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The almond *Museo Vivente "F. Monastra"*: From genetic resources rescue to germplasm collection

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SUMMARY – During the 1st ISHS Almond Congress, held in 1993 in Agrigento together with the IX Grempa Meeting, the idea to organize in Sicily an "on-farm" collection on almond biodiversity in Sicily came up just discussing with Francesco Monastra, who was a founding member of the Grempa Group, an unforgettable researcher and friend. The Sicilian almond production and acreage evidenced, a lot before that time, a rapid decrease making the risk of genetic erosion of the old and historical cultivars extremely feasible. In 1997, with the financial support of the Sicilian Government and of the Regional Province of Agrigento, a 5 hectare field collection was realized planting around 300 cultivars recovered from the most traditional almond growing areas throughout the Sicilian territory. The collection was called Museo Vivente del Mandorlo (*almond living-museum*) and in 1999 it was entitled Francesco Monastra. It is located in the Temple Valley Park, in Agrigento, just at the foot of the Juno Temple.

Key words: Almond, genetic resources, on-farm collection.

RESUME – "Le musée vivant de l'amandier 'F. Monastra' : Du maintien des ressources génétiques à la collection de germoplasme". Pendant le premier Congrès ISHS pour l'amandier, qui s'est tenu en 1993 à Agrigente en même temps que le "IX GREMPA MEETING", a été évoquée l'idée de créer une collection aux champs pour la grande biodiversité de l'amandier sicilien. Depuis longtemps déjà, la production d'amandes siciliennes avait montré une perte de superficie et de production, ce qui avait rendu évidente une forte érosion génétique du vaste patrimoine variétal sicilien qui, au cours des siècles, par la voie d'une reproduction prédominante, s'était diffusé dans les plus importants secteurs de culture de l'amandier. En 1997, avec l'appui financier de la Province Régionale de Agrigento, a été réalisé un champ de collection de 5 hectares dans lequel ont été plantées environ 300 variétés siciliennes. La collection, créée en 1999, a été dédiée au Prof. Francesco Monastra et est localisée dans la Vallée du Temple d'Agrigente et se trouve au pied du Temple de Junon.

Mots-clés : Amandier, ressources génétiques, collection 'ex situ'.

Introduction

In the last years, many projects have been developed in order to better study how to preserve genetic resources which, along the years, have rapidly lost their economic value. Among fruit trees species, many cultivars have recently assumed a new role by evidencing an importance for maintaining traditional and local uses. In this way, these cultivars, although not used anymore for intensive cultivations, are preserving their value and considered relatively important in the economic complex of each traditional growing area.

The more recent interest for old fruit trees species cultivars has also been encouraged by the always increasing trend toward old and traditional foods which seemed to be able to better preserve the alimentary sanity and safety for the consumer. In addition, all these aspects took a significant advantage from the related interest to preserve the old landscape in which many less important species traditionally played a notable role.

This kind of agro-ecological systems usually takes place in areas where the possibility to carry out an economic intensive fruit trees cultivation is not feasible anymore for many different reasons.

Considering the opportunity to increase the genetic resources value for several fruit trees species, a preliminary survey and recovering of the most important accessions in the traditional growing areas as well as their collection and evaluation appeared to be the first step to gain this objectives.

A similar way has been approached for the almond genetic heritage in Sicily. The Sicilian almond production and acreage evidenced, at the end of the 80s, a rapid decrease making extremely feasible a risk of genetic erosion for the old and historical cultivars.

As regards the almond spreading, the species reached Sicily from Central Asia in a very remote period (Zohary and Hopf, 1993). Since that time, due essentially to the biological peculiarities together with the propagation activity mainly operated by seed, a very large genetic diversity rapidly developed determining a massive genetic pool of cultivars in several Sicilian growing areas.

The first more accurate information on the Sicilian almond genetic diversity has been reported by Cupani (1696) who described 27 sweet-seed and 9 bitter-seed cultivars. The description, also confirmed by Nicosia in 1735, was mostly related to the nut traits of cultivars growing in the West part of Sicily. More than 100 years later, Bianca (1872) described about 750 cultivars but this author concentrated its attention on the peculiarities of all seedling trees that usually had a very restrictive diffusion. The Di Mattei's report (1910) represents the first agronomic approach to the species for the Sicilian almond growing areas since a deeply evaluation of the most important agronomic and productive behavior was also reported.

Many others reports followed along the years, also more recently; in any case they evidenced that during the almond gold-age in Sicily, the cultivation was primarily based on local cultivars, originated in the growing areas, while cultivars coming from Apulia, the nearest most important growing area, were rarely introduced for an economic production.



Fig. 1. The almond living museum (Museo vivente del mandorlo), Agrigento (Italy).

However, during this evolution and spreading period, very few cultivars have been assuming more and more importance revealing remarkable nut characteristics that always represented the first selection criterion. In any case, just few growing areas had a dominant cultivar; it was much more probable to seed a mix of different local cultivars whose production was destined to the alimentary industry and pastry.

As a traditional species, for many years, almond has been usually propagated by seed determining a wide biological diversity among the genotypes. A massive selection has been carried out only in the recent past by adopting grafting techniques for new orchards. In this way, a high risk of genetic resources loss has been identified suggesting the needs to evaluate alternative strategies.

The almond in the Valley of the Temples

The extraordinary landscape today still well preserved in Agrigento, all around the "temples hill", dominates a beautiful valley that smoothly slopes to the Mediterranean sea.

In this location, the landscape is synthesis between archaeology and traditional agriculture characterized mainly by old traditional fruit orchard in which olive, grape and almond where the most diffused species. Olives and grapes were usually more scarcely diffused while almond, also by its

winter flowering, always played an important agronomic role but also represented a fundamental element of the landscape.



Fig. 2. Landscape in the Valley of the Temples

This was testified by many ancient travellers as, for instance, J.H. von Riedesel (1767) who visited Italy and Sicily on the XVIII Century and evidenced how the Temple Valley was doubtless folded with the nearby landscape. Also, he gave an important role to the almond trees largely diffused and underlined the technical culture adopted for the species as well as the notable taste of the production and its derivatives. He wrote: "...*The slope coming from the city to the sea ... is characterized by vineyards, olive and almond trees, wonderful fodder and legumes, all productions obtained by those soils, alternatively planted with beautiful variability, and by gardens ... and in this delicious landscape, really an Eden, it is possible to see venerable rests of antiquities. This all together, open to the infinite sea, represents an admirable effect...*"

The Valley of the Temples is today Human Patrimony by a UNESCO statement; this certifies not only the great importance of the archaeological site but also the particular beauty of the rural and natural landscape. Up to this date, some few very old almond orchards, traditionally planted and managed are still existent and testify the real landscape of the Valley as it appeared many Centuries ago.

It practically represented a landscape in which almonds participated as the main vegetative component giving also an important contribute to sustain the economy of the Agrigento area. The drastic modifications occurred on the agricultural economy and productivity in the last forty years surely determined a strong contraction of the traditionally managed old almond orchards.

The living museum

During the 1st International Congress on Almond and Pistachio held in 1993 in Agrigento together with the IX Grempa Meeting, the idea to organize in Sicily an "on farm" collection on almond biodiversity came up just discussing with Francesco Monastrà who was a founding member of the Grempa Group and an unforgettable researcher and friend.

Since 1997, with the financial support of the Regional Province of Agrigento, a strong effort on recovering the old Sicilian almond varieties has been carried out. The collection field has been located in the middle of the Temple Valley where almonds, along the centuries, traditionally offered an unique landscape view decorating a wonderful historical place. About 300 accessions were collected from the most important almond growing areas commonly identified by traditional names related to the growers or to the growing area. Moreover, the most important cultivars actually used in commercial orchards were introduced into the collection.

Five trees per each genotype were grafted onto GF 677 planted at 6 x 6 m. The collection was enlarged on 1999 by recovering many others accessions and planting a second orchard just adjacent to the first one. Both two collection orchards were mapped using a GIS methodology with a sub-metric precision. A data dictionary based on the IBPGR Almond descriptor has been organized also integrating all the information related to the origin of the genotypes included. In this way, starting on 2001, blooming time and yields have been recorded as well as data on shelled and unshelled fruits using the above mentioned descriptor mainly focusing on the biometric data.



Fig. 3. The "Museo Vivente del Mandorlo" with the old building destined to the "Ethno-anthropological Almond Museum".

The almond living-museum has been inaugurated with an official presentation on September 1999 and, in that occasion, it has been entitled to Francesco Monastra, who strongly encouraged and contributed to the idea of this initiative. The "Museo Vivente del Mandorlo", in the near future, will be completed by restoring a neighbouring building which will be destined to host an ethno-anthropological section related to the almond history and culture as well as an exposition of the main products deriving from the post-harvest industry.

This building, also, will be soon completed by a laboratory, which will be used to carry out new and innovative researches on germplasm rescue and conservation.

Research opportunities

In the last 6 years, all technical practices have been arranged in order to have a good and healthy trees growth. The most part of the collected cultivars are already bearing and a minor research activity has also been carried out in the last two years.

In any case, since the trees were significantly bearing, all data related to flowering (date and intensity), production and nut traits have been collected according to the almond descriptor list.

Many other research aspects appear to be feasible in the near future. Germplasm conservation techniques, flowering and fruiting biology; as well as all aspects related to post-harvest transformations mainly for old and historical cultivars will be deeply evaluated. Also, since many cultivars are usually reported by slightly different names according to an area of origin, a biometric based study will be carried out in the coming years also integrated by a molecular characterization.

Once a significant data collection for each cultivar will be managed, a description catalogue will be definitively published giving the opportunity to show the large and variable almond genetic resource still present in Sicily.



Fig. 4. Research conducted at the "Museo Vivente del Mandorlo".

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