

Diversity, relationships and conservation of Sicilian wild taxa of *Brassica*: an overview

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An important input to Sicilian crop diversity is given by varietal groups of Brassicas that are characterized by distinctive appreciable qualitative traits.

Most of the diversity in the Sicilian *Brassica* crops are the result of domestication of *B. oleracea* wild populations and other wild species, sharing the same diploid chromosome complement $2n=18$ ($x=9$) and forming a well defined evolutionary unit, known as *B. oleracea* cytodeme (1), *B. oleracea* group or coenospecies (2, 3).

A variable number of wild taxa have been described for the *B. oleracea* group. Taxonomically they are members of the section *Brassica* and occur along the eastern Atlantic coasts and in the Mediterranean region (4). The arrangement of species and infrageneric taxa within this section is rather complex and controversial. Over the time many taxa have changed their taxonomic statement and new combinations have been proposed based on morphological and genetic information, while some new species were discovered and described. Currently, *Brassica* sect. *Brassica* comprises a total of 20 taxa at specific and infraspecific level, 12 of which occurring in Sicily; ten taxa are strictly endemic to the Sicilian area, i.e. *B. macrocarpa* Guss., *B. rupestris* Raf. (subsp. *rupestris*, subsp. *hispida* Raimondo & Mazzola), *B. villosa* Biv. (subsp. *villosa*, subsp. *bivoniana* Raimondo et Mazzola, subsp. *drepanensis* (Caruel) Raimondo et Mazzola, subsp. *tinei* (Lojac.) Raimondo et Mazzola, subsp. *brevisiliqua* Raimondo et Mazzola), *B. raimondoii* Sciandrello et al. and *B. trichocarpa* Brullo et al., while *B. incana* Ten. and *B. insularis* Moris also occur in other Mediterranean territories. Not surprisingly, Sicily is considered one of the two centres of differentiation of this section, the second one being in the East Mediterranean area (5).

The wild taxa of sect. *Brassica* are all perennial suffruticous plants, with a strong habit, very large and thickened leaves, well developed racemes, big flowers with white to yellow petals, ellipsoid to linear siliquae with convex and woody valves ending in a 0-2-seeded beak, globose and \pm reticulate seeds. These plants are chasmophytes not obligate, which mainly occur on carbonate sea cliffs but also in gentle rocky slopes, maquis or ruderal sites, up to 1000–1200 m of elevation. The populations are often restricted in size and distribution, often

due to the limited areas of cliffs, the competition with other species and the human disturbance (grazing, fire, quarries, etc.). Consequently, some of these populations are endangered or threatened and need to be preserved by genetic resources conservation measures (6-10).

Various molecular and biochemical methods were applied by different authors to various sets of species in order to assess genetic diversity within and among Mediterranean *Brassica* wild species. Biochemical methods mainly used storage proteins and isozymes, while molecular methods included RFLP, AFLP, RAPD, SSR, ISSR and SNP markers (11-15). Overall, the results do not provide a definite understanding of the phylogenetic relationships in this group. Somewhat consistent patterns emerging from the above studies show that 1) *B. oleracea* and its allied wild taxa form a monophyletic group separating in a well supported clade; 2) the Sicilian taxa are genetically more distantly related to *B. oleracea* wild population and the cultivated crops than other species; 3) *B. incana* and *B. macrocarpa* show a clear separation from the *B. villosa-rupestris* group, forming clearly separate clades; 4) particularly, *B. rupestris* and *B. villosa* taxa are closely associated; 5) depending on markers, high inter-specific and intra-population diversity occur.

Plants are often self-incompatible, with high tendency to mutations and freely inter-crossing among them and with *B. oleracea* crops. Crosses between and among *B. oleracea* and its wild closest relatives are known to produce fertile or semi-fertile offspring (2, 15).

Researches dealing with the phytochemical characterization aiming at assessing contents and quality of secondary metabolites such as phytosterols, polyphenols and glucosinolates, both from seeds and leaves, allowed to document available resources for better understanding genetic diversity, characterizing germplasm collections, assessing nutritional values and improving varietal productivity (16-18). Again, Sicilian wild taxa of the *B. oleracea* group revealed high contents of these antioxidant and unsaturated fatty acid, suggesting that they can be useful in breeding programs to develop new genotypes with enhanced nutritional values.

As far as germination ecology is concerned, various studies allowed to assess the germination responses of different taxa, the dormancy regulation, and especially the effect of drying and ageing on seed germination and long-term conservation (19-22).

Analyses on seed morphology and testa microsculpturing also provided useful information about inter- and intraspecific variation of Sicilian brassicas revealing the existence of very distinct ornamentation patterns within and among different taxa which proved to be informative as valuable discriminating traits both in ecophysiological responses and taxonomic or phylogenetic studies (23, 24).

Although lots of studies have been carried out through various analytical approaches and at different taxonomic levels, this overview reveals that actually a comprehensive biosystematic survey on the Mediterranean wild populations of *B. oleracea* group is still lacking, but strongly recommended in view of their relevance as endemic, rare or threatened elements of the Mediterranean flora and available CWR for Brassica crop improvements.

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