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*The RIBES seed-banks
for the conservation of the
Crop Wild Relatives (CWR)*

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Crop Wild Relatives (CWR) in the Majella National Park territory: first results on the presence, distribution and size of the populations of some entities

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The "*International Treaty on Plant Genetic Resources for Food and Agriculture*", the result of several years of negotiation, was adopted in Rome in 2001 during the thirty-first meeting of the FAO Conference. The Italian Parliament ratified the Treaty with the Law n. 101 of 6 April 2004, by which, the key role that conservation and sustainable use of plant genetic resources in agriculture have in feeding the growing world population is recognized. In fact, the plants, either spontaneous or cultivated, are the basis for food production as well as medicines, textiles, materials for construction and industry, etc. Little more than ten plants including cereals, legumes and other vegetables (Poaceae, Fabaceae, Solanaceae) are indispensable for the food survival of humanity. Wild species from which food plants were derived by artificial selection (Crop Wild Relatives) play a key role as phylogenetic resources and they are still consumed in many countries.

The Majella National Park is located in Central Apennines, a strategic biogeographic area due to the confluence of Eurosiberian, Mediterranean and Balkan species. The park preserves a flora with over 2,100 entities, i.e. more than 65% of the flora of the Abruzzo region and almost 30% of the Italian one. About 15% of these entities are endemic, rare or protected (Conti & Tinti, 2006). More than 150 entities have so far

been recognized as crop wild relatives in the territory of the park (Manzi, 2006; Di Cecco & Ciaschetti, 2015; Di Martino & Di Santo, 2015) among which *Secale strictum* (C. Presl) C. Presl (syn. *S. montanum* Guss.), likely the progenitor of *Secale cereale* L., and many wild legumes some of which are rare. In addition, numerous indigenous agricultural varieties have been recognized (Di Santo & Di Cecco, 2015).

The Park Authority, according to the FAO Treaty and with the more recent Nagoya International Protocol (effective since October 2014), has realized a database that can provide information on location and size of the populations of the CWR species to be protected, their level of risk, morphological and genetic features, etc. At the same time, the *ex situ* conservation of some particularly rare entities has been started with their cultivation in the two Botanical Gardens “Michele Tenore” and “Daniela Brescia” and the conservation of their seeds in the Germplasm Bank (Majella Seed Bank). The Majella Seed Bank collaborates with the international project “Towards a more complete coverage of CWR diversity in *ex situ* collections”, directed by the Millennium Seed Bank and coordinated in Italy by the Germplasm Bank of the University of Pavia, carrying out field investigations and collecting samples in the Abruzzo and Molise regions (www.cwrdiversity.org).

CWR and LANDRACE legumes in the territory of the Majella National Park

The Abruzzo region boasts a remarkable diversity in legumes that were cultivated especially in the past, before globalization entailed a strong flattening of the diversity both in the crops and on the table. Among legumes nowadays in disuse but widely cultivated in the Middle Ages for human consumption, there are the “robiglio” (*Pisum arvense*), a red flowered pea suitable to be grown also above 1300 m a.s.l. and some species of grass pea as the “cicerchiola” (*Lathyrus cicera* L., Fig. 1), the “cicerchia porporina” (*Lathyrus clymenum* L.), both consumed especially in periods of famine, the common grass pea (*Lathyrus sativus* L.) also used for the preparation of the “fracchiata”, a green mash obtained from seeds ground into flour.

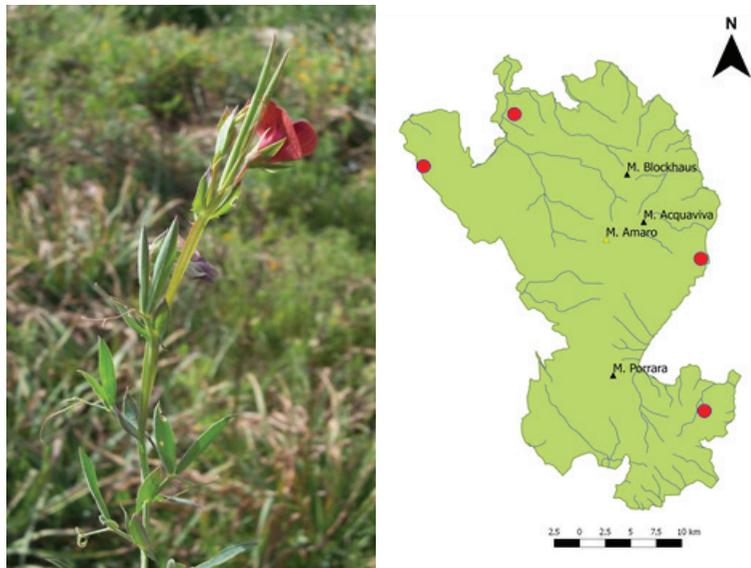


FIGURE 1. a) *Cicerchiola* (*Lathyrus cicera*) (Photo MarioPellegrini) and b) its distribution in the Majella National Park

The cowpea (*Vigna unguiculata* (L.) Walp.), a species of African origin, was the only bean cultivated in Italy before the discovery of America from where the better known beans of the *Phaseolus* genus come. These last, whose presence in the Abruzzo region is already documented since the second half of the sixteenth century, have today replaced the indigenous cowpea that is still rooted only in the Sulmona basin, where it is named “gentle bean”. The beans of the genus *Phaseolus* are present in the territory of the Park with numerous ancient varieties (e.g. “*quaranta giorni*”, “*socere e nore*”, “*tabacchino*”, “*a caffè*”, etc.), that the Park Authority has described, preserved and promoted within the project “*Cultivating Bio-Diversity*” (Di Santo & Di Cecco, 2015).

Many other legumes were cultivated as forage for animals, often in intercropping with cereals in an ancient practice used by the Romans and likely by Italic peoples. Among the legumes for animals, but sometimes also consumed by humans, there are the “*mochi*” (*Vicia ervilia* (L.) Willd.) mainly cultivated to feed pack animals, the “*cicerchia odorata*” (*Lathyrus odoratus* L., Fig. 2), the “*veccia comune*” (*Vicia sativa* L.) and the “*veccia di Narbonna*” (*Vicia narbonensis* L.), the last used to feed chickens and pigeons.

In detail, an initial analysis of CWR belonging to the Fabaceae family present within the Park has led to the identification of 55 entities of the genera *Lathyrus*, *Lotus*, *Lupinus*, *Medicago*, *Melilotus*, *Pisum*, *Trifolium* and *Vicia*. For the most rare and localized species, among which *Lathyrus clymenum*, *L. odoratus* and *L. cicera*, the characterization and conservation of germplasm have been made, in addition to gathering information on their populations (Table 1).

Presence of *Secale strictum* in Abruzzo and Molise: estimates of populations and the first conservation actions

The cultivated rye (*Secale cereale*) is a cereal of great agronomic interest, particularly for countries with cold climate of Northern and Eastern Europe. Its cultivation began



FIGURE 2.
 a) *Cicerchia odorata* (*Lathyrus odoratus*) (Photo Mario Pellegrini) and b) its distribution in the Majella National Park

TABLE 1. Information about the most rare and localized species of the Park. Data about occurrence are reported as follows: sp: spontaneously present; r: rare; i: grown wild; ?: dubious presence

CWR Fabaceae	Occurrence	Abundance (Conti 1998)	n. observed populations	Average size of each population (n. individuals)
<i>Lathyrus cicera</i> L.	sp	NC	4	200
<i>Lathyrus clymenum</i> L.	sp	NC	1	150
<i>Lathyrus nissolia</i> L.	r	r	2	300
<i>Lathyrus odoratus</i> L.	sp	r	1	300
<i>Lathyrus pannonicus</i> (Jacq.) Garcke subsp. <i>asphodeloides</i> (Gouan) Bässler	r	r	4	> 2000
<i>Lathyrus setifolius</i> L.	r	r	3	100
<i>Lathyrus sphaericus</i> Retz.	sp	C	2	> 1000
<i>Vicia dumetorum</i> L.	r	r	3	200
<i>Vicia ervilia</i> (L.) Willd.	i	C	3	> 1000
<i>Vicia narbonensis</i> L. subsp. <i>narbonensis</i>	sp	NC	3	200

during the Neolithic in the Near East. In Europe, the first countries interested by its cultivation were Poland, Romania and Czech Republic since the Neolithic period. Unlike other crops arrived in Western Europe by sea, the cultivation of rye seems to have followed a continental path from Asia through the countries of Eastern Europe. In Italy, the first clues on the cultivation of this grain date back to Roman times. The first archaeo-botanical evidence of rye cultivated in the Italian peninsula refers to the archaeological site of Juvanum in Abruzzo (Manzi, 2006).

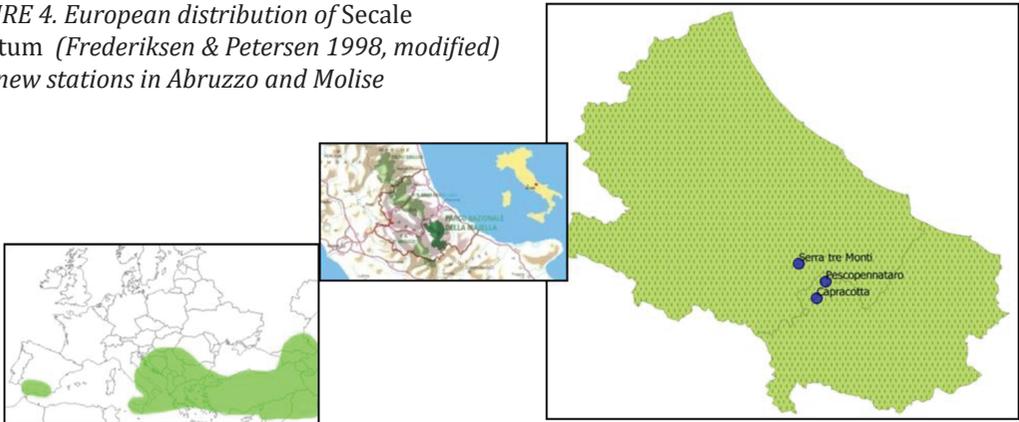
Secale cereale probably derived by domestication of annual species of the genus *Secale* of Asian origin, such as *S. segetale* (Zhuk.) Roshev. subsp. *segetale*, *S. segetale* (Zhuk.) Roshev. subsp. *afghanicum* (Vavilov) Bondarenko ex Korovina, *S. segetale* (Zhuk.) Roshev. subsp. *dighoricum* (Vavilov) Tzvelev, *S. ancestrale* (Zhuk.) Zhuk., *S. vavilovii* Grossh. (Zohary & Hopf, 2000).

Besides the annual species, the genus *Secale* also includes perennial entities grouped in the species *S. strictum* (syn. *S. montanum*), distributed in Middle East, Caucasus, Iran, Balkans, Southern Italy and Sicily. The spikes of this rye, compared to the annual ones, appear smaller, more appressed and with a very fragile rachis that involves its sudden disintegration (Fig. 3). In Italy, the species is reported for Sicily, Marche, Abruzzo, Molise, Basilicata, Calabria and is unconfirmed for Campania (Conti et al., 2005; 2007).



FIGURE 3. Spikes of *Secale strictum* (Photo Luciano Di Martino)

FIGURE 4. European distribution of *Secale strictum* (Frederiksen & Petersen 1998, modified) and new stations in Abruzzo and Molise



Because of the great agronomic and phytogeographical interest of this species, a specific research has been led within the territory of the Park and in its surroundings.

In addition to the locations known in the literature, often unconfirmed, three new stations have been identified: two in Molise, in the territories of Capracotta and Pescopennataro (IS), and one in Abruzzo on Serra Tre Monti, Gamberale (CH) in the Majella National Park (Fig. 4). The sites are located on rocky ledges of limestone relieves at an altitude comprised between 1,450 and 1,850 m a.s.l. In each site at least 1,000 fruiting individuals live.

The germplasm collected in those sites has been filed in the Majella Seed Bank where, in addition to the seed dehydration for final storage at -20°C , germination tests and seed characterization are still ongoing. The seeds of *Secale strictum*, which have a lateral basal embryo, were sterilized with hydrogen peroxide and sodium hypochlorite and sowed on 1% agar in 9cm Petri dishes (4 replicates of 20 seeds). Germination tests were performed in a light and temperature controlled growth chamber at 20°C constant temperature and photoperiod of 12/12h. The following results have been obtained: final germination percentage = $87.11 \pm 5.77\%$ with a germination delay and half-germination time (T50) of only 2 days (Fig. 5).

From these first results, *Secale strictum* shows to have no dormancy and the cultivation phase seems relatively little problematic as the seedlings have a great vigor. This agrees with the results of germination tests performed by Ansari et al. (2012) on the same species.

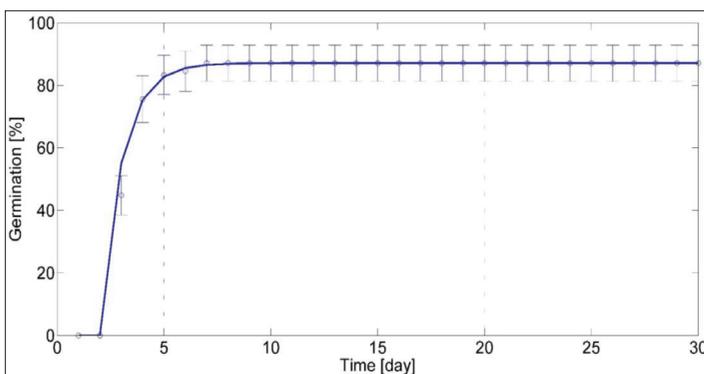


FIGURE 5. Germination dynamics of *Secale strictum* (with Weibull function)

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