



# Crop Wild Relatives (CWR) from Italy: Threatened Endemisms <sup>†</sup>

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**Abstract:** The study presents an updated overview of the 29 endemic threatened Crop Wild Relatives (CWR) in Italy: *Arrhenatherum elatius* subsp. *nebrodense*, *Barbarea rupicola*, *Brassica baldensis*, *Brassica glabrescens*, *Brassica macrocarpa*, *Brassica rupestris* subsp. *hispidula*, *Brassica rupestris* subsp. *rupestris*, *Brassica tardarae*, *Brassica trichocarpa*, *Brassica tyrrhena*, *Brassica villosa* subsp. *bivonana*, *Brassica villosa* subsp. *brevisiliqua*, *Brassica villosa* subsp. *drepanensis*, *Brassica villosa* subsp. *tineoi*, *Brassica villosa* subsp. *villosa*, *Daucus broteroi*, *Daucus carota* subsp. *rupestris*, *Daucus nebrodensis*, *Diplotaxis scaposa*, *Festuca centroapenninica*, *Lathyrus apemminus*, *Lathyrus odoratus*, *Malus crescimmanoii*, *Phalaris arundinacea* subsp. *rotgesii*, *Vicia brulloi*, *Vicia consentina*, *Vicia giacominiiana*, *Vicia ochroleuca* subsp. *ochroleuca*, *Vicia tenuifolia* subsp. *elegans*. Geographical distribution, ecology (with plant communities and habitat 92/43/EEC aspects), genetics (focused on gene pools), property, and in situ and ex situ conservation were analyzed. In addition, with the aim of their protection and valorization, specific actions are recommended.

**Keywords:** gene pool; geographical distribution; threatened; valorization

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## 1. Introduction

The concepts relating to the conservation and enhancement of Crop Wild Relatives (CWR) have been stated in several studies [1–5]. The FAO has developed the Voluntary Guidelines for the Conservation and Sustainable Use of Crop Wild Relatives and Wild Food Plants well resumed in the foreword of Ren Wang: “Crop wild relatives (CWR) thrive in their natural habitats without human intervention. In fact, they are continuously evolving adaptive characteristics that enable them to cope with changing environmental conditions. Therefore, they are a rich reservoir of novel traits and genes that can be used to develop crop varieties that are adapted to climate change. There is ample evidence of their successful use in crop improvement. Wild food plants, on the other hand, constitute important components of the diets of many people across the globe. Though undomesticated, they are rich sources of very important micronutrients, which, sadly, are lacking in the main staple crops that people are increasingly relying on for nourishment. Wild food plants could therefore play critically important roles in combatting malnutrition. As they exist in the wild, they are also continuously evolving adaptive features. Crop wild relatives and wild food plants share one thing in common: their habitats. These natural wild habitats are increasingly under threat from both human activities and natural disasters, implying that the diversity of both crop wild relatives and wild food plants are being continuously eroded. In fact, many could become extinct if the current level of neglect is not checked” [6].

The Italian national checklist of CWR and WHP (Wild Harvested Plant) [<http://vnr.unipg.it/PGRSecure>, accessed on 16 September 2021] identify a very high

number of taxa (11.710), of those 92 % are CWR/WHP, 1118 of which taxa were prioritized, and 129 taxa with highest priority [1], than could be preserved with the national financial resources and expertise available.

The CWR and wild food plant taxa must therefore be prioritized as a means of selecting taxa for which active conservation should start immediately, and taxa for which conservation actions can be delayed [6].

Conservation prioritization depends on a number of factors, including the number of CWR and wild food plant taxa in the country, the resources available for their conservation, the differing needs of the target areas and local communities, as well as the policies and interests of the implementing body.

The very rare CWR species, with disjoint distribution, of phytogeographic or conservation interest, often characterized by populations of few individuals, and therefore listed in the international conventions, in the national or international Red Lists, are species need of greater attention, as already been highlighted for Italy from some authors [1] and for which specific actions have been proposed for their enhancement and conservation [7].

Among these species, there are those with a very restricted distribution range, called "endemic species". Geographically restricted species are potentially more adversely affected by localized threats. Thus for species of restricted distribution, the loss of any single population or group of populations may affect the entire viability of the species. Taxa that are known to be endemic to a country or those that occur in only a few countries or regions would be considered vulnerable. Species with a restricted distribution should therefore be given higher priority than species occurring more widely [6].

This vulnerability becomes even more critical if we evaluate endemic CWRs with a comparable gene pool to the related cultivated taxon, with which they can exchange genes. Unfortunately, as said several times [2,5], not all wild relatives are equally ready, because they have different ability to exchange genes, that explain the current existence of 3 different gene pool groups (GP1, GP2, GP3) [8]. The primary gene pool (GP1) includes species that can be directly crossed with the cultivated species to produce fertile breeds. For example, it is easier for *Beta macrocarpa* Guss. (GP1) to interbreed with cultivated chard (*Beta vulgaris* L.) as they have a very good genetic affinity, than other species that are less related, and for that they belong to more distant gene pools (GP2 or GP3).

The aim of the work was to assess the list of the CWR threatened endemics in Italy, in order to draw up the planned actions for their conservation and enhancement, focusing on their distribution, ecology, *in situ* and *ex situ* conservation. It should be noted that *Thinopyrum corsicum* (= *Elytrigia corsica*) is not evaluated, as it is endemic to Corsica and reported in the past by mistake in Sardinia by many authors [9-11].

## 2. Materials and Methods

The study was planned starting from 29 threatened CWR (listed in the national and international IUCN Red Lists, Annex II of 92/43 EEC Directive, and Berna Convention), reported as Italian endemism in the "An updated checklist of the vascular flora native to Italy" [12] and subsequent works [13,14], according to the taxon group concept of CWR [2] and not at all of the gene pool concept [8]. Thus, the following taxa were investigated: *Arrhenatherum elatius* (L.) P. Beauv. ex J. Presl & C. Presl subsp. *nebrodense* (Brullo, Miniss. & Spamp.) Giardina & Raimondo, *Barbarea rupicola* Moris, *Brassica baldensis* (Prosser & Bertolli) Prosser & Bertolli, *Brassica glabrescens* Poldini, *Brassica macrocarpa* Guss., *Brassica rupestris* Raf. subsp. *hispida* Raimondo & Mazzola, *Brassica rupestris* Raf. subsp. *rupestris*, *Brassica tardarae* Ilardi, Geraci and Troia, *Brassica trichocarpa* C. Brullo, Brullo, Giusso, Ilardi, *Brassica tyrrhena* Giotto, Piccitto & Arrigoni, *Brassica villosa* Biv. subsp. *bivonana* (Mazzola & Raimondo) Raimondo & Mazzola, *Brassica villosa* Biv. subsp. *brevisiliqua* (Raimondo & Mazzola) Raimondo & Geraci, *Brassica villosa* Biv. subsp. *drepanensis* (Caruel) Raimondo & Mazzola, *Brassica villosa* Biv. subsp. *tineoi* (Lojac.) Raimondo & Mazzola, *Brassica villosa* Biv. subsp. *villosa*, *Daucus broteroi* Ten., *Daucus carota* L. subsp.

*rupestris* (Guss.) Heywood, *Daucus nebrodensis* Strobl, *Diplotaxis scaposa* DC., *Festuca centroapenninica* (Markgr.-Dann.) Foggi, F. Conti & Pignatti, *Lathyrus apenninus* F. Conti, *Lathyrus odoratus* L., *Malus crescimannoii* Raimondo, *Phalaris arundinacea* L. subsp. *rotgesii* (Husn.) Kerguelen, *Vicia brulloi* Sciandr., Giusso, Salmeri & Miniss., *Vicia consentina* Spreng., *Vicia giacominiiana* Segelb., *Vicia ochroleuca* Ten. subsp. *ochroleuca*, *Vicia tenuifolia* Roth subsp. *elegans* (Guss.) Nyman.

The nomenclature of the taxa follows “An updated checklist of the Vascular flora native to Italy” [12], while the syntaxonomic references was conceived by several contributions [15-17].

### 3. Results

According to the taxon group concept, the 29 endemics in Italy belong to the Brassicaceae (51.7%), with 15 species, followed by Fabaceae (24.1%) with 7 species, Apiaceae (10.3%) and Poaceae (10.3%) each with 3 taxa, and finally with only one specie by Rosaceae (3.4%) (Figure 1a). The most represented genus is *Brassica* L. (44.8%) with 12 species, followed by *Vicia* L. (17.2%) with four species, *Daucus* L. (10.3%) and *Lathyrus* L. (6.9%), respectively with three and two species, and finally the genera *Arrhenatherum* P. Beauv., *Barbarea* R. Br., *Diplotaxis* DC., *Festuca* L., *Malus* Mill., and *Phalaroides* Wolf (each with 3.4%), with only one species (Figure 1b).

The geographical distribution of the endemic CWR species in Italy shows that almost 2/3 grow in the Sicily region. This data can be justified for the peninsular regions, but not find a rational reason for Sardinia, comparable those to Sicily for geographical extension and climatic characteristics. In particular the genus *B.* with 10 endemism, of which 9 exclusive to Sicily, with 5 subspecies of *B. villosa*, explains this discrepancy data (Figure 2). It is also true that Sicily having a greater extension of cultivated environments in relation to Sardinia, and being one of the main centers of the diversification of wild taxa of *Brassica* sect. *Brassica* in the Mediterranean basin, favors the crossing with the cultivated species [13,18,19].

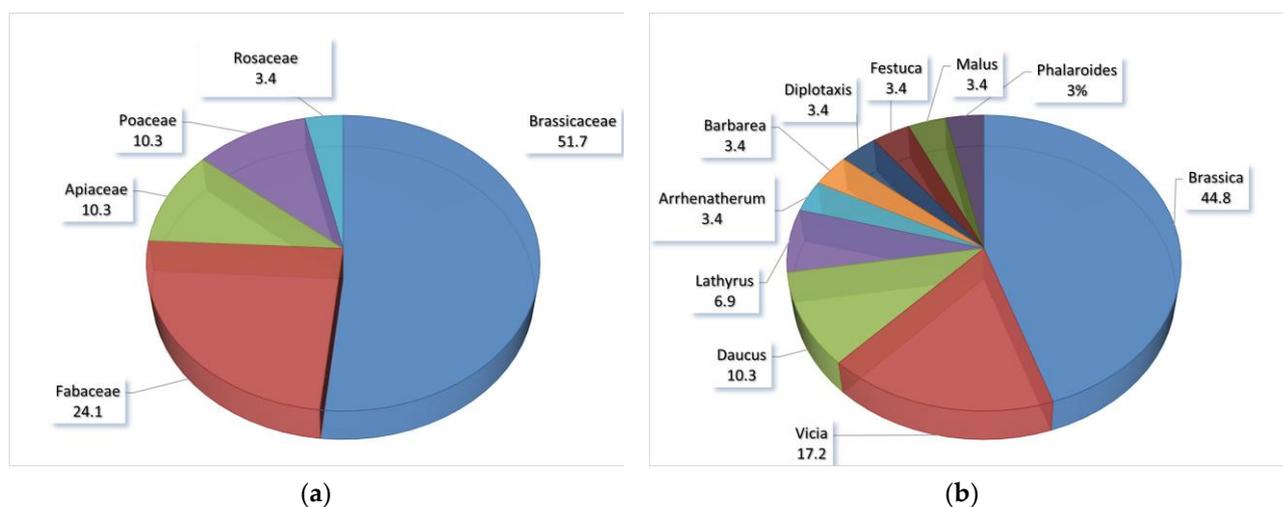
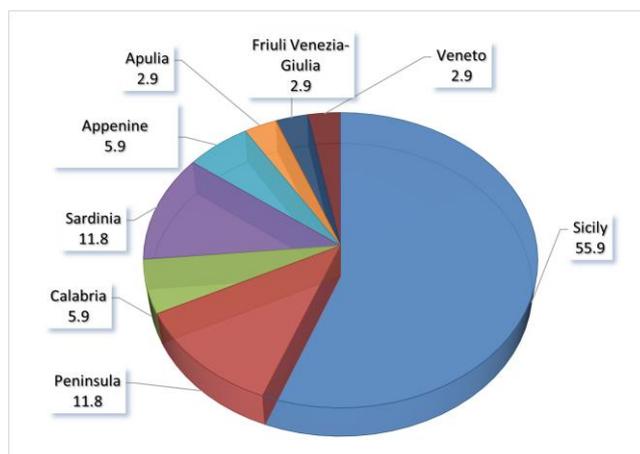


Figure 1. Endemics Italian CWR taxa (%) grouped for family (a) and genus (b).



**Figure 2.** Geographical distribution of Endemics Italian CWR (%).

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