In particular, the outline of the cells and the curvature of the anticlinal cell walls (ACW) were very variable, so a combination of character states was needed to describe the overall diversity of a sample. Conversely, the relief of the periclinal cell walls (PCW) was relatively constant throughout the seeds of the same species, but the relief of the cells of the lateral and peripheral faces was dissimilar in a number of taxa. In addition, other studies provide evidence that the relief of the PCW may vary in widely distributed species. Increased taxon sampling and multiple samples of species with wide geographical ranges will facilitate the study of patterns of variation, and may provide insights into the role of environmental variables on seed diversity of Portulacaceae.

**Key words:** Caryophyllales, *Portulaca*, scanning electron microscopy

### Introduction

*Portulaca* L. is the only genus in the recently recircumscribed Portulacaceae (Nyffeler & Eggli 2010). The family has ca. 100 species that are distributed worldwide mainly in tropical and subtropical regions (Legrand 1953). Plants of this family are herbs, annuals or perennials; the flowers are solitary or are arranged in cymose inflorescences (frequently compact and resembling capitula), and the fruit is a dehiscent circumscissile capsule that produces subreniform to suborbicular seeds (Figs. 1A–B). A recent molecular phylogenetic study showed that the family is monophyletic with high support and is composed of two main clades (Ocampo & Columbus 2012). One of them has opposite-leaved representatives restricted to the Old World (OL clade), except the pantropical weed *P. quadrifida* L., and its species form two subclades whose distributions are restricted to Africa and Asia (African-Asian clade) and to Australia (Australian clade). The second main clade has species with alternate or subopposite leaf arrangement and are distributed around the world (AL clade). Three monophyletic groups are recognized within the AL clade, and include widely known species like *P. pilosa* L. (Pilosa clade), *P. oleracea* L. (Oleracea clade) and the cultivar of *P. umbraticola* Kunth (Umbraticola clade).

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