SEM studies on fruit and seed of some Chenopodium L. species (Chenopodiaceae)

Jagna Karcz¹, Bozena Kolano², Jolanta Maluszynska²

University of Silesia, Faculty of Biology and Environmental Protection
¹Laboratory of Scanning Electron Microscopy,
²Department of Plant Anatomy and Cytology, Katowice, Poland
INTRODUCTION

It is well known that fruit and seed characters are useful in the identification and classification of plant taxa, and in establishing phylogenetic and evolutionary relationships among taxa. In Chenopodium genus some economically important species, especially Chenopodium quinoa, Chenopodium berlandieri and Chenopodium album are interested from a taxonomical and phylogenetical point of view. To date, no detailed study on fruit and seed surface structure have been carried out on these species except for some physiological and systematic reports by Wilson (1980), Wood et al. (1993) and Prego et al (1998).

In our study mature fruits and seeds of C. quinoa, C. berlandieri subsp. berlandieri, C. berlandieri subsp. nuttalliae and its cultivated forms: Huauzontle and Quelite (sect. Chenopodium subsect. Cellulata) and polymorphic species of C. album (sect. Chenopodium subsect. Leiosperma) were studied with light microscopy and scanning electron microscopy (SEM). Chenopodium album is often defined as a polyploid complex or a single polymorphic species with 3 cytotypes on the diploid (2n=2x=18), tetraploid (2n=4x=36) and hexaploid (2n=6x=54) level. This work was initiated with the objective of using pericarp and seed coat surface patterns to identify taxa and to establish their interrelationships. The study was carried out as a part of a broader research project: Molecular-cytogenetic studies in Chenopodium species.
Sect. Chenopodium

subsect. Cellulata

C. quinoa

subsect. Leiosperma

C. berlandieri

C. album

2n=36

2n=36

2n=54

2n=18

5 µm
**Plant material:** Fruits/seeds of *Chenopodium* species were obtained from the following sources: Jardins Botaniques de Nancy, France; The Botanic Garden and Botanical Museum Berlin-Dahlem (BGBM) and Botanischer Garten der Friedrich-Schiller Universität (Jena), Germany; United States Department of Agriculture-Agriculture Research Service (USDA-ARS) and Brigham Young University, Provo, Utah (USA).

**Cytogenetic analysis:** the ploidy level of the sampled plants (young leaves and shoot apical merystems) was established by the use of a DAPI preparation.

**Scanning electron microscopy (SEM):** mature fruits/seeds (without fixation) were sputter-coated with gold and examined with a scanning electron microscope TESLA BS340.
Mature indehiscent (1-seeded) fruit of *Chenopodium berlandieri* subsp. *berlandieri* (BW)

Epicarp cells development
RESULTS

**FRUIT SURFACE PATTERN**

Alveolate-fruited taxa: C. *quinoa* (C5) and C. *berlandieri* (BW, C17, C19) with reticulate surface pattern

Smooth-fruited C. *album* group: 2X, 4X, 6X
RESULTS

SEED COAT SURFACE PATTERN

Testa cells with tuberculate (C. quinoa, C5) and reticulate (C. berlandieri BW, C17, C19) cuticular secondary ornamentation

Smooth seed coat surface pattern in C. album group: 2X, 4X, 6X
RESULTS

POLLEN GRAINS MICROMORPHOLOGY

Micropapillate exine ornamentation
The SEM analysis revealed that alveolate-fruited taxa (C. quinoa, C. berlandieri) are phenotypically distinct from the smooth-fruited C. album group. Similarly, seed surface characteristics of each species were reported in detailed description. Three general types of seed surface topography were observed: reticulate (C. berlandieri), flately tuberculate (C. quinoa) and smooth and finely lineated (C. album). Testa patterns of C. berlandieri and C. album were more variable than those of C. quinoa. In addition, seed coat topography in C. berlandieri taxa varied only in the extend of protrusion of the anticlinal cell walls. These micromorphological seed surface features were also taxonomically informative. Thus, carpological analysis showed that C. quinoa is more closely related to C. berlandieri than to the C. album. According to Barthlott (1984), the species bearing fruits/seeds with similar surface ornamentations may have common genetic-phylogenetic relations.

Relationships among these taxa were also analysed using cytogenetic and molecular methods. Comparative study of repetitive sequence organization indicated that repetitive DNA fraction of C. quinoa genome is more similar to C. berlandieri than C. album. It was also showed that there is intraspecific polymorphism in repetitive sequences genome organization in C. berlandieri. Therefore, mature seed coat patterns may be valuable additional parameters for species identification and also indicate the different phylogenetic lineages in Chenopodium species.

REFERENCES: