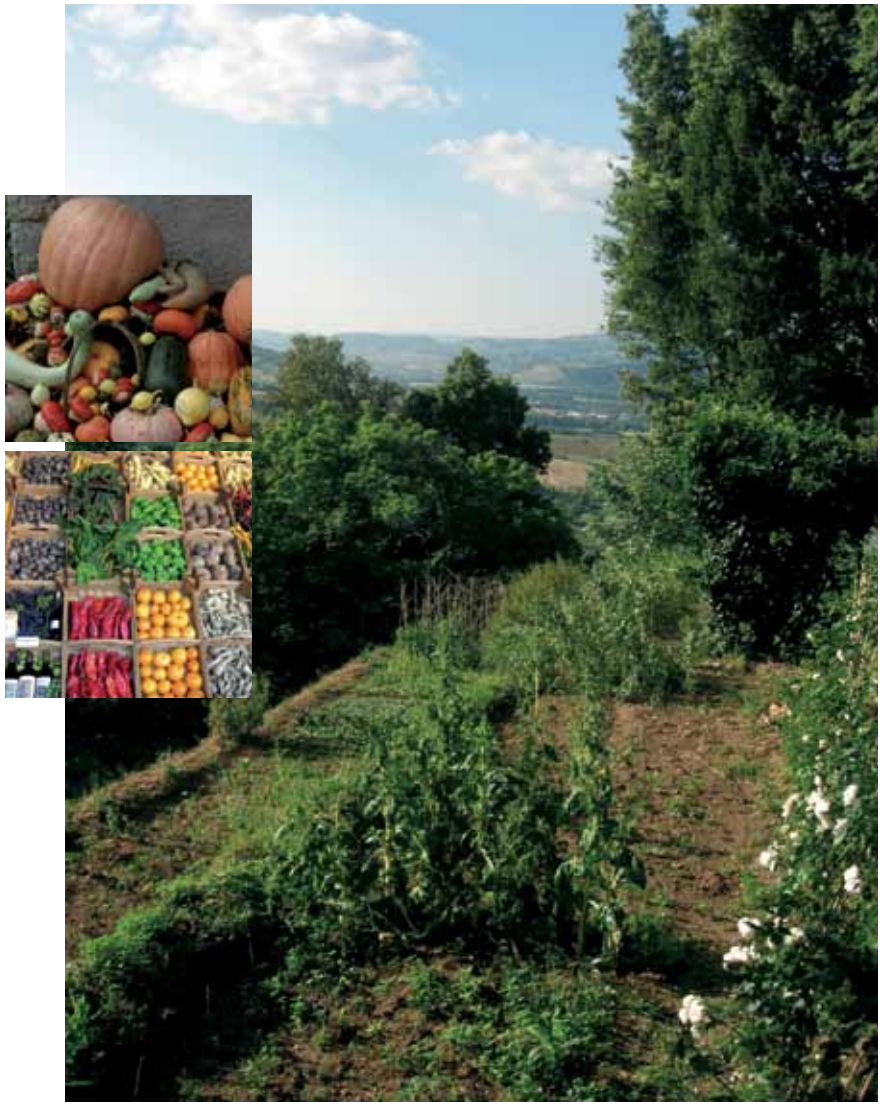
European Cooperative Programme for Plant Genetic Resources

ECP//GR

Crop genetic resources in European home gardens

Proceedings of a Workshop
3-4 October 2007, Ljubljana, Slovenia

A. Bailey, P. Eyzaguirre and L. Maggioni, *editors*



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Bioversity International is an independent international scientific organization that seeks to improve the well-being of present and future generations of people by enhancing conservation and the deployment of agricultural biodiversity on farms and in forests. It is one of 15 centres supported by the Consultative Group on International Agricultural Research (CGIAR), an association of public and private members who support efforts to mobilize cutting-edge science to reduce hunger and poverty, improve human nutrition and health, and protect the environment. Bioversity has its headquarters in Maccarese, near Rome, Italy, with offices in more than 20 other countries worldwide. The organization operates through four programmes: Diversity for Livelihoods, Understanding and Managing Biodiversity, Global Partnerships, and Commodities for Livelihoods.

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The European Cooperative Programme for Plant Genetic Resources (ECPGR) is a collaborative programme among most European countries aimed at facilitating the long-term conservation and the increased utilization of plant genetic resources in Europe. The Programme, which is entirely financed by the member countries, is overseen by a Steering Committee composed of National Coordinators nominated by the participating countries and a number of relevant international bodies. Bioversity International provides the Coordinating Secretariat. The Programme operates through nine networks in which activities are carried out through a number of permanent working groups or through ad hoc actions. The ECPGR networks deal with either groups of crops (cereals; forages; fruit; oil and protein crops; sugar, starch and fibre crops; vegetables) or general themes related to plant genetic resources (documentation and information; *in situ* and on-farm conservation; inter-regional cooperation). Members of the working groups and other scientists from participating countries carry out an agreed workplan with their own resources as inputs in kind to the Programme.

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Home garden near Orvieto, Umbria, Italy; courtesy of © J. Cherfas, Bioversity International. The variability of horticultural crops grown in home gardens (Griblje, Slovenia); courtesy of © J. Drobná, SARC-Research Institute of Plant Production Piešťany, Slovakia. Traditional varieties grown by farmers and gardeners within the ProSpecieRara conservation network; courtesy of © B. Bartha, ProSpecieRara, Switzerland.

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CONTENTS

Foreword

Lorenzo Maggioni
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A review of a book edited by Eyzaguirre and Linares (2004) on "Home gardens and agrobiodiversity" was made by Salick and Posey in 2006, and reported the following considerations:

> "There is no doubt that these production components are major sources and sinks of genetic diversity and that any efforts to conserve that genetic diversity must recognize the immeasurable value of Home Gardens. We are left wondering how best to sustain systems so diverse with such varied processes maintaining and threatening them. Is there a global strategy IPGRI[1] could develop and lead, or must grass-root efforts deal with the multifarious particulars of each situation, or can these strategies be coordinated through a network?"

Even though there is no clear cut answer to the above question, the *In situ* and On-farm Conservation Network of the European Cooperative Programme for Plant Genetic Resources (ECPGR) took the initiative to organize a workshop on home gardens in Europe. This Workshop was organized in Ljubljana, Slovenia, 3-4 October 2007, in collaboration and with the contribution of the Agricultural Institute of Slovenia, the Slovenian Institute for Hop Research and Brewing and Bioversity International.

The opportunity to convene scientists working on home gardens in a regional meeting was based on the awareness that home gardens probably constitute the richest agro-ecosystems in Europe in terms of genetic diversity of agricultural crops. At the same time, there is incomplete information on the actual composition of home gardens and on the trends that may affect the maintenance of these precious but possibly fragile ecosystems in the near future.

Brainstorming sessions that took place at Bioversity International in preparation for this meeting identified a number of areas where further research and collection of information could shed light on the value of home gardens, as well as contribute to their continued management:

- Research on seed systems and seed exchange
- Definition of statistical parameters to look at optimal conservation of diversity
- Population genetics studies (academic sector)
- Dynamics of conservation (grass-roots organizations)
- Policies to ensure home gardens viability

[1] The International Plant Genetic Resources Institute (IPGRI) and the International Network for Improvement of Banana and Plantain (INIBAP) now operate under the name Bioversity International.

- Benefits and constraints of commercialization of home gardens seed
- Linking home gardens conservation with national systems, including *ex situ* activity
- Self-sustainability, as opposed to dependency on subsidies

The specific objectives of the workshop were then set up as follows:

- Collect information on:
  - Home gardens composition, status and distribution in Europe
  - The role of home gardens for the conservation of diversity
  - Incentives
  - Policies
- Define ways to bring forward research
- Assess possibility of forming networks
- Raising awareness

Consequently, nearly fifty participants gathered in Ljubljana in October 2007, including the members of the ECPGR On-farm Conservation and Management Task Force, representatives of research institutes, universities, local administrations and NGOs. The members of the EU-funded project "DIVERSEEDS – Networking on conservation and use of plant genetic resources in Europe and Asia" also attended.

The workshop was organized in five thematic sessions, including presentations and discussion. The international background and the state of the art in scientific research about home gardens in Europe were presented in session I. A series of local and national activities involving home gardens followed in session II, describing experiences from Austria, Italy and the UK. Session III focused on studies from Italy and Hungary on the measurement of genetic diversity in home gardens. Policy issues such as seed supply, European legislation, the role of incentives and experiences from an NGO perspective were proposed during Session IV. The last Session V was a discussion on a possible way forward in order to create a consortium that could continue collaboration for research into home gardens in Europe. This resulted in a concept note proposing to establish a research "budget line" in the framework of the EU Framework Programme "Food, Agriculture and Fisheries, and Biotechnology" (see Appendix I).

This book collects together a number of the contributions that were made in Ljubljana and intends to be a starting point demonstrating the opportunity to join efforts to understand and maintain precious resources in Europe.

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International case studies and tropical home gardens projects: offering lessons for a new research agenda in Europe

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The European network meeting for on-farm conservation and management of crop landraces held in Stegelitz, Germany (19-20 June 2006) called for action to stem the accelerating erosion of crop landrace diversity (Del Greco et al. 2007). Several points were made that require immediate attention. First, many crop landraces in Europe are being lost without our even knowing what is being lost. We do not have a clear understanding of what is under threat, nor how these losses affect future opportunities and the potential for Europe to produce crops that are adapted to new challenges such as environmental stresses including climate change, and the European public's changing and growing demand for nutritious and healthful foods with unique and novel traits. In addition, the increasing attention that European policies and consumers are placing on geographic origin, *produits de terroir,* biocultural heritage, and the role of crops and orchards, forages and forests in managing important landscapes adds urgency to the need to inventory, conserve and manage crop landraces. However, the attention that policymakers give to this issue is not commensurate with the potential value of these resources nor is it enough to stem the pace at which many of these crop landraces are disappearing from European agricultural systems. There is however a niche within European farming systems where crop landraces are being maintained and exchanged, namely home gardens. A focus on crop landraces in European home gardens may be an effective way to accelerate and scale up our efforts to understand and conserve crop landraces in Europe as part of a wider biodiversity conservation movement. However, we also need to understand the conditions of and threats to European home garden biodiversity. The collection of papers in this volume identify the areas of research which are key to understanding and supporting the role of home gardens in conserving and using crop genetic diversity.

Research on European home gardens is part of a much larger picture of home garden management for biodiversity conservation. There is a significant body of research on tropical home gardens that has increased our understanding about the identity, dynamics and sustainable management of landrace populations and rural landscapes. Given the hegemony of large-scale standardized agricultural production systems in Europe, the need to study and conserve the agricultural biodiversity found in European home gardens is all the more urgent. Key principles from home gardens studies from all over the world can contribute to the new research agenda in Europe and heighten the impact of European home gardens.

Lessons from home gardens around the world

International case studies can illustrate specific methods for identifying biodiversity in home gardens and how to use them to contribute to national plant genetic resource strategies (Landauer and Brazil 1990; Eyzaguirre and Linares 2004; Kumar and Nair 2006). One of the important aspects of home gardens worldwide is their role as a place of dynamic adaptive management of a rich variety of species and varieties. The plants are actively selected and managed in ways that allow them to evolve in changing circumstances. Home gardens that are significant for biodiversity commonly occupy a small space (on average up to 0.5 ha) and are primarily found in rural environments although they can also be found in peri-urban areas. They exemplify sustainable land use systems built upon biodiversity, which can be models for low-input, small-scale farming. The crop varieties found in home gardens are often unique and have been passed from generation to generation, neighbour to neighbour, undergoing human selection and natural drift on their journey through time. Examples of this uniqueness can be seen in the papers by Negri and Polegri (this volume, pp. 55-61), Silveri and Manzi (this volume, pp. 26-36), and Pavia et al. (this volume, pp. 21-25), which document the biodiversity found in three regions of Italy. The dynamic path many species and varieties follow is illustrated in the paper by Szabó (this volume, pp. 37-54), which exemplifies how a species (*Phaselous* spp.) can travel and take on different use values and cultural associations over space and time. This is an example of home gardens' role in preserving cultural heritage and conserving rural landscapes.

Home gardens can be part of an integrated national plant genetic resource programme complementing *ex situ* conservation. While individual populations of species in home gardens may be small, source-sink dynamics theory would suggest that they may be vital refuges for species that are no longer grown in larger agro-ecosystems nor found in the wild. Research in home gardens in Cuba (Castineiras et al. 2002) showed the value of home gardens as a viable conservation unit. Fig. 1 shows the

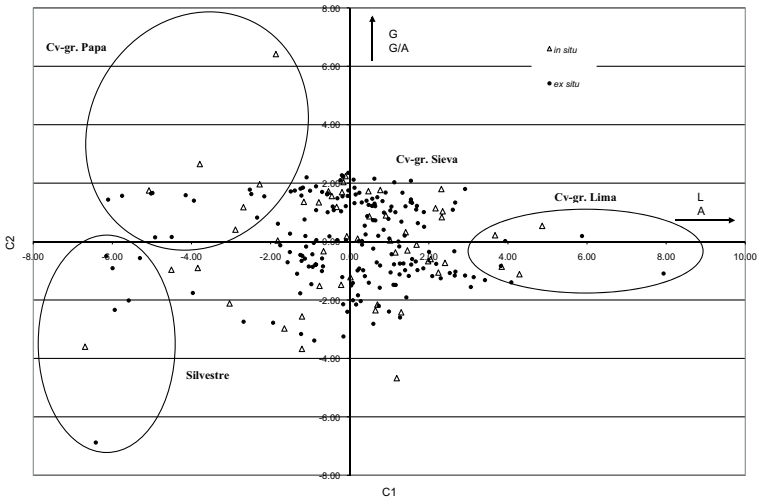

Fig. 1. The lost *ex situ* collections of Lima Beans (*Phaseolus lunatus*). Results of the Principal Component Analysis of the accessions of *Phaseolus lunatus* characterized in *in situ* and *ex situ* conditions.

overlap in the genes of lima beans (*Phaseolus lunatus*) from the lost *ex situ* collection and those still maintained in home gardens. This case illustrates the importance of linking home garden biodiversity to national plant genetic resources programmes. In the Cuban case, it was fortuitous that a home garden project underway was able to identify and recover the varietal diversity in beans that had been lost in the *ex situ* genebank due to loss of seed viability.

A study on chilli peppers (*Capsicum* spp.*)* in Guatemala investigated the potential of home gardens and found that levels of diversity in home gardens were similar to that in *ex situ* genebanks (Table 1). Furthermore the range of types was greater in home gardens. In the Guatemalan case researchers conducting studies in three distinct agro-ecosystems in the country concluded that a sample of 30-40 home gardens was often sufficient to have a representative sample of the crop diversity present in the ecosystem.

Table 1. Diversity values as calculated for different types of samples (home gardens vs. *ex situ* collection and semicultivated vs. cultivated materials). *H*i is the diversity within each type of sample; *H*s is the average genetic diversity within each type of sample; *G*st is the genetic differentiation coefficient; *n* is the number of accessions per sample; *H* = 0.280 (Total genetic diversity).

	n	***H*i**	***H*s**	***G*st**
Origin				
Home gardens	34	0.251		
Ex situ	40	0.281		
			0.268	0.043
Types				
Semicultivated	24	0.248		
Cultivated	50	0.286		
			0.274	0.021

One of the countries where home gardens have been most extensively documented and studied is Nepal. Studies by Sunwar et al. (2006) offer important methodologies and lessons for home gardeners in Europe, for example in understanding the motivations behind home gardens management, and the dynamics of local seed supply systems for long term sustainability. Practices, findings and research methodologies from home gardens projects worldwide can inform home gardens projects in Europe. At the same time, however, it is important to notice what is peculiar to the European context. Home gardens contain crop varieties that are sources of current or potential global public goods in the form of unexplored traits which might be useful for breeding, for novelty, for nutritional content, or to face changing climate patterns better. Research from Hungary highlights the case of home gardens as a source of crop genetic diversity for new markets and high value crops, in addition to their traditional role in families' food security. This is particularly important as Hungarian agriculture adapts to the quality and competitive demands of EU markets. The home garden represents a potential reservoir of genetic traits

that are important for European agriculture to continue to develop more nutritious, novel and quality foods while at the same time meet increasingly strict standards of environmental sustainability and reduced negative environmental impacts from agricultural production.

The European Context

Focus on small patches and niches that harbour crop diversity

Unlike other regions of the world, where landraces represent important crops if not the majority of the crops planted (Jarvis et al. 2007), Europe has few large areas planted with landraces. Landraces are found in small pockets and niches within European farming systems and are often grown for non-market and non-commercial purposes. Home gardens represent these types of niches par excellence. By their proximity to the home, these gardens also allow farmers to maintain those varieties that have great use or cultural value despite their relatively low commercial value.

Vegetable crops and fruit trees are the species where crop landraces are most important

In Europe, diversity in fruit trees and vegetables is widely recognized and appreciated by farmers and consumers. Landraces of these crops continue to thrive in home gardens despite the lack of formal attention to the on-farm conservation and management of these landraces (Pavia et al. this volume pp. 21-25; Silveri and Manzi ibid pp. 26-36; Negri and Polegri ibid pp. 55-61). Vegetable and fruit breeders and markets recognize the value of the traits that are contained in the genotypes grown in traditional European home gardens. These qualitative traits may assume greater importance as more attention is given to the organoleptic, nutritional, and health properties that define "functional foods".

New market diversification and regulation favourable to home garden crops

Landraces grown in home gardens could qualify under regulations and policies concerning geographic origin, terroir, cultural practices, and cultural history (Lopez Noriega, this volume, pp. 62-69) for an outline of current regulations and policies). Many of the varieties grown that qualify are referred to as "heirloom" or historic varieties and are gaining increasing attention among the public (Sherman, this volume, pp. 18-20). Farmers can be motivated to cultivate landraces and old cultivars by highlighting certain advantages such as cultivar adaptability to local conditions, better quality of product, demand for local specific (niche) products, traditional home consumption, etc. These advantages are likely to be realized in small-scale production and will often be found in home gardens.

Landraces and seeds

Increased or secure cultivation of crop landraces is often constrained by the lack of seeds. Legislation often limits exchange of landrace seed to lots smaller than 10 kg. Grown in small amounts and small patches, farmers often lack seed to meet their own needs much less supply others. There are however new and emerging seed networks for farmers growing landraces that increase the levels of trust, reliability

and quantity of seed supply. These networks can bring together the formal and informal sectors in order to create a shared agenda for action (see Bartha, this volume, pp. 70-71). This is an important factor for conservation but it is in its early stages and often takes place through exchanges of seed, saplings, and root stock in home gardens.

Ageing farmers, fewer farmers and loss of knowledge

It has been noted that European farmers growing landraces are fewer, older, and not able to pass knowledge and traditions to the next generation as the number of small farms cultivating landraces declines. The macro-economic and long term trends are difficult if not impossible to reverse or attenuate. However, even people whose full time occupation may not be agriculture may continue to maintain crop landraces in home gardens and orchards precisely for those non-economic, cultural and adaptive factors that are intrinsic to many European crop landraces. Rather than try to focus on conservation and restoration of large scale production devoted to crop landraces, a focus on niches such as home gardens may be more realistic. A focus on crop landrace conservation in home gardens would bring together the sense of culture, geographic specificity and "*terroir*", the link between the culture and the crop traits that are valued, maintained and observed as they evolve, and the traditional knowledge of uses, tastes, and cultivation practices, that are the underpinnings of continued use of landraces in European agriculture. Negri (this volume, pp. 72-80) presents some insights into incentives that have been used in Umbria (Italy) to preserve home garden biodiversity and raise awareness about home garden landraces.

An agenda to scale up and expand ongoing European home garden PGR research

Preliminary work on crop diversity and genetic resources in home gardens by European research partners in Hungary, Austria, Italy, France, Germany, Portugal, United Kingdom, Serbia and Montenegro among others has shown the values and cost effectiveness of a home garden approach for the inventory, conservation, and management of crop genetic resources, especially landraces of vegetable crops and fruit trees. Szabó (this volume, pp. 37-54) makes a case for long term monitoring of European home gardens biodiversity trends through a *Phaseolus* diversity model.

Galluzzi et al. (this volume, pp. 8-17), make it clear that there is great potential to address crop landrace conservation through a focus on home gardens. It is also clear that policies and growing public interest in the biodiversity benefits and products of home gardens in agro-ecosystems make it propitious to begin a Europe-wide research initiative on this topic. However, as the Galluzzi paper points out, there are still important research questions to answer and hypotheses to be tested before a range of *in situ* crop conservation strategies can be developed based on home gardens in agroecosytems for the varied conditions of the European network (ECPGR). This will require a set of committed partners ready to move forward seeking support to implement this agenda. Funding proposals to the EU and other donors, collaborative research arrangements, and sharing of existing information on home gardens and crop genetic resources will be among the important first steps. Below are some of the research issues that need to be addressed.

Definitions and scope

European home gardens need to be defined, inventoried and understood. Key research questions are:

- What are the peculiarities and characteristics of European home gardens?
- What are their main motivations for conserving diversity in home gardens?
- What are the socio-economic and cultural assets of European home gardens?
- Which factors (biological, human and political) mainly influence the composition and persistence of home gardens in time? For example, how does commercialization impact the level of diversity and its maintenance over time?
- Who are the stakeholders involved and by whom are home gardens and their managers "represented"?

Current gaps in knowledge

Focusing especially on the genetic diversity of crops conserved in home gardens, urgent and significant gaps in knowledge need to be identified and filled by further collaborative research at the European level:

- What contribution do European home gardens make to the conservation of genetic diversity?
- How much and what type of diversity do they conserve?
- What is their composition in terms of crops and species?
- Is such diversity undergoing genetic erosion in larger agro-ecosystems?
- Is the diversity different from that conserved in *ex situ* collections?
- Why and how could home gardens be successfully included in PGR *in situ* conservation strategies?

European policy and socio-economic factors

Analysis is needed of the main constraints to the survival of home gardens as places for active *in situ* conservation of biological and cultural diversity:

- How is current and future EU policy impacting on genetic resources and conservation of diversity, especially in small systems like home gardens?
- What is the relevance of the current changes in the seed supply and exchange system?
- What are the incentives and measures that could persuade gardeners to maintain diversity in their systems?
- What could be the most effective mode of representation of home gardeners and how should we strengthen the link between them and the national/international governing bodies?

The questions posed above are best addressed through a network of European partners beginning with plant genetic resource programmes in agricultural research institutes or ministries. It should also include farmer networks, regional agricultural development agencies, and organizations (NGO or non-profit) that are concerned with promoting the unique identity and quality of European agriculture and crop varieties. The papers and challenges laid out in this collection of papers are intended to stimulate and support early action for the conservation and '*mise en valeur*' of European crop genetic resources maintained and nurtured in home gardens.

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Uncovering European home gardens: their human and biological features and potential contribution to the conservation of agro-biodiversity

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Home gardens have mostly been considered in their role as sustainable production systems contributing to food security, nutrition and income generation especially in developing countries. Studies on the role of home gardens in the conservation of agricultural genetic resources are not frequent, and in Europe in particular these small-scale farming systems have been neglected. Nevertheless, home gardens still exist and are especially relevant in marginal agricultural areas of the old continent. A renewed interest has recently been directed at the study of their potential for *in situ* conservation of agricultural biodiversity.

Home gardens can generally be defined as family-managed microenvironments within larger farming systems, often displaying high levels of species diversity. In the present paper, the existing scientific data and unpublished information (for example from the internet, policy measures, ideas from NGOs etc.) regarding European home gardens were collected in an effort to produce a description of their common biological features, with special focus on their social and cultural value, the genetic diversity they harbour and the factors influencing it. The economic and policy issues relevant to the maintenance and promotion of home gardening across European countries are also discussed, and improved coordination between potential stakeholders involved in home garden studies and activities is proposed.

On-farm conservation and home gardens

There is a growing global concern about the loss of genetic diversity, and in particular the loss of crop diversity, which contains important resources needed for agricultural progress. Because of the limits of *ex situ* conservation of genetic resources, especially in the conservation of landraces, wild relatives and under-utilized crops (Hammer et al. 2003), it is generally agreed that *in situ* conservation of genetic resources is an indispensable complementary tool to be adopted (Altieri and Merrick 1987; FAO 1989) for genetic diversity conservation. This is mentioned explicitly in the Convention on Biological Diversity (CBD). *In situ* conservation is concerned with maintaining species' populations in the biotic environment they belong to, whether as uncultivated plant communities or in farmers' fields (on-farm conservation) as part of existing agro-ecosystems. It seeks to maintain the processes of evolution and adaptation of crops to their environments and calls for active participation by farmers (Jarvis et al. 1997).

In the holistic approach required when planning *in situ* conservation strategies, it has been suggested that small-scale farming systems such as home gardens should be included as potential reservoirs of agricultural biodiversity. Generally until recently, home gardens have mostly been studied as production systems in

projects for food security, nutrition and income generation in developing countries. Studies on the conservation value of home gardens are not as frequent, especially in developed countries, where agricultural policies are oriented towards intensification and large-scale commercialization. Nevertheless, even in Europe, the few studies available indicate the persistence of home gardens, especially in marginal areas, and document their role in securing crop genetic diversity, shaping the landscape and maintaining the traditional knowledge in communities.

Home garden biological and human traits

Home gardens can be defined as microenvironments within a larger farming system (Eyzaguirre and Watson 2002). They are usually more carefully tended and well delimited (with fences or hedges) from the neighbouring fields but nevertheless maintain a certain degree of exchange with the surroundings, in terms of natural or man-driven movement of species and of gene flow. Home gardens vary in size, structure and design, depending on the ecological, economic and cultural environments they are found in (Gliessman 1988). Although home gardens have no defined or fixed dimension, studies in different eco-zones of developing countries have described an average size of 0.1-0.5 ha (Eyzaguirre and Linares 2004), whereas in Europe they seem to be smaller, between 180 m^2 (Smith et al. 2006) and 500 m^2 (Birol et al. 2005a).

Despite the variety of home gardens identified, some common features can be used to describe them. The arrangement of different species, both cultivated and wild, over the physical area of the garden and over a succession of time periods determines the occurrence of a stratified "architecture" that is also common to agroforestry systems. This typical spatial arrangement of different plants, together with the constant dynamic experimentation carried out by the owners seem to be more important in delivering a home garden's ecological function and maintaining its viability than the identity of the plants themselves (Smith et al. 2006). Home gardens often act as a refuge for wild fauna (Daniels and Kirkpatrick 2006) and thus constitute a bridge between more intensely managed agricultural landscapes and the natural surroundings, sometimes acting as buffer zones for wildlife. The low application of pesticides and fertilizers and the intense degree of space coverage preventing soil erosion contribute to the creation of sustainable ecosystems (Eyzaguirre and Linares 2004).

Home gardens are closely connected to the social group residing in the household. The species serve multiple purposes in the household and the garden itself has multiple functions. Gardens become a culturally constructed space where indigenous knowledge is kept and transmitted through the involvement of different actors such as women or elderly farmers (Negri 2003; Eyzaguirre and Linares 2004). At the same time, home gardens can generate primary or secondary income (Eyzaguirre and Linares 2004) by producing food for subsistence or small-scale marketing. They also offer work and recreational space and protect the environment.

Diversity maintained in home gardens

Inter-specific diversity

Home gardens often contain a high degree of biodiversity (Eyzaguirre and Linares 2004) and may contain species or varieties that are different from those found in

the surrounding macro-system. Horticultural crops, aromatics, trees, ornamentals and medicinal plants can be found in various combinations and to different extents depending on the households' needs. Minor, underutilized crops and landraces are common, especially in remote or mountainous regions (Vogl-Lukasser and Vogl 2004). In the same home garden both commercial cultivars and a variety of landraces can be found (Negri and Tosti 2002; Negri 2009). It is worth noting that landraces of certain crops are maintained almost exclusively in home gardens, which thus prove to be an effective refuge for those varieties that have long been abandoned in commercial fields (Negri 2003; 2009; Perales et al. 2003). Landraces may be favoured because they compete successfully with new varieties; they often are better adapted to specific environmental conditions and guarantee, if not high, stable yields even in unfavourable years (Kulpa and Hanelt 1981; Negri 2003; Andonov and Ivanovska 2004).

Immigration into Europe has led to the appearance of gardens managed by individuals from countries outside Europe, who have introduced their own crops, landraces and cultivating methods into the gardens (Gladis 2002), adding to the genetic diversity and overall complexity of the system.

Wild forms and weeds are also likely to be found; on a household basis they are often appreciated for their colour or scent (Vogl-Lukasser and Vogl 2004), and some can be used as food. A study in Poland found that home gardens there act as a refuge for weeds, primitive forms of cultivated plants and relic crops, and are sometimes places for domestication of wild forms (Kulpa and Hanelt 1981).

Intra-specific diversity

Intra-specific diversity in home garden crops may vary greatly with the species; it also depends on the crop's population size and the selection pressures applied. For example, native fruit trees that may be widely present in the surrounding ecosystem may not be well represented in their overall diversity in a home garden; trees require more space than herbaceous plants, have a long life cycle and in addition one or two individuals might be sufficient to provide fruit for family consumption. Therefore, the intra-specific diversity of such species might be low. Even so, the few individuals in a home garden often possess rare alleles related to an elite or prized characteristic (like the "lemon-scented" pear tree described by a farmer in his home garden in Southern Tuscany) allowing a specific use within the family (Guarino and Hoogendijk 2004).

Recent studies based on molecular markers have allowed rapid, efficient assessments of intra-specific genetic diversity (Hammer et al. 2003) providing useful information on which to base future decisions on the management and conservation of genetic resources. With molecular markers, the diversity between home garden populations and *ex situ* collections of the same crop has been compared. The results obtained for *Capsicum* populations in Guatemala show that home gardens contain as much intra-specific diversity for that crop as that conserved in genebank collections (Guzmán et al. 2005) and strongly support the inclusion of home garden systems in on-farm conservation strategies. In addition, molecular markers have shown that home garden landraces, even when cultivated across small geographical areas, display a substantial amount of diversity at the sub-population level. In other words, each landrace (i.e. population) is made up of several distinct types, each belonging to a certain farmer or family, so that the total diversity is structured and distributed across a set of gardens (Tosti and Negri 2005; Negri et al. in press; Tiranti and Negri 2007).

To study the evolution of diversity in home garden crops and to plan strategies for the conservation of intra-specific diversity, scientists stress the need to consider a basic unit which is capable of an "independent evolutionary future" (Perales et al. 2003). Because of the small size of home garden populations (Frese 2002) and of the structure they show (Tosti and Negri 2005), neither investigations into molecular diversity nor conservation planning can rely on a single garden, but should be based on as many different populations as possible and a certain number of home gardens within a cultural, social and ecological system.

Factors influencing home garden diversity

The level and persistence of diversity in home gardens are influenced by factors such as mutation, mating system of the crops, selection, genetic drift, and gene flow, but little data are available about these factors in home garden environments.

The level of spatial isolation between wild and cultivated populations (Frese and Burenin 1994; Zizumbo-Villarreal et al. 2005), the number of cultivars and landraces grown on each farm, the amount of seed exchange among neighbouring farmers and of course the crop's mating system can each affect the level of gene flow and contribute to the shaping of diversity.

Selection is a complex issue because it embraces both biological and social areas of investigation. Micro-environmental selective effects are reported for some crops (Tosti and Negri 2005; Negri et al. in press), however it is not easy to distinguish these effects from those caused by human selection. Selection carried out on each crop by the gardener is a particularly important factor because of its implications on conservation activities (Brush 2004). Different patterns of selection can determine profoundly different effects on population structures depending also on the crop being conserved, the population size, the adoption of either traditional or "modern" breeding schemes and the influence of market demand. Selection pressures applied by farmers are likely to change with time, among different farmers, across generations and under varying social dynamics. For example, seed selection practices carried out by farmers in Mexico and in Italy have been shown to maintain the desired agronomic characteristics of their varieties (Louette and Smale 2000; Pallottini 2002). Instead, families immigrating into Europe from warmer climates seek to gradually adapt their horticultural crops to the colder environment (Gladis 2002) by planting early ripening varieties.

The significant role of seed exchange within the home garden system or between the latter and the larger commercial system (Fundora Mayor et al. 2004) must not be underestimated, as it is an important driving force leading to modification of the existing diversity or restoration of eroded diversity.

Socio-economic and cultural aspects

Many different social and cultural factors affect the level of interest and decision-making patterns of home garden cultivators and consequently the structure and composition of their gardens.

Wealth differences and ownership of the land are sometimes reflected in home garden plant diversity; farmers who do not own the land they cultivate are not usually willing to make investments in long-term improvements and diversity in their gardens is lower.

Production type and market demand are the fundamental socio-economic driving forces in determining the diversity of home gardens. Farmers in depressed areas of Europe most value agricultural diversity and the food it produces. On the contrary, in richer areas, as the markets become denser and physical infrastructures improve, farmers rely less on their home produce and get more often involved in off-farm jobs, which results in an impoverishment of the biodiversity on their farms (Birol et al. 2005b). It has been observed that subsistence-oriented home gardens in remote areas usually contain greater crop diversity than gardens closer to cities, which are more oriented towards commercial production and display less diversity (Leiva et al. 2002). The impact of markets can be seen when a traditional home garden crop is taken up by the market. This can cause strong selective pressures on the garden populations of that crop, which favour only a few genetic variants carrying the traits required by consumers and determine a dramatic reduction in the diversity of the population (Portis et al. 2004).

The impact of markets and the historical political situation have led to a greater persistence of home gardens in the poorer areas of the old continent. In Eastern European countries, which were ruled by collectivized state systems, families were permitted to cultivate their own gardens in small plots adjacent to their dwellings. This was crucial for their food security. Even since the transition to a market economy, weak food markets still persist in many rural communities and families still rely on their home gardens for some of the foods they consume, improving the breadth and quality of their diet while ensuring the conservation of crops and landraces (Birol et al. 2005a). In these and other marginal environments, the maintenance of home gardening, due both to cultural reasons and economic opportunities, counterbalances the general decline of agriculture, forestry and the related social and cultural activities observed across most of Europe (Vogl-Lukasser and Vogl 2004).

The cultural heritage belonging to those who manage a home garden is also of paramount importance for the system's survival. Factors such as gender, age, awareness of conservation issues (Birol et al. 2005a; Smith et al. 2006) and aesthetic preferences play a role in determining selection practices, levels of material exchange and consequently the overall aspect of the gardens. Studies in which gender and age have been recorded in Europe show that women are often responsible for the introduction of and experimentation with new species in home gardens (Vogl-Lukasser and Vogl 2004) and that it is mainly elderly people who are involved in home gardening (Negri 2003; Vogl-Lukasser and Vogl 2004). Younger people living in the countryside are often employed in agriculture part-time and find it more convenient to buy commercial seed, a solution which reduces the agrobiodiversity conserved on-farm and also causes a gap in the generational transmission of knowledge related to traditional seeds.

Policy issues concerning home garden diversity maintenance

The concept of multifunctional agriculture was first embraced by the EU's Common Agricultural Policy (CAP) through the agro-environmental regulation 2078/92 on agricultural production methods compatible with the requirements of protection of the environment and maintenance of the countryside. It was then incorporated again into later regulations until the most recent reform of the CAP in 2003. Nevertheless, European agricultural policies in favour of biodiversity conservation, as they are today, provide no incentive for explicit forms of on-farm conservation and fail to

recognize the role of small-scale farming or home gardening in providing public goods. Some policies (such as SAPARD[2]) have even offered direct payments to cease the production within small landholdings, which is believed to have caused a severe loss of biological diversity in the agricultural systems and landscapes of the countries involved (Birol et al. 2005a).

A problem of particular relevance is that of the current seed system, which does not allow the commercialization of varieties that are not registered according to EU legislation. Such legislation requires varieties to be distinct, uniform and stable. Since the 1980s, the EU's seed marketing regulations have been widely criticized by the informal sector, consisting of civil society groups, associations of farmers who grow and exchange landraces or vintage varieties mainly for niche and local markets, and NGOs who fund (directly or indirectly) their activities through the diffusion of amateur varieties. They emphasize the importance of allowing commercial exchange of farmer seed and non-registered varieties for the maintenance of small-scale farming systems and home gardens.

In response to pressures from the informal sector, in 1998 the EU adopted a directive (98/95/EC[3]) proposing the possibility of legalizing farmer seed commercialization through a separate regulation system dedicated to "conservation varieties". However, no agreement on the actual conditions for marketing them has been achieved yet despite many meetings and discussions being held. On 17 April 2007, a document aimed at implementing the above-mentioned directive (paper SANCO3322/06rev12) was adopted unanimously by the Standing Committee on Seeds. Lively discussions have continued since that date, especially on the issues of geographic and quantity limitations and have caused the failure of further negotiations. The current situation is that the Standing Committee has in fact refused to modify the text that was approved in April 2007 on such points and a decision from the EC on procedures for the implementation of the directive is still forthcoming[4]. At present, it appears that the only law in Europe allowing the commercialization of conservation varieties is one in Italy (Law n.46, 6 April 2007), which is not far from being operative.

Conclusions

Increased awareness about the multiple services home gardens can offer to the community and the environment is needed among the public and European policy makers in order to promote their maintenance and restoration. Ad hoc strategies and funding schemes should support this action. However, the policy of including home garden microenvironments in conservation strategies for a given species needs to be supported by more scientific data.

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[2] Special Accession Programme for Agriculture and Rural Development.

[3] Directive 98/95 amending, in respect of the consolidation of the internal market, genetically modified plant varieties and plant genetic resources, Directives 66/400/EEC, 66/401/EEC, 66/402/EEC, 66/403/EEC, 69/208/EEC, 70/457/EEC and 70/458/EEC on the marketing of beet seed, fodder plant seed, cereal seed, seed potatoes, seed of oil and fibre plants and vegetable seed and on the common catalogue of varieties of agricultural plant species

[4] The EC finally published on 20 June 2008 the DIRECTIVE 2008/62/EC on seed production and marketing of landraces and varieties threatened by genetic erosion.

There is a general consensus on the sustainability of home gardens as agricultural systems, but more data are needed on the interrelations between home gardens and the surrounding ecosystems and communities. This would clarify the benefits provided by home gardening activities and the added value of including home gardens in European conservation policies. The characteristics of European home gardens need to be investigated and the variability among different countries, which is expected to be high, should be recorded in detail. Not enough is yet known about the amount of genetic diversity in home garden crops, but precise quantification is essential, especially of intra-specific genetic variation, in order to know how viable home garden populations can be in the future. In addition, it would be useful to investigate to what extent home garden plant populations may contain unique alleles and traits that might be rare in the same species grown in different agricultural systems. As molecular tools become increasingly available, population genetics can be used to study the persistence and evolution of the diversity in home garden crops and thus plan on-farm conservation and management strategies based on sound scientific results.

Some key social issues also need to be clarified at a European level in order to promote the maintenance of home gardens and to make conservation strategies effective. Motivation and willingness among owners to run a home garden is the first of these. The role of family and society in maintaining and transmitting the knowledge, traditions and cultural heritage associated with local varieties and landraces needs to be investigated as a relevant aspect of diversity maintenance.

Some key issues have been identified that should be addressed in future studies on European home gardens:

- Multi-functionality of home gardens in Europe
- Home gardens' contribution to the maintenance of landraces and/or rare, underutilized or threatened species
- Amount of genetic diversity which is maintained in home gardens, especially at the infra-specific level for individual crops
- Evolutionary factors influencing (maintaining or eroding) such diversity
- Nature of the benefits (direct or indirect) provided by home gardens to the ecosystem and people
- Sociological studies on people and groups involved in home gardening and level of awareness about their contribution to biodiversity conservation
- Local knowledge and how it is maintained, developed and transmitted over generations in the home garden systems
- Economic and policy issues that influence the survival and characteristics of home gardens.

Introducing home gardens into national plant genetic resource systems calls for better integration between the formal and informal sectors and the development of regional, national and European legal frameworks.

Most importantly, efforts are needed to facilitate the sharing of information across Europe. Stakeholders from the different sectors that are involved in home garden studies or activities need to be more clearly identified and recognized. At present a missing link between the "basic" level of the home gardeners and national and European legislation is evident in many countries and appears to be a common

feature across Europe. The choice of a representative group (composed of delegates from Scientific Institutions, NGOs, Farmers Associations) in each country, specifically dealing with key issues concerning home gardens and participating in discussions, might be a first step towards improved interactions between policy makers and scientists on the one side and home gardeners on the other.

In conclusion, a more detailed analysis of home gardens across Europe could provide a clearer picture of home garden biodiversity and its potential role in the conservation of plant genetic resources. This would facilitate the raising of awareness among European policy makers about the importance of including home gardens in plans for the conservation of agro-biodiversity to the benefit of the ecosystems and people.

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Seed saving in the home garden: Garden Organic's Heritage Seed Library[5]

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Background

The English are often thought of as being a little eccentric. Certainly if you look at some of our habits, you might be justified in thinking that. One typical British passion is collecting – anything from bottle-tops and old packets to train-spotting. Fortunately for the human race it also seems to include seeds. Add to this the British love of gardening and you can begin to see why the UK charity Garden Organic can make a success of their Heritage Seed Library (HSL).

Recently in the UK there has been a resurgence of interest in vegetable and fruit growing, either in the home garden or on an allotment. This has brought many new gardeners into contact with the concept of conservation and saving heirlooms. It has not been difficult to explain the principles behind the Heritage Seed Library to the public; they seem to understand the issues very quickly.

One factor that has particularly boosted support is the mistrust of bureaucratic intervention, especially from Europe. There is an English adage, "An Englishman's home is his castle", which describes the belief that what anyone does at home is their own business and they will defend this space against any invaders. Thus an EU Directive, suggesting that gardeners can't buy and grow what they want, is not popular! The Directive never intended to affect the home gardener, but, in fact, indirectly but also directly, it has reduced the availability of seed.

Origins of the Heritage Seed Library

Many of our best ideas originate with Garden Organic's founder, Lawrence D. Hills (1911-1990), a visionary and true eccentric. He was greatly concerned about the EU Marketing Directive on Plants and Seeds and feared that many traditional varieties all over Europe would disappear as a result, especially those that had never been on any list or in any catalogue but were handed down from one generation to the next or to a neighbour over the fence.

We have learned from Lawrence's ability to translate difficult subjects into popular language. He did not talk about genetic resources but described the old varieties as masterpieces of breeding: Rembrandts, Van Goghs and Monets of the vegetable kingdom. In 1991, a year after his death, we decided that British interest in these old masterpieces could serve to safeguard the seeds and popularize the issues. The Heritage Seed Library came into existence as a membership-based operation. In the

[5] Updated 14/10/08

first few years membership grew every year by between 500 and 1000 people, reaching its current total of 11 500. We started to learn skills from professionals such as Dave Astley, nearby at the national genebank that Lawrence Hills had helped into existence, and Nigel Maxted at the University of Birmingham. Eventually through a large grant from the Heritage Lottery Fund we gained proper facilities for our operations.

How it works

For an annual subscription every member receives six or seven packets of seed ordered from a catalogue that is sent out in December. It offers about 200 of our 800 varieties each year and members must order by the end of March to be sure of seed. In fact only half our members order seed, showing that the other half are happy just to support our conservation work.

Seed is produced by Garden Organic staff on site and by up to 250 volunteer "Seed Guardians", who "adopt" a variety for us. We are never short of volunteers, although training them in what we need in terms of quality is challenging.

We further publicize the issues and our work through events, workshops, displays of growing vegetables at our two sites open to the public and through our indoor interactive exhibition called 'The Vegetable Kingdom'. This is aimed at families and children but also offers more in-depth information for keen students. It also literally provides windows onto the work of the Garden Organic HSL staff as they clean seed, packet and despatch to members.

Seedy Sundays began in Canada but are now a growing phenomenon worldwide. They have caught on remarkably quickly in the UK with new venues for these seed swapping markets appearing every year. Although this bypasses the conventional economy it does fuel interest in the ideas behind saving rarities, trying something unusual, conserving heritage. The idea was born from a realization that much seed is probably wasted when it could be shared or offered to others. Seedy Sundays (or Saturdays) vary in style but generally centre round a free exchange informal market, to which you can bring surplus seed and take away someone else's spares. It is an ideal forum for promoting the principles of conservation.

It is particularly beneficial that HSL does not try to stand alone as an operation. The fact that it is one of the activities of Garden Organic means that it is free from the costs of separate administration and finance.

Some typical varieties

Pea 'Carlin' – a historic variety

This variety had been grown by the family of our donor for more than 100 years. Originally given to her great, great grandfather as a wedding present, this ancient round pea dates back to at least Elizabethan times. Protein rich (about 25%) Carlin is a classic drying pea, still traditionally eaten in northern England on the Sunday before Palm Sunday, known regionally as Carlin Sunday. The peas are soaked in brine overnight, boiled and eaten with salt and vinegar or doused in beer or mint sauce. It is said that the tradition commemorates the arrival of a shipload of peas in besieged Newcastle in 1644, saving many from starvation. Attractive pink and lilac flowers are followed by pods of small, brown mottled seeds.

Broad bean 'Crimson Flowered' – family heirloom

The Heritage Seed Library's most well known variety, used to promote the message about our work to conserve and distribute heritage varieties. Our sample comes from seeds originally donated to the Seed Library in 1978 by Rhoda Cutbush of Kent. We do not know the age of this variety, but crimson-flowered broad beans were mentioned as long ago as 1778. A beautiful bean in flower, they have a bonus of numerous, small upright pods that are delicious picked immature and cooked whole or can be left longer on the plant for the small, tender deep green beans.

Lettuce 'Northern Queen' – former commercial variety

The donor, Sheila Smith from Sandwich in Kent, found these seeds amongst her father's gardening clutter. Further investigation revealed that this variety was originally sold by Finneys, a Northumberland firm with nurseries and trial grounds in Newcastle. Finneys closed during the 1950s at which time Northern Queen was the main outdoor variety, popular with both amateurs and commercial growers. A large butterhead variety with soft, mild flavoured leaves, it is reported to be tolerant of both frost and damp.

Linking in with fashion

In the UK it is now fashionable to be seen to be green, and also people of all ages are responding to concerns about modern damaging lifestyles. Vegetable growing has become popular again and, as a result, old varieties appear to have gained a cachet to the extent that several of our seed companies have introduced 'heirloom' ranges of seeds to their catalogues.

Of all Garden Organic's activities it is time and again HSL that attracts corporate interest for something to support. They can clearly see the benefits in being allied to something so unusual, and unique within the UK. They sometimes have unrealistic expectations of the possibilities and we have to be careful to explain clearly the limitations. Managers of vegetable box schemes, now growing rapidly in popularity in the UK, are beginning to see that they can add curiosity value to their range of vegetables by including our varieties. This places new pressures on us, as we are organized to look after gardeners, not professional growers.

Historical context

Our final contribution to publicizing and popularizing the issues in conservation of genetic resources has been to place our varieties in suitable contexts - in other words, in gardens. We have done this at our sites open to the public, one in particular adding a historic background. Audley End Organic Kitchen Garden, which the organization manages in association with English Heritage, is a 250-year-old walled garden at its peak of perfection in the late 19th century. Here we have been able to save sufficient seed to show long rows of some crops and offer the produce for sale to visitors.

Autochthonous fruit tree germplasm at risk of genetic erosion found in home gardens in the region of Latium (Italy)

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Introduction

Due to ecogeographical and historical reasons, Italy is a country with a rich biological diversity and a very long horticultural tradition. Climatically manifold conditions, from alpine-continental to subtropical-maritime environments, in combination with mountainous, hilly and plain topography in all parts of the country allowed the introduction of a large number of tree species and successively the development of ecotypes adapted to a variety of specific environmental conditions. The introduction of species from other parts of the world through human migration and mercantilism since pre-Roman times further contributed to this development.

Today, there is a profound awareness among Italians of this natural heritage at national, regional, and local levels. Examples of the strong links between the population, the territory and its products are still found today in rich local cuisines as well as in local festivals dedicated to local products.

Nevertheless, increasing standardization in agricultural production severely marginalizes large parts of the traditional autochthonous plant diversity. As a result, during the last 20 years, many different initiatives for the protection, conservation and promotion of Italian germplasm have emerged, both at the governmental and the non-governmental level.

Recently, Italy's adhesion to and signature of various global agreements and treaties (Convention on Biological Diversity, 1992; Global Plan of Action, 1996; FAO International Treaty, 2004) aiming at the development of strategies for the conservation and sustainable utilization of plant genetic resources for food and agriculture also stimulated the different regional governments to set up action plans to implement the several tasks emerging from the responsibility assumed.

Regional laws for the safeguard and valorization of autochthonous plant and animal genetic resources, with particular attention to those which are at risk of extinction or genetic erosion, have, so far, been set up in six Italian Regions, namely Abruzzo (1997), Molise (1999), Latium (2000), Umbria (2001), the Autonomous Province of Bolzano (2001), Friuli Venezia Giulia (2002), Marche (2003) and Tuscany (2004).

Common issues and provisions of these laws are:

- the inclusion of identified autochthonous varieties and ecotypes in regional catalogues of germplasm to be protected

- the institution of scientific commissions to survey and coordinate the composition of these catalogues and decide on priority measures for the protection of the single accessions
- the establishment of a regional network of existing *in situ* and *ex situ* facilities for the conservation of the material identified (regional genebanks, Guardian Farmers, etc.)
- the collection, conservation and propagation of this material.

Materials and methods

In 2002, the Regional Council of Latium funded a two-year-project called "Individuation, recovery and characterization of local autochthonous fruit tree germplasm at risk of genetic erosion". Institutions involved were the Research Institute for Fruit Trees (ISF, nowadays CRA-Centre for Fruit Tree Research) in Rome and the University of Viterbo, Department of Plant Production. In 2006, the Regional Agency for Agricultural Development and Innovation in Latium (ARSIAL) funded ISF for a two-year continuation of the activity. The main tasks of the project are:

- the identification of local varieties and ecotypes of fruit tree species autochthonous to Latium
- the collection and transfer of the material identified to the *ex situ* collections of the project partners involved
- the production of mother plants
- the cataloguing of the material collected
- the study and characterization of the new accessions, with the aim of identifying those to be included in the regional catalogue of protected varieties
- dissemination of the results.

The survey, based on initial bibliographic studies and personal contacts, was carried out in fifty-four locations spread throughout the Region: in five places in the open landscape, three "villas" (i.e. former private gardens or parks belonging to noble people, which are nowadays open to the public, in which fruit trees were usually grown) and forty-six private home gardens. Criteria for the choice of the varieties and ecotypes were their autochthony and rarity, the rusticity of the trees, their local historical and cultural significance, and their economic and horticultural characteristics.

The home gardens visited, usually up to 0.5 ha in size, were located either in the outer suburban belt of urban centres or in remote areas, often close to the surrounding agro-ecosystems. In most cases they are characterized by mixed crops (fruits and vegetables), sometimes also in combination with animal husbandry (chicken, geese, sheep). As such, the gardens are an integral part of everyday life and play a fundamental role not only in daily household activities but also in social events with friends and family. Generally, people are very much aware of rare or local varieties present in their gardens and they preserve them carefully. However, it was observed that the maintenance of these trees and related knowledge is in most cases left to older people, while younger people usually show little concern about active preservation of the local, old germplasm growing in their parents' or grandparents' gardens.

Results and discussion

One hundred and twenty-eight different fruit tree varieties or ecotypes were identified, which represent eleven different species (Table 1), apple, pear and cherry being the species richest in autochthonous varieties.

Table 1. Autochthonous fruit tree germplasm identified in home gardens in the Region of Latium.

Species	Number of varieties
Apple	38
Apricot	3
Cherry (sour)	4
Cherry (sweet)	21
Chestnut	3
Grapevine	4
Hazelnut	4
Peach/ Nectarine	11
Pear	29
Plum	8
Pomegranate	3
Total	128

As shown in Table 2, nearly 40% of all varieties were found only once. Regarding the age of the trees, a third were younger than 20 years old, 40% were younger than 60 years old, almost a quarter younger than 90 years old and 5% were estimated to be older than 90 years old. Some very old exemplars were found, with ages up to 200 years old. The trees were either grafted onto local or commercial varieties. Concerning the individual history of the trees, investigations revealed that in 70% of cases, they had been planted by the current or previous owner of the gardens, either as single trees or as part of small orchards; 15% of the trees derived from old abandoned mother trees in the open landscape of which graft sticks had been transferred to the private gardens. In the remaining 15% of cases, the origin of the trees in their current surroundings is unknown. Nearly all the fruit growing in home gardens is destined for family consumption; in about one third of cases, the fruit is also sold on local markets.

The strong link between the fruits and their territory is often expressed by their names which recall the specific locations of their occurrence. For example there is a pear called "Spadona di *Castel Madama"*, "*Monteporzio* apricot", "Reginella di *Moricone* peach", "*Sabina* cherries", "Moscato di *Terracina* grapes", "*Gaeta* pomegranate", and so on. The crucial role of local varieties in people's identification with their territory and its products is underlined by annual town festivals (*sagre)* dedicated to typical local fruit varieties, which often date back more than 50 or even 100 years. For example the festival of the grape variety "Pizzutello di *Tivoli*" has been celebrated annually since 1845. Common features of these festivals are the

public exhibition of the harvested fruits, an award to the best grower in the region and the consumption of all kinds of dishes and drinks (sweets, desserts, liqueurs) prepared from the respective fruit.

When it comes to the names of the varieties collected, it was found that sometimes several varieties of the same species have the same name but differ to a greater or lesser extent in their morphological and/or agronomical aspects. This is particularly true for apples ("Mela Rosa" 'Pink Apple'), and cherries ("Ravenna"). Similarly, other varieties collected are reported to be autochthonous not only in Latium but also in adjacent regions of similar ecogeographical conditions. Therefore, the same variety might be known under several different regional names.

Table 2. Description of the trees.

Number of exemplars found per tree	only one: 40% more than one: 60%
Age of the trees	young (0-20 years): 33% medium (21-60 years): 40% old (61-90 years): 23% very old (>90 years): 5%
Type of propagation	grafted on local varieties: 80% grafted on commercial rootstocks: 15% probably by seed: 5%
History of the trees	planted by the current owners of the gardens: 65% were part of former orchards in the gardens: 5% were "saved" from old abandoned mother trees: 15% unknown: 15%
Utilization	family consumption: 65% family consumption and local markets: 30% no use: 5%

Molecular analysis will be necessary to clearly define the different accessions, the genetic variation expressed in clones or ecotypes of the same variety and to clarify cases of heteronymy and synonymy.

Conclusion

Within a period of only two years, it has been possible to identify 128 autochthonous varieties or ecotypes of eleven of the most important European fruit tree species in home gardens in the Italian Region of Latium. These local varieties, cultivated more for traditional reasons than for commercial purposes, represent a strong link between local populations and their territories, and they are proudly being cared of. Nevertheless, cultivation of these traditional varieties is threatened by two key socio-economic aspects: firstly, large scale production for commercial cultivars has marginalized the cultivation and consumption of locally adapted varieties to private households and niche markets. At the same time, traditional knowledge about the

characteristics, maintenance and use of this germplasm, and thus the germplasm itself, is at risk of being lost if future generations prove not to be interested in learning about it and neglect it.

A precise risk assessment of the single accessions needs, however, clear identification both to understand the threats and to better understand the varietal dynamics and the development of ecotypes.

Horticultural biodiversity and gardening in the region of Abruzzo

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Territory and research

Abruzzo is a region in central Italy characterized by mountainous and rugged territory overlooking the Adriatic Sea. Within a short distance of 40 km, the altitude ranges from sea level up to almost 3000 m asl. This peculiar orography, the diversity of the lithologic substrates and soils, together with the biogeography of the region, lead to a multitude of environments and microclimates. The regional flora is one of the richest in Italy and in the Mediterranean basin; the same applies to the agricultural biodiversity. The rich tradition of cultivation is also linked to the human history of the region in which the first evidence of agriculture dates back to 7000 years ago (Manzi 2006).

Since 1996, the Regional Agency for Agricultural Development Services (ARSSA) has been collecting, preserving and studying the germplasm of species of agricultural interest. The results are encouraging: around 30 different species were surveyed for a total of 280 accessions of which 230 are herbaceous and 50 are trees species.

Seeds of herbaceous crops have been stored in a semi-refrigerated seed bank in Sulmona (province of L'Aquila). The accessions of plant trees (apple, pear and almond) have been collected in three field catalogues located in Ortona dei Marsi, Capestrano (province of L'Aquila) and Scerni (province of Chieti).

Among the varieties identified, many are those of particular interest from an historical point of view, their precious organoleptic characteristics, and their close ancient connection with the life of the people of Abruzzo.

Among the cereals, 'Solina' common wheat should be mentioned as a variety which has been cultivated in Abruzzo since 1500. This is indicated in the notarial acts of sales from the fair at Lanciano for this period (currently kept in the local section of the national archives). This bread wheat grows in mountainous areas up to 1500-1600 m asl. The union of the flour it yields with its mother-yeast produces a unique flavour which is very much appreciated. The same flour is used to prepare homemade pasta: a simple and tasty dish.

Pulses have left clear tracks of their presence among the main crops cultivated in the mountains. Lentils, chickpeas and grass peas draw, in all central Abruzzo, the map of subsistence farming systems, characterized by a high degree of sustainability, even at the highest altitudes and poorest substrates. These fragile agro-ecosystems have allowed the maintenance of human settlements even in very harsh conditions. The mountainous areas of central Abruzzo are also known for the continued cultivation of vegetables no longer in use in other regional contexts, like field peas (*Pisum sativum* var. *arvense),* chickling vetch (*Lathyrus cicera*), and bitter vetch *(Vicia ervilia).*

Down at lower altitudes, the agriculture practised in valleys is richer thanks to the presence of deep soils and available water for irrigation. In some cases, such as in the Peligna Valley, Roman (or even pre-Roman) irrigation systems or terraces are still in operation. In these areas, horticulture has been recognized and celebrated since ancient times. For instance, the Latin writer and poet Ovid, described his motherland, the Peligna basin as "*... gelidis, uberrimis undis ...*" (rich in cold waters and bearer of large fruits). Nowadays, though marginal compared to local and national horticultural crops, the cultivation of local varieties is still practised, primarily for self-consumption. Beans and tomatoes are the most widely represented crops; nearly every farmer has kept their own local variety or its variants in different regional areas (the pear tomato, the smooth round tomato from Sulmona, the 'Frattura' bean also called the oil bean, the 'Cannellino' bean, and so on). Among the legumes, the presence of cowpeas (*Vigna unguiculata)* is to be noted since it is considered to be the oldest variety cultivated in Europe even before the American beans (*Phaseolus vulgaris* and *Ph. coccineus*). The latter, introduced after Christopher Columbus, has been grown in Abruzzo since about the XVI century (Manzi 2008a). Many regional basins can be considered centres for secondary differentiation of beans of the genus *Phaseolus*. Furthermore, there is no valley inland that does not have its own variety (Parco Nazionale del Gran Sasso e Monti della Laga 2008).

Among the fruit crops, apple and pear trees are extremely diversified. Some varieties are historically linked to the land and have names that go back in history such as the following apples: 'Limoncella' (lemon-like), 'Zitella' (old maid), 'Gelata' (frozen), 'Piatta' (flat), etc. Other apple varieties, of no less value, had become completely unknown and so new names have been given to them like 'Cajine', blackberry, 'Tinella', etc. Some varieties, though beautiful and valuable in terms of taste, have already lost their true identity because they have been retrieved without recording the original name or the geographical origin. In either case the fruits were "renamed" according to their place of retrieval, their identified holder or their appearance: 'Mela della suocera' (Mother-in-law's apple), 'Mela rossa grande di Pettorano' (The big red apple from Pettorano), etc.

Particular attention has been paid to autochthonous forage plants, in particular to alfalfa (*Medicago sativa*) and sainfoin (*Onobrychis vicifolia*). Two varieties of alfalfa have been selected on a broad genetic base and introduced into the Italian national register, and ARSSA is currently undertaking the same task for two varieties of sainfoin (Torricelli et al. 2000).

Traditional gardens in Abruzzo

The horticultural tradition of the region is ancient. During the Roman Empire for instance, the gardens around Amiternum (L'Aquila) were well known in Rome. Latin writers such as Pliny the Elder, Columella and Martial refer to various vegetables from Abruzzo which were appreciated in the cities. Among these feature the onions and turnips of Amiternum, the kales of Chieti, and the faba beans and onions of Marsica. Roman gardens were also used for producing species of vegetables with medical properties, which are rarely if ever used for human consumption today, such as elecampane (*Inula helenium)* and alexanders *(Smyrnium olusatrum)*.

In the medieval period, gardens surrounded large and small towns, convents and hermitages. The medieval communities' by-laws list the garden management and protection rules. Some by-laws imposed an obligation on citizens to cultivate gardens or to grow specific vegetables in them, such as cabbage, which was considered vital for food security. (Di Menna and Manzi 2006; Manzi 2008b).

After the discovery of America, some important vegetables reached Abruzzo including beans of the genus *Phaseolus* and pumpkins of the genus *Cucurbita,* which probably spread throughout the region during the sixteenth century. The cultivation of sweet pepper and chilli (*Capsicum annuum* and *C. frutescens)* was developed in the first half of the eighteenth century, while the first record of tomato fields is reported in the early nineteenth century. After the terrible famine of 1764 in southern Italy, political decisions imposed an obligatory cultivation of maize, replacing traditional cereals. The cultivation of potatoes, however, started only at the end of the XVIII century (Manzi 2006). Their widespread dissemination soon led to the disappearance, or scarcity, of some traditional vegetables such as parsnips (*Pastinaca sativa)* and black salsify *(Scorzonera hispanica)*. During the nineteenth century, the Jerusalem artichoke (*Helianthus tuberosus)*, another species of American origin, was cultivated for its edible roots. Later this species became consumed less as a vegetable and was used for animal feed.

The second half of the eighteenth century saw the beginning of land reclamation and deforestation of large flooded plains along the rivers Vomano, Pescara, Sangro, and Sinello Trigno. These new, fertile, irrigated, reclaimed plains were cultivated mainly with vegetables. This was the beginning of intensive horticulture for marketing. Even today the production areas for the main horticultural products are located on those fertile river plains.

The traditional horticultural types identified in Abruzzo

Urban and peri-urban gardens

These gardens are usually linked to urban centres of medieval origin and are often equipped with wells or cisterns. When irrigation water is not available, they are traditionally called "dry gardens". Located either inside or outside the city walls, they were frequently established on terraces or on the lands of destroyed houses. They thus represent, besides their agricultural interest, an important record of local history and urban planning.

Gardens located near springs

These gardens are located in the countryside or near rural villages, close to springs or fountains, and situated in both hilly and mountainous areas, often on terraces and separated by stone walls. Amongst the cultivated crops, there is the giant reed (*Arundo donax*) whose stalks were often used for staking prevailing vegetable or fruit crops.

A typical crop of these gardens is celery (*Apium graveolens*) and in particular the landrace "laccie nire" or black celery (province of Chieti). This vegetable is traditionally eaten during the celebration of the feast of Saints Cosmas and Damian in the hill town of Roccascalegna and represents a convivial dish in local inns.

Dry gardens in mountains areas

Often enclosed with dry stone walls, these gardens are mostly dedicated to the cultivation of potatoes, maize and beans, especially those varieties requiring little watering. The gardens receive enough water from the seasonal rains, even if the short growing season restricts the type of species cultivated.

Gardens of convents and noble mansions

Monasteries have always played an important role in the spread of both new crops and new agricultural techniques. Each convent, particularly the Benedictine convent, had its own garden for subsistence purposes. Often, next to the food crops, what was termed the "simple garden" (*giardino dei semplici*) was cultivated, with medicinal plants and aromatic herbs. The San Francesco grape, for example, was introduced into the Peligna Valley when the Franciscan monks established the convent of San Antonio of Sulmona. The monastery gardens, and those of noble or wealthy families, were often interspersed with herbaceous crops and orchards, especially apples and pears, often from external sources.

Gardens located in well-watered alluvial plains

These gardens are usually located 1) in alluvial plains traditionally occupied by intensive horticulture practised since the second half of the seventeenth century, 2) in areas historically dedicated to vegetable production like in the Peligna Valley, mentioned by Latin authors, 3) in the Fucino highlands, a vast flat cultivated area of 15,000 hectares obtained from colossal reclamation work started in Roman times and completed during the nineteenth century. The fluvial valley floors near the river mouths are still generally dedicated to vegetable production despite the fact that agriculture is now declining and being replaced by commercial and industrial activities.

Rare and endangered horticultural species identified in Abruzzo's gardens

Below is a list of traditional vegetables cultivated for different purposes (food, aromatic, medicinal, etc.). These plants, in rapid decline, have already disappeared in certain locations. For the botanical nomenclature, refer to Conti et al. (2005) and Pignatti (1982). The seeds of many of these plants are kept at the headquarters of ARSSA in Sulmona or at the Regional Reserve of Lake Serranella.

- Bastard dittany *(Ballota pseudodictamnus* (L.) Bentham)
- Bottle gourd (*Lagenaria vulgaris* Ser.)
- Caper spurge (*Euphorbia. lathyris* L.)
- Chamomile (*Matricaria chamomilla* L.)
- Chervil (*Anthriscus cerefolium* (L.) Hoffm.)
- Chickling vetch (*Lathyrus cicera* L.)
- Coriander (*Coriandrum sativum* L.)
- Cowpea (*Vigna unguiculata* (L.) Walpers)
- Dill (*Anethum graveolens* L.)
- Field peas (*Pisum sativum* L. var. *arvense* (L.) Gams.)
- Mint-geranium (*Balsamita major* Desf.)

- Opium poppy (*Papaver somniferum* L.)
- Opposite leaved saltwort (*Salsola soda* L.)
- Parsnips (*Pastinaca sativa* L.)
- Shallots (*Allium cepa* L. var. *ascalonicum* Back)
- Snake cucumber (*Cucumis flexuosus* L.)
- Southernwood (*Artemisia abrotanum* L.)
- Spearmint (*Mentha spicata* L.)
- Tree mallow (*Lavatera arborea* L.)

Horticultural varieties of ancient species of reduced distribution

A list of traditional local varieties of vegetable follows. They are often rare and their distribution is very limited. Seeds are stored 1) at the headquarters of ARSSA Sulmona, 2) in the seed banks of the regional reserve "Lake Serranella", in Sant' Eusanio Sangro, 3) in the botanical garden of Lama dei Peligni managed by the National Park of Majella, 4) in the flora research centre of the Apennines in Barisciano, managed by the National Park of Gran Sasso/Monti della Laga and 5) in the University of Camerino.

Beans (*Phaseolus coccineus* L.)
- *a scafa* (hulled)

Beans (*Phaseolus vulgaris* L.)
- *a caffè* (coffee bean)
- *a olio* (oil bean)
- *a pane* (bread bean)
- *a pisello* (pea bean)
- *borlotto antico* (old borlotto bean – plump, speckled kidney bean)
- *cannellino* (dwarf white kidney bean)
- *corallo* (flat French bean)
- *gialletto* (yellow)
- *nero* (black)
- *quaranta giorni* (forty days)
- *suocera e nuora* (mother- and daughter-in-law)
- *tondino* (round)

Cabbage (*Brassica oleracea* L.)
- *cavolo aquilano* (cabbage of L'Aquila)

Celery (*Apium graveolens* L.)
- *della Rivera* (from Rivera)
- *nero* (black)

Chickpeas (*Cicer arietinum* L.)
- *a fiaschetta* (flask-shaped)
- *nero* (black)
- *rosso* (red)

Garlic (*Allium sativum* L.)
- *rosso di Sulmona* (red garlic of Sulmona)

Lettuce (*Lactuca sativa* L.)
- *della Rivera* (from Rivera)
- *nostrana* (ours)

Onion (*Allium cepa* L.)
- *di Fara Filiorum Petri* (from Fara Filiorum Petri)
- *di Scurcula Marsicana* (from Scurcula Marsicana)
- *del bergamasco* (from Bergamo)

Potato (*Solanum tuberosum* L.)
- *fiocco di neve* (snowflake)
- *turchesa* (turquoise)
- *rossa dei Monti Pizzi* (red from the Pizzi Mountains)

Rape and turnips (*Brassica rapa* L.)
- *broccolo riccio* (curly broccoli)
- *valle dell'Aventino* (Aventine valley)

Sweet peppers (*Capsicum annuum* L.)
- *a corno* (horned)
- *di Altino* (from Altino)
- *di Sulmona* (from Sulmona)

Tomatoes (*Lycopersicon esculentum* Miller)
- *a pera* (pear-shaped)
- *costoluto* (ridged)
- *della secca* (dry)
- *mezza* (half)
- *mezzitempi* (half time)
- *tondo di Sulmona* (round from Sulmona)

Crop wild relatives of vegetable crops in Abruzzo

Abruzzo possesses a large number of flower species considered to be crop wild relatives of vegetable plants. Due to its strategic bio-geographic position, the region is at the confluence of species distribution from Euro-Siberian, Mediterranean and Balkanic origins. Some species such as chives (*Allium schoenoprasum)* or caraway (*Carum carvi)* reach in Abruzzo the southern limit of their diffusion in Italy. Others, like common sage (*Salvia officinalis),* dwarf chicory (*Cichorium endivia* subsp. *pumilum)* or cardoons *(Cynara cardunculus)*, in Abruzzo mark the northern limit of their diffusion in the Italian peninsula or, at least, in the Adriatic.

The gullies, located on clays locally named "*varicolori*" (multi-coloured) and dating back to the Oligocene period, are of particular interest for vegetable cultivation. They house several progenitors of vegetables including cardoons *(Cynara cardunculus),* opposite leaved saltwort *(Salsola soda),* garden orache (*Atriplex hortensis),* and sea beet *(Beta vulgaris* subsp. *maritima).*

The list that follows is of species considered to be spontaneous and indigenous. It does not include species introduced (or considered to be introduced) from outside, weeds, or species used for pharmacology, fodder, textiles or dyeing. The list takes into account the wild relatives of plants cultivated for aromatic and food purposes only.

- Alexanders (*Smyrnium olusatrum* L.)
- Asparagus (*Asparagus officinalis* L.)
- Black mustard (*Brassica nigra* L.)
- Black salsify (*Scorzonera hispanica* L.)

- Borage (*Borago officinalis* L.)
- Buckhorn plantain (*Plantago coronopus* L.)
- Capers (*Capparis spinosa* L.)
- Caraway (*Carum carvi* L.)
- Cardoons (*Cynara cardunculus* L.)
- Carrots (*Daucus carota* L.)
- Charlock (wild mustard) (*Sinapis arvensis* L.)
- Chickling vetch (*Lathyrus cicera* L.)
- Chicory (*Cichorium intybus* L.)
- Chives (*Allium schoenoprasum* L.)
- Common or garden vetch (*Vicia sativa* L.)
- Common rue (*Ruta divaricata* Ten.)
- Common sage (*Salvia officinalis* L.)
- Coriander (*Coriandrum sativum* L.)
- Dwarf chicory (*Cichorium endivia* L. subsp. *pumilum* (Jacq.) Court.)
- Elecampane (*Inula helenium* L.)
- Fennel (*Foeniculum vulgare* Mill. subsp. *vulgare*)
- Fringed rue (*Ruta chalepensis* L.)
- Garden orache (*Atriplex hortensis* L.)
- Lamb's lettuce (*Valerianella locusta* (L.) Later.)
- Leek (*Allium ampeloprasum* L.)
- Narbon vetch (*Vicia narbonensis* L.)
- Opposite leaved saltwort (*Salsola soda* L.)
- Parsnips (*Pastinaca sativa* L. subsp. *urens* (Req.) Celak)
- Prickly lettuce (*Lactuca serriola* L.)
- Rocket (*Diplotaxis tenuifolia* (L.) DC.)
- Sea beet (*Beta vulgaris* subsp. *maritima* L.) Arcang.)
- Spanish vetchling (*Lathyrus clymenum* L.)
- Sweet fennel (*Foeniculum vulgare* Mill. subsp. *piperitum* (Ucria) Coutinho)
- Sweet pea (*Lathyrus odoratus* L.)
- Watercress (*Nasturtium officinale* R. Br.)
- White mustard (*Sinapis alba* L.)
- Wild buckwheat (*Fallopia convolvulus* (L.) A. Love)
- Wild pea (*Pisum elatius* M. Biebi)
- Wild radish (*Raphanus raphanistrum* L.)

On-farm conservation activities

After dedicating the first years exclusively to germplasm collection inside the territory, it became evident that the collection *per se* did not mean saving. In the refrigerated seed banks, the material could be considered "buried" rather than safe, unable to evolve within a fast-changing environment. The only way to maintain the link between the seeds and their territory of origin was by encouraging their cultivation, consumption and trade. It was necessary to support the cultivation of marginal varieties which met a market demand that, however small or potential, would motivate the farmers to produce them. The approach was therefore changed. A new link between the following, till that moment unconnected, three concepts was therefore created:

Autochthonous = Typical = Organic

The word "*tipico*" (typical) is widely used in Italian to indicate 'typical of a certain region' and has connotations of authentic, unique flavours with strong links to the land. The term has become over-used and had lost its meaning since only the original varieties provide the genuine, unique flavours. The connections between these three concepts marks the end of a free and random exploitation, allowing strong policies of valorization to be embedded that can be defined as "social agriculture". The third notion in this approach, organic farming, provides value addition and would meet increasing demand on the part of consumers. Organic production is spreading in Abruzzo, especially in protected areas: one regional and three national parks that occupy more than 35% of the total territory. Within these areas, encouraging conventional agricultural practices would be senseless.

Joint projects are currently being developed between the ARSSA and the National Park of Maiella, the National Park Gran Sasso/Monti Della Laga and the Regional Park Sirente-Velino.

National Park of Maiella: Project "Let's Cultivate Diversity"

The project aims to collect, preserve and valorize the varieties traditionally grown in the park area. The research conducted thus far has led to the rediscovery of many traditional varieties still jealously guarded by farmers. All these varieties are surveyed and catalogued in the "Repertoire of autochthonous agricultural varieties of the National Park of Majella", "which describes the distinguishing features of each. Many can also be observed in the botanical gardens of the park Lama of Peligni and in S. Eufemia a Majella.

One facet of the project is to introduce elementary home gardening into the local primary school curricula, linking also to the history and culture syllabi in the explanation of the domestication of local varieties.

The project aims to encourage the cultivation of landraces among the farmers who have "preserved" them so far, a form of dynamic conservation (on-farm conservation). This implies the identification of the custodian farmer who physically takes care of them and improves them year by year. The most important advantage of conservation carried out in this way is that the landraces continue to evolve under the joint action of environment and traditional agricultural techniques, keeping alive the link with the local cultural matrix (Di Santo and Silveri 2004).

The National Park of Majella and ARSSA give subsidies to farmer custodians according to a precise schedule that includes:

- cultivating local varieties (annual fee)
- planting new orchards (50% of the cost of the initiative)
- cultivating old orchards or particularly valuable old trees (annual fee)
- purchasing machinery for small-scale processing and packaging of products from local varieties (50% of the cost estimates)
- investing in conversion to organic farming and certification.

A contribution, representing 70% of the expenses, has been planned for the operators of school canteens purchasing products from the parks' farmer network.

For their part, farmers commit to:

- joining the network of custodian farmers to maintain and increase the local varieties
- exchanging seeds with other farmers in the network
- obtaining organic farming certification
- using food processing equipment purchased with the help of the project for the processing requirements of other members of the network
- supplying school canteens and restaurants participating in the project.

National Park Gran Sasso and Monti della Laga: Project Cerere

The project was financed under the "Leader+" initiative[6] and is jointly implemented by the Gran Sasso-Laga Park and ARSSA. It aims, once again, to identify, on a more detailed scale, the indigenous genetic resources still present in the territory, and the creation of a network of custodian farmers aware of the importance of biodiversity for themselves, the territory and society as a whole. Specific valorization activities were not intended for this phase of the project, although in fact the attention focussed on the crops (e.g. the 'Santo Stefano di Sessanio' lentil) and animal products ('Campotosto' mortadella, 'Farindola' pecorino) worked as a *de facto* valorization process. In addition to the varieties found previously by the agency and by individual researchers, 53 accessions have been identified and a network has been established to link up 29 farms representing a network of "custodian farmers" through which to redistribute the reproductive material identified. A small germplasm bank has been created and has been duplicated at the ARSSA bank of Sulmona. In this case, although a more stable relationship among institutions and farmers has not yet been created, farmers have received a contribution in cash in recognition of the social value of their conservation work. In any case, the valorization of products will now proceed formally and has already started for some crops, like the 'Santo Stefano di Sessanio' lentil, which has been inserted by the Park within the Slow Food presidia.

Regional Park Sirente-Velino: Project "Enhancing biodiversity and biological production"

This project is the most recent, approved in 2007 and started in 2008. Previous to this project, the Regional Park Sirente-Velino decided in 1999 to carry out a detailed reconnaissance of the genetic resources of agricultural interest available in the territory. Activities were implemented under the technical-scientific supervision of ARSSA with field work carried out by a consultant agronomist. This project, concluded in 2001, covered both plant and animal husbandry resources. Considerable difficulties characterized this preliminary work, particularly in establishing relationships with the farmers, who in many cases were reluctant to collaborate. Even so, a total of 26 species and / or varieties with a probable origin within the territory of the park were identified:

[6] Leader+ gives rural areas the chance to launch their own cooperation projects which may be implemented either with French territories (interregional cooperation) or with European and Mediterranean territories (transnational cooperation) (http://www.una-leader.org/).

- among the vegetable species: red garlic (one accession) and potato (five accessions).
- among cereal species: wheat (six accessions), corn (two accessions), barley (five accessions).
- among legumes for human consumption: chickpea (two accessions), grass pea (two accessions), lentil (three accessions).

The origin is given as *probably* autochthonous, but it is not possible to say with certainty without coupling the identification and reference work done with morphological, agronomic and, in some cases, even molecular characterization. These studies would have the aim of clarifying unequivocally the nature of the selected varieties and would influence decisions about whether they deserve to be taken into account for further valorization efforts or not.
This preliminary work set the ground for the second intervention, started in 2008, which gives particular attention to training for the farmers, who are being asked to perform a task quite different from simply producing food. Meetings and training courses have been planned, including visits to key companies or institutions representing interesting case-studies. A thorough investigation will also take place in the near future to identify all possible undocumented local varieties that may still be present in the area. Particular attention will be given to fruit species and varieties, which were neglected in the previous project; the project foresees the planting of four field catalogues: two of mixed apple and pear trees, one of almond trees and the fourth of summer fruits (plums, cherries).

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Phaseolus as a model taxon for monitoring trends in European home garden diversity: a methodological approach and a proposal

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Dedicated to the memory of Professor John Gregory Hawkes (1915-2007) former president of The Linnean Society London, a pioneer of plant genetic resource research, passed away on 14 September 2007.

Introduction

Phaseolus beans have a high diversity, which has evolved for millennia, first in the gardens of different Amerindian cultures then, after 1492, also in the gardens of European and other communities. Traditional, "ethnic" gardens (bounded by mostly symbolic but often also by real fences) served as an ecological theatre for a strange evolutionary play – that of the domestication and evolution of our vegetables. On the stage, besides the plant actors, were also human actors, or more commonly actresses: housewives who would select the most suitable taxa, the best performing plants and the best seeds for further reproduction.

The "domestication play", based on constant observation, collection, cultivation and selection, belongs both to cultural history (names, uses, customs, beliefs etc.) and to biological history in the emergence of new varieties and better adapted plant and human populations. The scenes of the "theatre" were, and still are, micro- and macro-environments: landscapes and cultivation zones around the different gardens. The main actors are plants and people. Plants of different properties and uses. People of different cultures, languages, customs, tastes and needs. But not only plants and people are actors in this play; there are also animals (e.g. seed-eating insects, birds, mammals and their predators), parasitic fungi and even bacteria (e.g. legume and *Rhizobium* interactions). The time scale is about 10 000 years; the geographic scale – in our special *Phaseolus* case – is almost global and the diversity resulting from these biological and cultural interactions is enormous.

What is surprising is sometimes the lack of even basic knowledge about the emergence of this exciting agro- and ethno-biodiversity. We are fairly uninformed, for example, about the evolution and early cultural significance of the spectacular seed coat genetic marker system in *Phaseolus*, or about the differential co-migration of co-adapted *Phaseolus*, *Cucurbita* and *Zea* cultivars across different human cultures during the migration and diffusion process of the taxa involved. However, even if the details are often obscure, the chain of the main events in the domestication process is essentially the same: 1. meet the plant in the wild or in cultivation (e.g. in a garden, in the market etc.); 2. try the plant (in cultivation, in nutrition etc.);

3. name the plant or variety properly (ethnotaxonomy, germplasm science); 4. collect knowledge about the plant or variety (ethnobotany); 5. use the plant regularly (economic botany); 6. cultivate the plant regularly (of special interest for agronomy, forestry); 7. study it scientifically as a botanist, geneticist etc. (scientific botany, genetics); and finally 8. protect it if needed, making inventories and protocols for monitoring the dynamics of its diversity and distribution in order to serve genetic resource science (GRS), germplasm science and conservation science, to assure its sustainable use in the future.

The ethnobotanical approach followed here requires the definition of some basic concepts related to ethnobotany in its broadest sense.

Ethnobotany deals with traditional, generally non-written knowledge about plants. As such, ethnobotany is a very old and traditional field of science, but it gained independence through its first printed "research report" (Clusius and Beythe 1583) and was given a proper name only 313 years later (Harshberger 1896). Ethnobotany, in the sense accepted in this approach, studies the interplay between traditional (non-rational, non-written) and scientific (rational, written) knowledge regarding different relations between humans and plants. Understanding the evolution of ethnobotanical knowledge is important for ethnography (cultural anthropology), (agro)botany, evolutionary genetics and genetic resource research (germplasm science) etc.

A special field of ethnobotany is **aedobotany**, which deals with plants tolerated, used and/or cultivated in and around constructions (Szabó 1995). Consequently, aedobotany deals with the study of plants preserved or planted mostly in a fenced area around the buildings according to the needs and traditions characteristic of different cultures, ethnic groups and/or different ecological conditions in different historical periods. Aedobotany (as a part of ethnobiodiversity research) evaluates the quantity and quality of plant diversity inside and around constructions, especially in home gardens, but also in the flower-rich Central-European churchyards, along rural roadsides etc. in a given place and time. Home garden research belongs by definition to the aedobotanical approach. Home garden monitoring based on ethnobotanical/aedobotanical methods may reveal interesting differences and similarities inside and among regions, countries or even continents.

Since the biological diversity found in gardens is influenced not only by ecological conditions but also by ethno-cultural traditions, by the traditional ecological (ethnobotanical, ethnozoological etc.) knowledge and experience accumulated by ethnically different human communities, a well conducted home garden research programme belongs also to the field of **ethnobiodiversity** studies. There is also a narrower approach, named **agrobiodiversity** studies, which is less interested in (mostly sensitive) ethnic issues (Hammer 2003). Accordingly, the main difference between ethnobiodiversity and agrobiodiversity studies is that although both deal with economically important biodiversity, the former links it with human genetic diversity and with language and cultural diversity components, while the latter does not. The use of the ethnobiodiversity concept is still rather limited, however, due to the fuzzy nature of the cultural and (ethno)cultural systems involved (cf. Szabó 2007).

The ethnobiodiversity approach is especially relevant in human influenced plant evolution: gardens were and still are the Elementary Ethnobiodiversity Units (EEU) of this process(cf. e.g. Vogl-Lukasser 2007). The ethnobotanical method allows a comparative statistical analysis of EEUs and may reveal important similarities, but also significant differences inside and/or among different EEUs on different levels: ethnic groups, settlements, regions, countries or even whole continents.

It is hard to deny that the traditional frames for plant selection and use are ethnic (language and cultural) communities. The ecologically and/or economically valuable varieties selected in and by these communities were and still are subjects of a constant interchange. Accordingly, the ethnic component is an integral part of crop evolution, which needs to be considered in *in situ* genetic resource conservation. Neglecting the ethnic components may be motivated by scientific, economic, methodological or other reasons, but also unfortunately by non scientific, political reasons.

Goals

Continuing from previous methodological studies on genetic resource protection, nature conservation, food plant ethnobotany and island ethnobiogeography (Bullitta 2007, Macbeth and MacClancy 2004, Serwinski and Faberova 1999, Simonic 2006) and in concordance with the aims of the ECPGR Home Gardens in Europe Workshop, this paper follows two main goals:

- To present ethnotaxonomical case studies from Central Europe regarding the history of common bean (*Phaseolus vulgaris* L.) diversity among three ethnic groups in Transylvania: Romanians, Hungarians and Transylvanian Germans.
- To discuss the potential for extending the ethnobotanical methodology applied in Transylvania (Romania) to home garden genetic diversity monitoring projects in other countries in Europe.

Materials

For data collection the following categories of materials have been used for this study: historical herbals, books and manuscripts on medical botany and other historical sources (the Lencsés manuscript 1577; Melius 1578; Clusius and Beythe 1583; Szikszai 1590; Beythe 1595; Szabó sen. 1976-2005) ethnobotanical guide books (Szabó and Péntek 1976, 1996); ethnobotanical field collections (Péntek and Szabó 1985); ethnobotanical dictionaries and monographs (Krauss 1943; Borza 1965; Butura 1979), ethnobiodiversity studies (Szabó 2007). Many of these sources were transformed by the author previously into electronic databases greatly facilitating the data search.

The case studies presented in this paper originate from a multiethnic area of Eastern-Central Europe, designated by the author in earlier studies as the Alp-Balkan-Carpath-Danube (ABCD) area. Not only the geographical properties, but also many similarities in the evolution of phenomena related to ethnobiodiversity motivate the examination of this area.

Methods

- **Historical data** regarding the trends in *Phaseolus* introduction and variability in the Central-European area were collected from printed and electronic sources using traditional and electronic methods. An **Internet search** was carried out based on Google research engines.
- **Field data** regarding *Phaseolus* samples required the collection of seed samples, and where possible also pod samples, herbarium samples, and photographic samples (plant and site characteristics etc.). Ethnobotanical data were collected using structured but open-ended interviews regarding names, uses and other data such as beliefs, poetry and songs. Agronomical data were registered at the interview sites where possible: sowing and harvesting dates; cultivation methods (pure or mixed cultivation, plot situation, size); cultivation mode (monoculture, mixed culture); seed selection methods; seed production practices regarding the farmers' seed, especially if selected yearly seed by seed (in Hungarian: "*szemen szedve*"); data on informants: name, age, gender, mother language, other language(s), religion (optional), social status, school level etc.
- **Experimental data**: the samples collected were cultivated in an experimental garden and growth type, seed and pod characteristics were verified, productivity per plant, 1000 seed mass and dates were registered. Database construction and data analysis were carried out manually and the results published in a monograph (Péntek and Szabó 1985).

It is important to note that because both field scientists were Hungarians, contacting Hungarian informants was relatively easier. As a result, the quantitative data of the Romanian ethnotaxonomic diversity is likely to be under-represented in our field data, as compared with the real situation in the field.

Ethnic groups included are mentioned in the text and tables either in alphabetical order, or in the chronological order of the sources cited.

Results

The main results of the different case studies will be summarized in the following passages.

Historical data on *Phaseolus* in the sampled area

Phaseolus in the renaissance Hungarian Herbals

Phaseolus was first mentioned in Hungarian manuscripts and herbals by Lencsés 1577, Melius 1578, Clusius and Beythe 1583, Clusius 1583/84 (under the name of *Phaseolus purkircherianus*, with illustration, see Fig. 1), Beythe 1595 and many others not cited here, indicating a growing Hungarian interest in this taxon, which had been introduced into Europe in the early 16th century.

The Transylvanian ethnohistorical data clearly reflect the bean's provenance from Turkey. *Phaseolus vulgaris* was first mentioned in Lencsés' pharmacobotanical manuscript (1577) under the name "*törökborsó*," i.e. *Turkish pea*, in two recipes: one for enhancing facial skin and another for treating poisoning from animal bites.

Fig. 1. *Phaseolus purkircherianus* – the first illustration in the Carpathian Basin regarding *Phaseolus-beans* (Clusius 1583/1584).

In the Herbarium by Melius (Colosvar 1578), *Phaseolus* was mentioned under the name of "*török bab*" (*Turkish bean*) as a purely medicinal plant used to cure testicular and nail diseases ("…if you boil in vinegar cypress cones with Turkish bean seeds or leaves, the infusion cures testicular and nail diseases") as well as to cure diseases of the skin ("… mix Turkish bean flour with vinegar and salt water for treating scabious head …") [author's translations]. It is worth noting that similar cures were cited in the twentieth century among the Romanians by Butura (1979).

Turkish pea (*törökborsó*) was also found in Pannonia, a region corresponding to an area of the present day Western Hungary, Western Slovakia, Northern Croatia, Eastern Austria and Eastern Slovenia, in the first true printed ethnobotanical "research report": a booklet signed by Clusius and Beythe (1583), edited by the Slovenian typographer Manlius and printed in historical Hungary, in Németújvár (now Güssing, Austria).

Phaseolus in "The Historical Thesaurus of the Transylvanian Hungarian Language" (Szabó sen. 1976-2005)

This historical thesaurus covers data from all kinds of written (not printed) documents created in Transylvania in the Hungarian language between the thirteenth and nineteenth centuries. Its remarkable value is reflected in the particular case of *Phaseolus*: even from the fraction of data available (only volumes I–XII, from A to S, have been published as yet) sound evidence emerges regarding the early "Turkish" route of *Phaseolus* migration towards Transylvania, and also the role of different ethnic groups (Romanians, Italians) as mediators in the way the crop spread, its territorial dynamics, cultivation, use and variability. The role of Romanian groups is seen in the Transylvanian historical names "oláhborsó" i.e. "Romanian", or more exactly "Vlach bean", indicating a southern migration route of *Phaseolus* from the Turkish Empire through the Romanian Countries (Oltenia, Muntenia and Moldova) towards the Carpathian Basin.

The data also reflect the competition and confusion between the cultivation of and names of the autochtonous faba beans (*Vicia faba*) and the allochtonous, newly introduced *Phaseolus* beans in Transylvanian area during the sixteenth to eighteenth centuries: *Phaseolus* is first called "Turkish pea". Thereafter the name "Romanian pea" is more frequent in Transylvanian documents from the late seventeenth and throughout the eighteenth century (cf. Szabó sen. et al. 1997). Simultaneously, from the early eighteenth century onwards, a marked direct or indirect Italian influence is reflected in the names for *Phaseolus*. Both the Romanian name "*fasole*" and the Hungarian *"fuszuly"* were vernacular names derived from the Italian word "*fagioli*". Different forms of "*fuszulyka*" became frequent in Transylvanian historical documents: "*kerti fuszuly*" i.e. garden bean (in Hungarian, 1729, 1732, 1744, 1835, 1834); *fuszulyborsó* i.e. fagioli-pea (1738). The word "*fuszulyka*", a Hungarian diminutive form for the *phaseolus* bean, became common beginning with 1756. At the same time, a new Transylvanian Hungarian name for *Phaseolus* beans was slowly gaining general acceptance: "*paszuly*" (1727, 1798, 1839, 1842) or in its diminutive form "*paszulyka*" (1792, 1806).

It is curious that in western and central Hungary the name for *Vicia faba*, "*bab*," became the official Hungarian name for *Phaseolus*, faba beans here being called "*lóbab*" i.e. "horse bean". In Transylvanian Hungarian, however, the old name "*bab*" is preserved for the old crop *Vicia faba* in traditional, rural use even today. This fact is not generally known and has been the source of great confusion and misinterpretation. About two decades ago it even misled this author (cf. Szabó jun. 1976: endnote for the "*bab*").

In Romanian the distinction between *Vicia* ("*bob"*) and *Phaseolus* ("*fasole"*) plant/seed is quite regular, but the ethnobotanical term "*bob*" often denotes any plant seed as well (e.g. "*un bob de grîu"* = a caryopse of wheat).

Phaseolus in the "*Diaria"* of Paul Kitaibel

The Balkan migration route for *Phaseolus* is reflected in the early nineteenth century in the "*Diaria"* of Paul Kitaibel (the Pannonian Linnaeus), who observed the relative abundance of *Phaseolus* in the Northern Balkan area belonging to historical Hungary, situated now in Croatia and Serbia, or even in Romania, e.g. Oravita (Matskási and Lőkös 2001). In *Iter slavonicum* for example, on 2 July 1808 he noted in the valley near

Verovtitz "*Phaseolus coccineus wird ziemlich viel gepflantzt*" [Translated: *P.c. is quite often cultivated*] (p. 127). Unfortunately Kitaibel was not interested in the infraspecific variability of *Phaseolus* beans.

Ethnotaxonomical diversity of *Phaseolus* in an extinct Transylvanian German ethnic group, based on the collection of Friedrich Krauss (1943)

The first comprehensive ethnobotanical field survey to include bean diversity was carried out in Transylvania in 1943 by Friedrich Krauss among an ancient Northern-Transylvanian German ethnic group (Nösnerländische Sachsen) originating from the Luxembourg area, who had settled there around 1300. This "Saxon nation" had survived here as an autonomous group under the Hungarian Kingdom and that of the Transylvanian Hungarian Princes for eight centuries but became extinct in eight decades after 1919, after the Nösnerland were integrated into the new national state of Romania as part of the present day Bistrița-Năsăud county.

The variability of *Phaseolus* revealed by the ethnotaxonomic diversity preserved by the Northern-Transylvanian Germans was documented in the last minutes of the 800-year-long life of this nation (Fig. 2, Fig. 3). Krauss found in the Nösnerland two *Phaseolus* species *(vulgaris* and *multiflorus* recte *coccineus)* with an ethno-taxonomical diversity reflected in 177 bean names (cf. Tables 1a and 1b, accepting here the nomenclature used by Krauss 1943).


ERDÉLYI TUDOMÁNYOS INTÉZET

NÖSNERLÄNDISCHE PFLANZENNAMEN

EIN BEITRAG ZUM WORTSCHATZ DER SIEBENBÜRGER SACHSEN

VON

FRIEDRICH KRAUSS

BUCHDRUCKEREI CARL CSALLNER
BESZTERCE-BISTRITZ
1943

Fig. 2. The title page of the "Nösnerländische Pflanzennamen" (Krauss 1943).


Tafel I. VERZEICHNIS DER ORTSNAMEN

Fig. 3. The list of settlements included in the survey of Krauss (1943).

Table 1a. *Phaseolus* ethnotaxonomic diversity collected in the Nösnerland area of Transylvania before 1943, expressed in number of local names at a species level.

Species	No. names	No. settlements	Average names/settlement
Phaseolus multiflorus	4	5	1.25
Phaseolus vulgaris	173	53	8.12
Totals	177	58	

Table 1b. Ethnotaxonomic diversity of *Phaseolus vulgaris* at a subspecies level in the Nösnerland, Transylvania before 1943 in number of local names/settlements according to Krauss (1943) (incl. homonymous names and synonymies).

Variety	No. names	No. settlements	Average names/settlement
Ph. vulgaris subsp. *vulgaris*	26	57	2.19
Ph. vulgaris subsp. *nanus*	14	33	2.36
Totals	40	90	2.28

Because of the primarily ethnological and linguistic character of this collection, it is quite difficult to reconstruct the full biological diversity of the *Phaseolus* gene pool existing around 1943 in the area. This gene pool probably survived (at least in part) the extinction of the Northern-Transylvanian German ethnic community of the Nösnerland, and is probably preserved (at least in part) by the larger Romanian and the smaller Hungarian populations in the area.

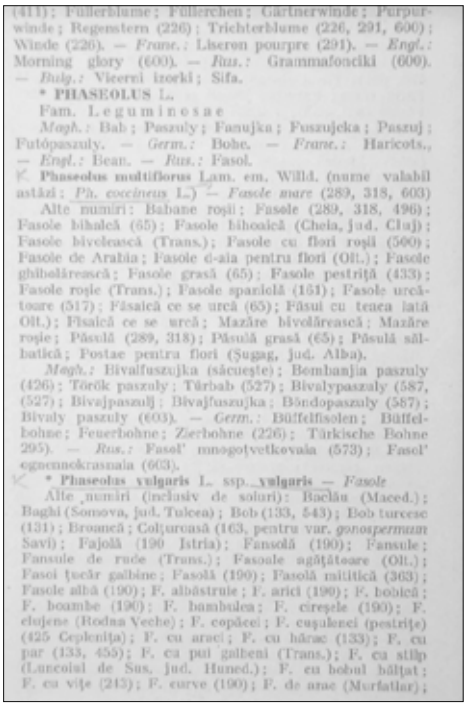
Working carefully with this published material, we have a good starting point for monitoring the changes in *Phaseolus* diversity in a well defined area and in a time scale of almost a century.

Ethnotaxonomical diversity of *Phaseolus* in the Romanian language area, based on the collection of Alexandru Borza (1965)

Another important title used in this case study is the multilingual "*Ethnobotanical Dictionary*" by Alexandru Borza (1965), the largest comprehensive collection of Romanian and Hungarian traditional plant names published to date (Fig. 4).

The dictionary lists only two named *Phaseolus* species from Romanian home gardens (citing here the nomenclature accepted in the dictionary):

- *Ph. multiflorus* Lam. em. Willd. syn. *Ph. coccineus* L. – "*fasole mare*" with 22 names cited according to about 30 sources
- *Ph. vulgaris* L. subsp. *vulgaris* and subsp. *nanus* – "*fasole*" with 158 Romanian names cited from more than 200 sources covering almost the whole Romanian language territory.



(411); Füllerblume; Füllerchen; Gärtnerwinde; Purpurwinde; Regenstern (226); Trichterblume (226, 291, 600); Winde (226). — *Franc.:* Liseron pourpre (291). — *Engl.:* Morning glory (600). — *Rus.:* Grammafonciki (600). — *Italy.:* Vicerei izorki; Sifa.

* **PHASEOLUS** L.

Fam. Leguminosae

Magh.: Bab; Paszuly; Fanujka; Fuszujcka; Paszuj; Futópaszuly. — *Germ.:* Bohe. — *Franc.:* Haricots., — *Engl.:* Bean. — *Rus.:* Fasol.

Phaseolus multiflorus Lam. em. Willd. (nume valahîl astăzi: *Ph. coccineus* L.) — *Fasole mare* (289, 318, 603)

Alte numiri: Babane roşii; Fusele (289, 318, 496); Fasole bihaică (65); Fasole bihoaică (Cheia, jud. Cluj); Fasole bivelească (Trans.); Fasole cu flori roşii (560); Fasole de Arăţia; Fasole ci-aia pentru flori (Olt.); Fasole ghibolăreasc; Fasole grasă (65); Fasole pestriţă (433); Fasole roşie (Trans.); Fasole sparicică (151); Fasole urcătoare (517); Făsaică ce se urcă (65); Făsui cu teaca lată Olt.); Fisaică ce se urcă; Mazăre bivolăreasc; Mazăre roşie; Păsulă (289, 318); Păsulă grasă (65); Păsulă sălbatică; Postae pentru flori (Şugag, jud. Alba).

Magh.: Bivalfuszujka (săcueşte); Bombanjia paszuly (426); Török paszuly; Törbab (527); Bivalypaszuly (587, 527); Bivajpaszulj; Bivajfuszujka; Böndopaszuly (587); Bivaly paszuly (603). — *Germ.:* Büffelfisolen; Büffelbohne; Feuerbohne; Zierbohne (226); Türkische Bohne 295). — *Rus.:* Fasel' mnogoţvetkovaia (573); Fasol' ognennokrasnaia (603).

* **Phaseolus vulgaris** L. ssp. **vulgaris** — *Fasole*

Alte numiri (inclusiv de soiuri): Baclău (Maced.); Baghi (Somova, jud. Tulcea); Bob (133, 543); Bob turcesc (131); Broancă; Colţurcoasă (163, pentru var. *gonospermum* Savi); Fajolă (190 Istria); Fansolă (190); Fansule; Fansule de rude (Trans.); Fasoale agăţăteare (Olt.); Fasoi ţucăr galbine; Fasolă (190); Fasolă mititică (363); Fasole albă (190); F. albăstruie; F. arici (190); F. bobică; F. boambe (190); F. bumbulea; F. cireşele (190); F. clujene (Rodna Veche); F. copăcei; F. cuşukeci (pestriţe) (425 Ceplenita); F. cu araci; F. cu hărac (133); F. cu par (133, 455); F. cu pui galbeni (Trans.); F. cu stîlp (Lunceiul de Sus, jud. Hunedoara); F. cu bobul bălţat; F. cu vîţe (243); F. curve (190); F. de arac (Murfatlar);

Fig. 4. *Phaseolus coccineus* L. ethnotaxonomic diversity as reflected by the vernacular names collected by Borza (1965).

Borza included under subsp. *vulgaris* (intentionally or erroneously?) all the *Phaseolus vulgaris* variability, including subsp. *nanus,* according to the vernacular names cited for this taxon.

The dictionary also contains 24 Hungarian and 78 German names, including those cited by Krauss (1943). The ethnic asymmetry reflects the ethnic interest of the author rather than the real situation in the field (in the opposite way to our own case study outlined below).

The ethnic interactions and the reticulate evolution of *Phaseolus* ethnotaxonomy among the interspersed (sympatric) ethnic communities is also reflected in this dictionary, for example by the formerly mentioned ethnic attributes in early Hungarian (e.g. *oláh borsó* = *Romanian pea*), as well as by mutual loaning and reticulate evolution of names, as for example *"fasole"* (Ro) > *fuszuly/ka* (Hu) > *"paszuly/ka"* (Hu) > *"păsulă"* (Ro).

Ethnotaxonomical diversity of *Phaseolus* in Transylvania as reflected in Péntek and Szabó (1985)

Joint ethnobotanical and genetic resource field studies were carried out through close cooperation between a biologist (botanist geneticist) and an ethnologist (philologist ethnographer). The studies began in Transylvania around 1970 and were realized in three phases:

- General evaluation of the ethnobotanical knowledge of the Transylvanian Hungarians carried out between 1967 and 1976. Results presented in an ethnobotanical field guide with field collection methodology and new data (Szabó and Péntek 1976-1996) published both in Romania (1976) and in Hungary (1996). This methodology has been applied in further studies (e.g. Rab 2001; Péntek 2003).
- Special evaluation focusing only on *Phaseolus* and *Vicia* beans carried out 1978-1979 with the aid of school teachers, their pupils and their families, but only among the Hungarian population in Romania. The project entitled "Wonder Bean" (see box) resulted in a large germplasm collection and an ethnotaxonomical database (results mostly unpublished).
- Monographical evaluation of a well defined Transylvanian sample territory (local names: Kalotaszeg in Hungarian; Calata Area in Romanian) carried out between 1975 and 1985 looking at all the main components of ethnobiodiversity (except the animal kingdom), with special emphasis on some crops e.g. *Triticinae* and *Phaseolinae* (Péntek and Szabó 1985).

The Wonder Bean Project

This survey was carried out with the participation of a biologist (A. T. Szabó: botany and ethnobotany, genetics and genetic resources) and a philologist (J. Péntek: ethnology, ethnotaxonomy, linguistics) in the period 1975-1985, on a sampling area situated in the piedmont of the Erdélyi Szigethegység – Muntii Apuseni (Transylvanian Island Mountains) crossed by 23° LongEst and 45° LatNorth. From an administrative point of view the **Kalota** area (Hungarian name) is known as **Zona Calata** (Romanian name) and is situated in Transylvania, Romania between two counties: **County Cluj** (Kolozs megye) and **County Sălaj** (Szilágy megye) (Romanian names in bold, Hungarian names in brackets). The total area sampled was about 800 sq km situated at an altitude of 350-850 m asl. The total number of sampled locations was 53, with a total population of about 65 500 persons (only in Cluj county, 1977) belonging to the following main ethnic groups: Gypsies and others (1.5%), Hungarians (37.5%), Romanians (61.5%). The population density was 67.5 persons/sq km, with an urban population of about 12.8%.

The general evaluation first drew our attention to *Phaseolus* as a taxon of significance for ethnobiodiversity studies (although this research field was not named at that time, Szabó 1992 in Polunin and Burnett 1992, Szabó 1999). This observation led to the next step: the "Wonder Bean" collection with the participation of volunteers.

The "Wonder Bean" ("*Csodabab*") project was an extension of the larger ethnobotanical project, regarding the traditional botanical knowledge of Transylvanian Hungarians. Few results from this project have been published (Szabó and Dankanits 1978; Szabó 1985; Szabó et al. 1987). The "Wonder Bean" survey had an important educational component: raising interest in local genetic values important for *in situ* conservation – a practice still not named at that time. The project was organized in cooperation with institutions belonging to the Ministry of Education (schools, universities etc.), the Ministry of Culture (TV, Radio, Journals) and the Ministry of Agriculture and Forestry. Unfortunately this project had no inter-ethnic components for a variety of reasons.

In the context of this paper the main outcome from this project was the demonstration that it was possible to organize successfully a large, simultaneous and well coordinated collecting mission based on professional scientists and volunteers, in cooperation with universities, mass media (press, radio, television) and public education (school children, teachers and their parents) in order to collect information on *Phaseolus* diversity in home gardens across a middle sized European country and among the members of a well defined ethnic group.

Ethnotaxonomical diversity of *Phaseolus* reflected by the field collections carried out by J. Péntek and A.T. Szabó between 1975 and 1985 in the area of Calata (Kalota), Transylvania, Romania

In this area the large majority of the taxa cultivated were housed in home gardens (47%), followed by ornamentals cultivated mostly in houses (30% including home, veranda, cemetery etc.), fruit gardens (4%), street and roadside (5%), arable fields (6%), hedges (4%) and other niches (4%). Varieties are not included in these statistics.

Phaseolus vulgaris (and more rarely *Ph. coccineus*) were mostly cultivated in mixtures with other vegetables in home gardens, but also in small fields far from homes ("distant gardens") where *Ph. vulgaris* subsp. *vulgaris* is always mixed with one or more other species: most frequently *Zea mays*, intercropped with *Cucurbita pepo* and *C. maxima*, but sometimes also *Zea* with *Solanum tuberosum* and *Beta vulgaris*. We collected in this area altogether 653 *Phaseolus* accessions and 507 different local names of different taxonomical value, belonging to two species (*Ph. coccineus* and *Ph. vulgaris*), the latter with two subspecies (*Ph. vulgaris* subsp. *vulgaris* and subsp. *nanus*).

The distribution of names in different taxonomic levels are included in Tables 2a and 2b. The codification system used during the survey is presented in Fig. 5.

Phaseolus vulgaris L. characters for quick diversity evaluation

Code	
	0 **Growth type**
0.1	vulgaris
0.2	nanus
xx	1st two digits: **Seed size and form**
1	*Microspermus*
1.1	– sphaericus
1.2	– ellipticus
1.3	– oblongus
1.4	– compressus
2	*Mesospermus*
21.	– sphaericus
2.2	– ellipticus
2.3	– oblongus
2.4	– compressus
3	*Macrospermus*
3.1	– sphaericus
3.2	– ellipticus
3.3	– oblongus
3.4	– compressus

	2nd digit: **Seed coat**
01	– albus
02	– luteus
03	– ruber
04	– carneus
05	– fuscus
06	– violaceus
08	– punctatus
09	– dimidiatus luteus
10	– dimidiatus ruber
11	– dimidiatus fuscus
12	– dimidiatus viola
13	– dimidiatus niger
14	– virgatus
15	– trimidiatus
16	– variegates
17	– marmoratus
18	– striatus
19	– miscell. dif
20	– dubiosa

Fig. 5. The numerical codification of *Phaseolus* seed characters. First digit = seed size; second digit = seed form; third and fourth digit = seed coat colour

Table 2a. Diversity of all *Phaseolus* taxa (*vulgaris* and *coccineus*) in number of local names/settlements in the Kalota area between 1975-1985.

Species	**Total accessions**	**Total names**	**Average names per settlement**
Phaseolus coccineus	81	28	1.53
Phaseolus vulgaris	572	479	8.12
Totals	653	507	---

Table 2b. Ethnotaxonomic diversity of *Phaseolus vulgaris* L. expressed in number of Hungarian and Romanian local names collected in the Kalota area between 1975-1985.

	Total no. of variety names (incl. homonymies and synonymies)		**Average no. of names per settlement**	
	Hungarian	**Romanian**	**Hungarian**	**Romanian**
Ph. vulgaris subsp. *vulgaris*	235	80	4.77	1.51
Ph. vulgaris subsp. *nanus*	100	35	1.89	0.66
Total *Ph. vulgaris*	335	115	5.94	5.58
Totals	450		8.11	

European and world diversity of *Phaseolus* reflected by collections and papers published online and available in cyberspace at the time of the European Home Garden Workshop held in Ljubljana Oct 2007

In this section we focus on home pages and online publications dealing with *Phaseolus* as a model taxon, in order to draw attention towards possibilities for monitoring long term trends in European home gardens with the aid of *Phaseolus* diversity. *Phaseolus* is a relatively widespread taxon and may represent a simple tool for detecting genetic diversity, genetic erosion and sedimentation, as well as collecting basic data for long term monitoring. It has been and still is a model taxon in many different fields of science.

*Phaseolu*s as a model taxon in genetics

Phaseolus experiments contributed to the birth and emergence of factorial genetics. This is relevant in Central Europe, because the Alp-Balcan-Carpath-Danube (ABCD) area may be regarded as a cradle of genetics due to the works of Imre Festetics (1819), Gregor Mendel (1865), Erich von Tschermak-Seysenegg (1900) and Carl Correns (1900), the "rediscovery papers" (not cited in references). Even the germplasm concept emerged in Central Europe (Weismann 1885).

Even before the birth of Mendel, Imre Festetics formulated some empirical laws of heredity and was among the first to name them as the "Genetic Laws of Nature" ("Die genetische Gesätze der Natur") in a series of papers published about inbreeding (Festetics 1819). This view probably influenced Mendel (1865-1866) in his hybridization experiments with inbreeding plants (*Pisum* and *Phaseolus).* It is not generally known that in the last part of Mendel's paradigmatic paper, after the mono-, di-, and trifactorial hybridization results, Mendel interpreted correctly the results of his *Phaseolus* hybridizations i.e. based on polifactorial inheritance of quantitative traits.

The development of *Phaseolus* genetics shifted later toward Western Europe due to the activities of Johannsen (1903, 1909), the first person to coin the term "gene" in the modern sense, on inheritance of pure lines in white seeded *Phaseolus* beans (Változékonyság és öröklékenység n.d.).

The Fabaceae family

The whole Fabaceae family is rich in model plants: *Trifolium repens* was a model for ecological genetics and gene-ecology (Daday 1954, 1965; Szabó 1988; Fick and Luckow 1991); *Vicia faba* was a model plant in cytogenetics; and Ellis et al. (n.d.) suggested lentils (*Lens* spp.) as model plants for comparative genetic understanding of leguminous food plants. *Phaseolus* emerged relatively late as a model plant for molecular genetics. Broughton et al. (2003) proposed beans (*Phaseolus* spp.) as model food legumes for agro-botanical studies, Estrada-Navarrete et al. (2007) examined genetic transformations in a *Phaseolus* and *Agrobacterium* model system, Choi et al. (2004) used *Phaseolus* for estimated genome conservation between legumes, Guzman-Maldonado et al. (2003) used common bean in the studies on inheritance of QTLs (Quantitative Trait Loci). The monograph by Velich and Unk (1995), the synthesis by Gepts (2009), Hammer (1993, 1998), Krell and Hammer (2008), and Piergiovanni's richly illustrated online report on the collection of Italian landraces (2007), the grain legume network (see the website references at the end

of this paper), the works published recently by J. Péntek (2003) all illustrate well the usefulness of the *Phaseolus* model in different fields of research.

Looking at on-farm conservation using molecular markers, the works of Valeria Negri, for example regarding '*Fagiolo a pisello*', are of general value as a model (Negri and Tosti 2002a, 2002b).

A proposal: Long term monitoring of European home gardens biodiversity trends through a Phaseolus *diversity model (PhDM)*

Designation of the model

Models are used as simplified tools in the study of complex phenomena. Here a ***Phaseolus* Diversity Model (PhDM)** is proposed for monitoring long term trends in home garden biodiversity dynamics across Europe in different social and ethnic environments. Focusing only on a single taxon makes it possible to collect simultaneously a large amount of basic data suitable for a series of monitoring purposes in the future.

The main components of the PhDM

- **Geographic component (GGC):** Global Positioning System (GPS) data for localization of the sampling site e.g. longitude, latitude, altitude; climatic data: temperature and precipitation in vegetation period (monthly average, minimum, maximum for the sampling location or area).
- **Human (ethnic) component (HEC):** human diversity in the sampling area (ethnic, religious, cultural) and human diversity in the sampling site (location).
- **Garden component (EEU=European Ethnobiodiversity Unit):** Garden location, size etc.; total number of taxa characteristic for the sampled garden; total number of persons cultivating and/or using the garden and its products in the "extended family", and/or in the market.
- **The *Phaseolus* component (PHC):** Total number of *Phaseolus* taxa in the sampled garden (species, subspecies, named vs. unnamed varieties); total number of traditional names used for these taxa; number of phenotypically different *Phaseolus* categories by character combinations: growth type (nanus, intermedius, vulgaris); pod size (minus, intermedius, maximus); pod form and colour (tubiformis, compressus; viridis, flavus, striatus etc.); seed size (microspermus, mesospermus, macrospermus); seed form: sphaericus, ovatus, oblongus, compressus; seed coat colour (cf. numerical codifications).
- ***Phaseolus* cultivation practice (PCP):** Pure or mixed; taxa included in intercropping, sowing, care, harvesting, and so on.

Suggested steps for data collection and interpretation

1. Standardization of data (PhDM descriptor lists, modified)
2. Selection of sample sites and that of the collectors
3. Instruction of the participants (standardization of collection methods)
4. Data collection in home gardens
5. Evaluation of data (on local, regional, country and continental scale)

A possible time table

1. Preliminary phase: online instructions; discussions, decisions
2. Preparatory phase: edition of a methodological guide; testing the method
3. Collection phase: simultaneous data collection in home gardens across Europe
4. Verification and evaluation
5. First monitoring (including Public Awareness activities)
6. Follow up monitoring.

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Genetic diversity in home gardens in Umbria: a cowpea case study

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Introduction

Landraces, reflecting people's cultural identity and harbouring a range of diversity of interest for future breeding work, as well as for developing new farming systems and new products, deserve to be preserved for future generations.

On-farm and in-garden conservation can safeguard genetic resources by maintaining their ability to evolve in the face of biotic and abiotic pressures, social and cultural changes and to meet the needs of unpredictable future demands (Frankel et al. 1995). The possibility of preserving these landraces on farm is presently under study in many areas of Italy but, before interventions can be designed, prior understanding of the level of variation among them is needed. If genetically similar landraces exist in a certain area, a single farm could carry out their conservation; but if the landraces are different, several farms should be involved in their preservation.

Cowpea (*Vigna unguiculata* subsp. *unguiculata* (L.) Walp.) is an important grain legume throughout the tropics and subtropics, covering Asia, Africa and Central and South America, as well as parts of southern Europe and the United States (Singh et al. 1997). In Italy, cowpea is a minor crop and its cultivation is restricted to a very limited acreage. Both *V. unguiculata* subsp. *unguiculata* cv-gr. unguiculata and cv-gr. sesquipedalis (Maréchal et al. 1978; Pasquet, 1993a, 1993b, 1997, 1999) are cultivated for seeds and for fresh pods (like French beans), respectively. Cowpea, domesticated in the sub-Saharan area around the second millennium BC, was cultivated by the Greeks in the third century BC and by the Romans in the first century AD as Theophrastus and Pliny affirm (Chevalier 1944; Burkhill 1953; Purseglove 1976). The plant could have been introduced well before then in Italy, since trade in the Mediterranean area had been intensive since pre-historic times. In Umbria (central Italy) the species was possibly already introduced by the Etruscans, who already dominated the area in the eighth century BC and traded intensively with several Mediterranean countries. Whenever it was introduced, by the 19th century there is historical documentation (*Giunta per l'Inchiesta Agraria*, 1885) that cowpea was being cultivated in the area around Lake Trasimeno.

This contribution details the genetic diversity detected within a collection of cowpeas (including landraces from Lake Trasimeno and from outside the area). Actions were undertaken to rescue the cowpea population from the risk of extinction (reported elsewhere in this publication), and these led to an increase in the number of farms cultivating cowpea and in the acreage in which the crop is grown in the area.

Collection of materials

Farmers were approached in a friendly manner and the reason for the visit was explained to them. An interview followed to gather information on the farmer's family, the farm and the crops cultivated. Cowpea seed samples were finally collected (Negri and Tosti 1997). Markets in Italy were also explored and packets of seeds collected. Finally accessions from Africa and Asia were obtained from the International Institute of Tropical Agriculture (IITA) in Nigeria. All the germplasm collected was stored in the germplasm bank of the Applied Biology Department at the University of Perugia (DBA).

Morphological and genetic characterization

Thirty-two accessions were analyzed (ten landraces from around Lake Trasimeno, one landrace from another area of Umbria, five landraces from other Italian regions, four landraces from abroad, eight commercial varieties, one population of unknown status, two populations belonging to the *sesquipedalis* cv-group and one accession belonging to var. *spontanea*, the nearest wild relative of cultivated cowpea) (Fig. 1).

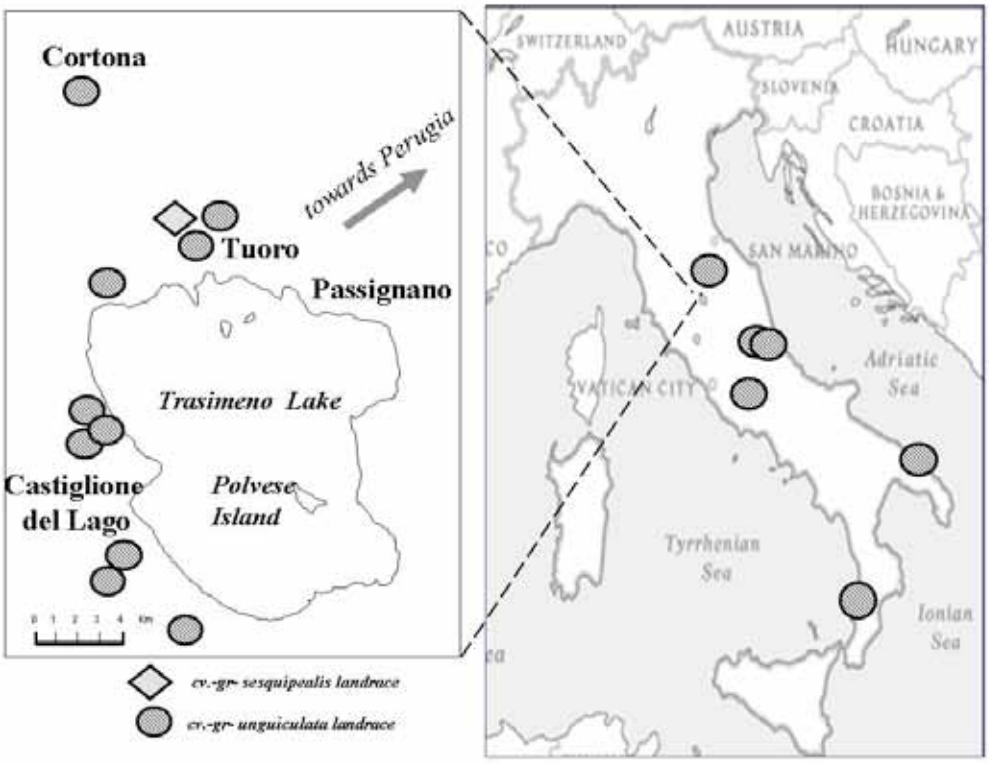

Fig. 1. Collection sites of Trasimeno and other Italian landraces examined.

The seed samples were analyzed for one-hundred seed weight and seed colour. Molecular characterization was performed using bulks of 20 plants for each cowpea accession and seven Amplified Fragment Length Polymorphism (AFLP) EcoRI/MseI primer combinations. Morphological datasets were used to perform univariate analyses: analysis of variance (ANOVA) for quantitative traits and chi-square test for qualitative traits. As for genetic traits, polymorphic AFLP fragments were used to calculate Jaccard's coefficient of genetic similarity between population pairs. The similarity matrix obtained was then used to produce a UPGMA (Unweighted Pair Group Method with Arithmetic Mean) dendrogram.

In another study, single plants from three landraces each were individually analyzed using five AFLP and five SAMPL (Selectively Amplified Microsatellite Polymorphic Locus) primer combinations (Tosti and Negri 2005).

Results

All the farmers stated that their cowpeas have been cultivated in their families for generations without exchanging seed or buying it on the market.

Landraces from around Lake Trasimeno differed from the others in seed weight and seed colour pattern. Different seed colour patterns were detected in the Lake Trasimeno landrace sample (Negri et al. 2000). In addition it should be noted that while some farmers maintain uniform populations, others cultivate mixed populations (Fig. 2).

Fig. 2. Around Lake Trasimeno different farmers maintain different types of cowpea.

Molecular analysis detected that Italian landraces were all grouped together and that the Trasimeno landraces formed a sub-group distinct from the other landraces (Fig. 3). The accessions from the Italian market were also clearly distinct from landraces. Commercial material and landraces from abroad were distantly related to Italian materials.

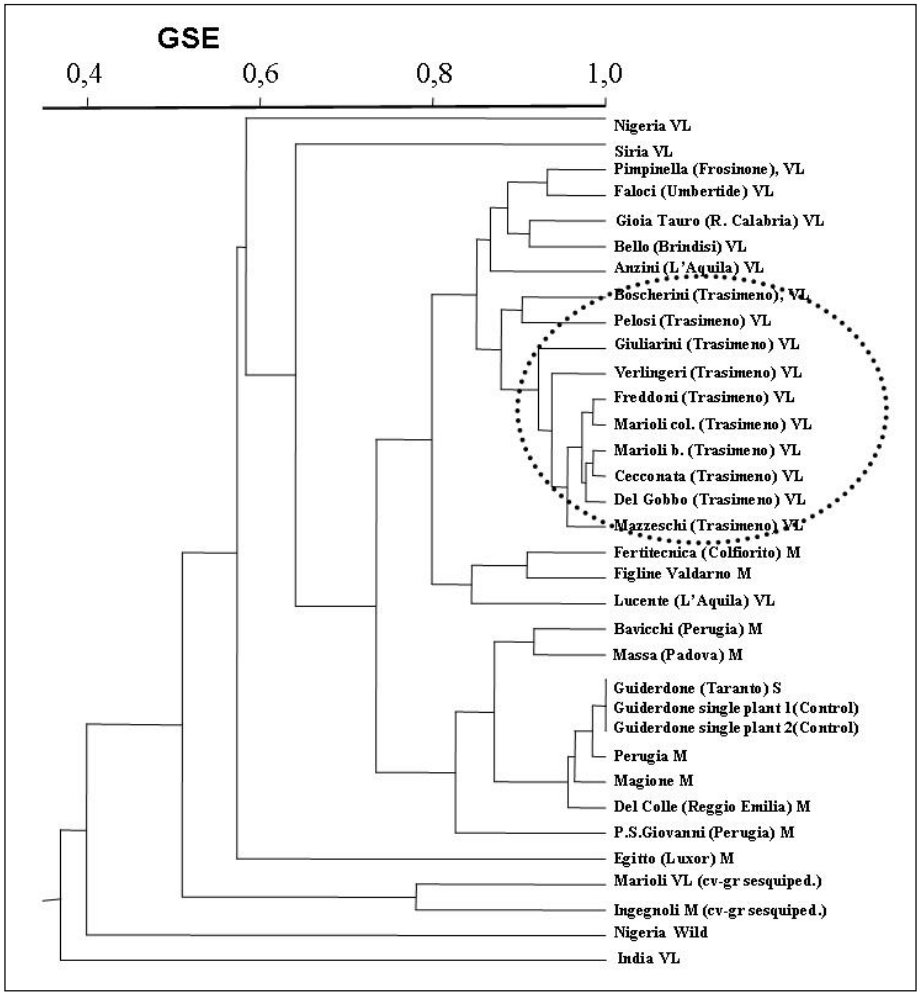

Fig. 3. Dendrogram of genetic similarity (Jaccard similarity index) relationships among the 32 analyzed accessions using UPGMA (7 AFLP primer combinations). Legend: VL= landrace, M= market, S=unknown status, W= wild.

In addition, the cowpeas from Lake Trasimeno appear to be a structured population in which a substantial differentiation is maintained at the subpopulation (i.e. farmer population) level (Fig. 4) (Tosti and Negri 2005). This reflects the results of studies into landraces of celery (*Apium graveolens* L.) and common bean (*Phaseolus vulgaris* L.), which were also found to be structured populations (Castellini 2005; Tiranti and Negri 2007; Negri et al. in press).

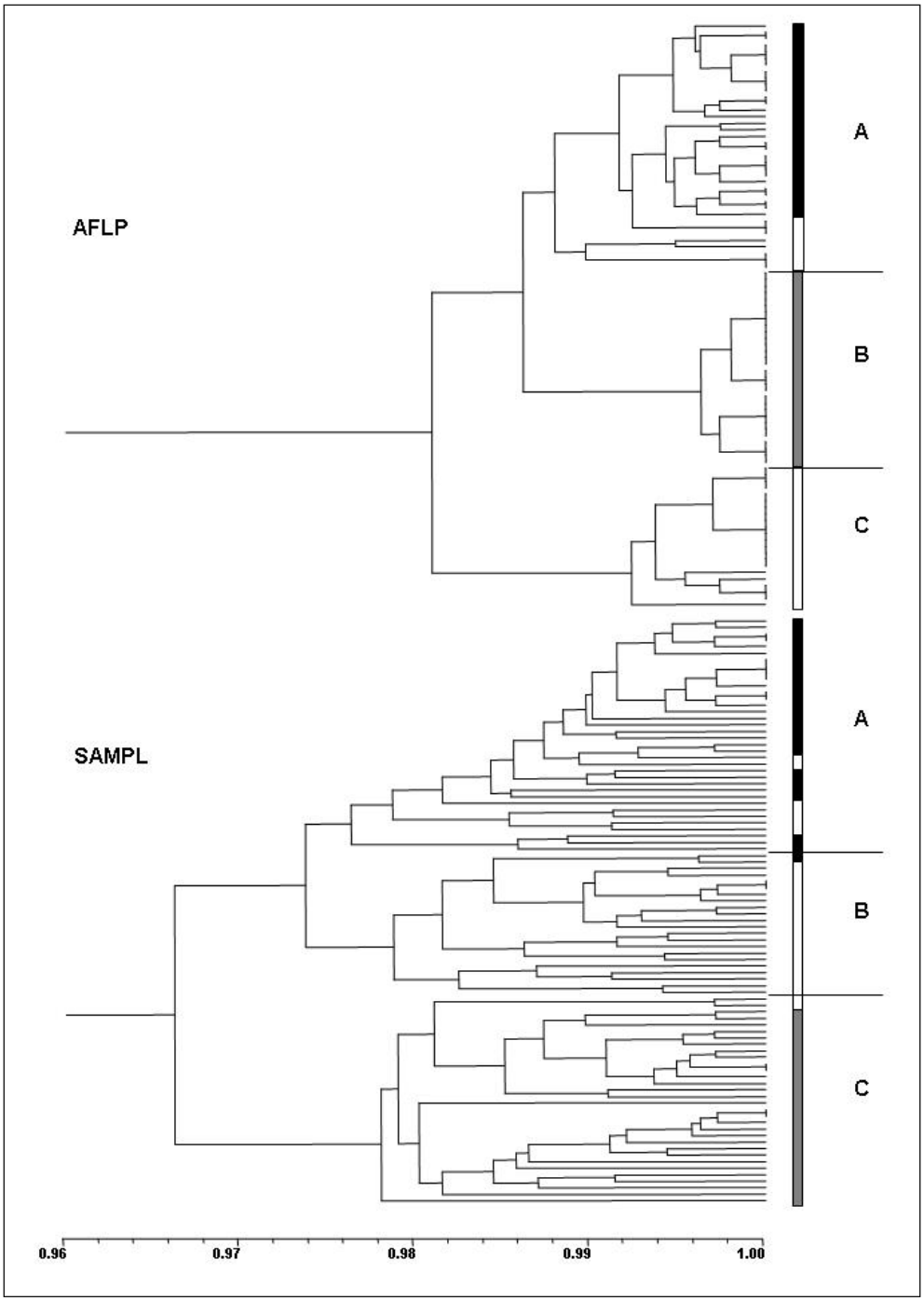

Fig. 4. Dendrograms of the relationships among single plants of three LRs obtained using AFLP and SAMPL data. Black, gray and white bars refer to Freddoni, Marioli and Boscherini landraces, respectively (from Tosti and Negri 2005).

Overall, molecular investigations confirmed the farmers' statements that cowpeas had been cultivated for generations on their land and that each farmer population was a family heritage.

Conclusions

The landraces studied in this work belong to the specific cultural identity of the human population living around Lake Trasimeno. Despite the limited territorial distribution of a few hectares, all the Trasimeno farmer populations were both morphologically and genetically clearly differentiated from each other and from other landraces and cultivars. Specific alleles or allele frequencies characterized each farmer population. These findings underline the importance of home gardens in conserving diversity.

The data collected show that landraces from Lake Trasimeno have a precise identity and probably a common origin. A complex interaction of factors (drift, landrace isolation, farmer selection, migration within landraces) explains the observed pattern of diversity.

Molecular data suggest that the best strategy for maintaining diversity in this area, as well as in other areas, is to preserve each of the landraces examined on the farm from which it came. On-farm and in-garden conservation take advantage of different farmers maintaining distinct gene pools and the landraces being structured populations. The fact that alleles found in a single farmer population are lacking in others is important for conservation because it counteracts losses due to random fixation at the landrace level (Crow 1986). With low or no migration between demes, any mutation that arises in a particular deme may be fixed in that deme, but cannot spread to other demes. Since no allele can ever be fixed at the landrace level, drift to fixation takes an indefinitely long time, the effective population size of the landrace becomes infinite and the landrace has more chances of survival (Whitlock and Barton 1997). Obviously, each farmer population is expected to lose some of its initial variability due to drift and selection in a particular environment, but total diversity is expected to be maintained at the population level due to genetic differentiation. At the same time, local extinction, which reduces the overall amount of genetic variation, should be prevented.

Strategies that were applied to maintain cowpea diversity in the area and problems related to on-farm and in-garden conservation are described elsewhere in this publication (pp. 72-80).

Acknowledgments

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European legislation in support of home gardens conservation

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Introduction

This paper provides an overview of current pan-European and European Union (EU) legal instruments that support the conservation and promotion of home gardens, and the creation of financial mechanisms which can be useful for their maintenance.

At present, there is no legal text that focuses exclusively on home gardens, but several EU directives and regulations, as well as some pan-European legal agreements, indirectly support the conservation of home gardens as pools of biodiversity and sources of genetic diversity. Although there is a wide variety of policies that may affect the conservation of home gardens in Europe, including urban development strategies, employment and industry development policies and market regulations, we have focused on those that deal explicitly with the conservation of biodiversity and the promotion of traditional and sustainable agricultural products, since it is these that may affect the existence and maintenance of home gardens more directly.

Although all the legal instruments presented below are potentially useful for the conservation of home gardens, their applicability and usefulness may vary from country to country and even from region to region, depending on a number of factors: how countries translate pan-European and EU law into concrete legal and administrative measures at the national level; the biological, cultural and socio-economic characteristics of the gardens; and the objective of the home garden production (own consumption or market sale).

Finally, we must point out that these legal instruments may encourage the activity of home gardening *per se*, but it is not clear whether they help to maintain a high level of biodiversity in the gardens.

Possible financial support under the umbrella of the Common Agricultural Policy and the Rural Development Policy in the EU

Home garden farmers can benefit from EU financial support distributed through the EU Common Agricultural Policy (CAP) and the Agricultural Fund for Rural Development, for the protection of agricultural environment assets. According to the last reform of the CAP in 2003, and the new Rural Development Regulation for 2007-2013, biodiversity, the preservation and development of high nature value

farming[7] and forestry systems, and traditional agricultural landscapes, are priority areas for defining direct support schemes. Home gardens in less-favoured areas such as mountainous regions, and those in areas where farming is restricted by the existence of specific constraints related to environmental protection, may access additional compensatory allowances in support of farming. These compensatory payments have a combination of social and environmental objectives and have the aim of increasing the profitability of farming in marginal areas under natural constraints. As such, they are potentially an effective tool for preventing abandonment of high nature value farmland, provided that they do not create incentives for intensification (European Environment Agency 2004).

However, the CAP subsidy system was not designed to favour small farming systems. Small farmers in Europe account for about 40% of EU farms, but receive only 8% of available subsidies from Brussels (Jeffery 2003). Financial support distributed through the CAP is calculated according to the size of farmers' lands. The result is that, in practice, home garden farmers have access to a very small piece of the cake. Although, according to the current scheme, farmers in areas with a high level of biodiversity can apply for additional funds linked to the conservation of such diversity, the amount of funds will correspond in any case to the extent of the land, which does not offer incentives to small-scale productions such as home gardens.

Potential market niches for home garden products

There are a number of market tools that could be used to add value to products originating from home gardens. Some of these market tools have been recognized and standardized at the EU level. The most important ones are those related to organic food, traditional specialties and geographical indications. In addition, each European country has generated a wide range of quality marks to promote local products, such as trademarks for agricultural products from national and regional parks, or from sites with a rich gastronomic tradition (Bérard and Marchenay 2007). The ministries of agriculture, tourism and the environment have been especially active in this field.

Although quality marks have proven to be a strong incentive for the diversification of agricultural production, they do not encourage genetic diversity *per se*.

[7] Baldock and Bennet (1993, 1995) described the general characteristics of low-input farming system in terms of biodiversity and management practices and introduced the term 'high nature value' farming systems. These systems are characterized by low stocking densities and intensity, arable cropping, low use of chemical inputs and often labour intensive. The high nature value farmland indicator cf. Andersen (2003) distinguishes between the following types of high nature value farmland: 1) farmland with a high proportion of semi-natural vegetation; 2) farmland dominated by low intensity agriculture or a mosaic of semi-natural and cultivated land and small-scale features; 3) farmland supporting rare species or a high proportion of European or world population. In general terms, home gardens would fall under the last typology.

Organic food

The market for organic food constitutes a promising niche for traditional small-scale producers. Products from home gardens in Europe can be certified as organic products and be labeled as such if they meet the requirements and follow the procedures of the EU Regulation on organic production and labeling of organic products 834/2007, which substitutes the old regulation of 1991, highly criticized for the long and costly procedures required to get the certification, as well as for the very strict controls over the production systems and the products. This new regulation aims to be clearer in the definition of the objectives, principles and rules applicable to organic production, and to introduce some flexibility in terms of controls and exceptions.

Organic production has traditionally focused on the sustainable use of resources (water, soil) rather than on the promotion of agrobiodiversity, and the current legislation reflects this approach. It does not require either the conservation of agrobiodiversity or the use of traditional varieties or landraces. Therefore, although the certificate of organic production is a promising instrument for home gardens with market orientation, it does not constitute a real incentive for the conservation of genetic diversity in home gardens.

Traditional specialities

Through a regulation that guarantees traditional specialities (Council Regulation (EC) No 509/2006 of 20 March 2006 on agricultural products and foodstuffs as traditional specialities guaranteed), the EU has created a legal tool to add value to traditional agricultural products and foodstuffs and make them distinguishable from other similar products. This regulation substitutes a previous one, passed in 1992, on "Certificates of Specific Character", which was not very successful. According to the new instrument, an agricultural product intended for human consumption or foodstuff, with a traditional composition, or produced according to a traditional production method, may be certified as a guaranteed traditional speciality. Designation of traditional specialty guaranteed relates to the protection of tradition, independent of the origin of the product. However, the infrequency of such registrations throughout the EU shows that tradition is not easy to disassociate from place (Bérard and Marchenay 2007).

This new legal tool might have some indirect effects on home gardens conservation, as it may encourage the cultivation of varieties involved in the preparation of traditional food products, although genetic diversity conservation is not the main purpose of the regulation. Its most relevant objective is to encourage the diversification of agricultural production and increase farmers' revenues and the rural economy in remote areas.

Geographical indications and designations of origin

Geographical indications and designations of origin identify an agricultural product and foodstuff as originating in a region or locality within the territory of an EU country, where a given quality, reputation or other characteristic of the product is essentially attributable to its geographic origin. The EU regulation (Council Regulation (EC) No 510/2006 of 20 March 2006 on the protection of geographical indications and designations of origin for agricultural products and foodstuffs) establishes two types of protection: protected geographical indications and protected designation of

Greening European agriculture: the evolution of the CAP

Since 1992, the Common Agricultural Policy of the European Union (CAP) has been continually re-adapted to better serve the aim of sustainability, by means of a fundamental reform process designed to move away from a policy of price and production support to a policy of direct income aid and rural development measures.

The reform of the CAP in 1999 provided for an increase in the application of agro-environmental measures. Payments would be made available to farmers who, on a voluntary basis, provided environmental services to protect the environment and maintain the countryside.

The 2003 CAP reform (Council Regulation (EC) No 1782/2003 of 29 September 2003, establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers) and its amendments have further integrated environmental concerns into the CAP. They reinforce a number of measures that encourage land use and practices compatible with the protection of environmental resources, both in the first pillar (market and income policy) and in the second pillar (rural development policy). In the second pillar, a number of measures exist to promote the protection of the farmed environment.

The new Rural Development Regulation for the period 2007–2013 (Council Decision of 20 February 2006 on Community strategic guidelines for rural development - programming period 2007 to 2013) links environmental measures to the objectives of the Sixth Community Environment Action Programme (Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions of 24 January 2001 on the Sixth Environment Action Programme of the European Community "Environment 2010: Our future, our choice" COM(2001) 31). The Community strategic guidelines identify three priority areas for measures to improve the environment and the countryside: biodiversity and the preservation and development of high nature value farming, forestry systems and traditional agricultural landscapes; water; and climate change. Among the main new measures is the provision of more support to farmers in Natura 2000 sites and other high nature value areas. Support for areas with handicaps and for agro-environmental measures is maintained.

These legal frameworks allow EU countries to include home gardens in national regimes that regulate and channel European financial support for "greening" European agriculture and rural development.

origin. The former describes foodstuffs which are produced, processed and prepared in a given geographical area using recognized know-how. Protected designation of origin indicates the area where at least one of the stages of production, processing or preparation has taken place. The use of the corresponding symbols on the product

labels provides consumers with concise information on the product's origins, and helps boost farmers' income and promote less favoured or remote areas where quality products have their origin.

As in the case of organic agricultural products and traditional specialties guaranteed, geographical indications do not constitute *per se* an incentive for conserving and managing genetic diversity in agricultural ecosystems. They can even have negative effects on the diversity of plant species and varieties, as they might lead to an intensification of the production of those crops or varieties that have the certification, and the abandonment of others that are not considered local or traditional.

Registration and marketing of seeds of home gardens varieties: draft EU directive on conservation varieties

The marketing of seeds and plant propagating material in the EU is subject to the conditions established in the Council Directive on the Common Catalogue of Varieties on Agricultural Plants Species (2002). According to this Directive, in order to be registered in the catalogue and commercialized, varieties must meet some minimum requirements of distinctiveness, stability and uniformity, which are checked in official examinations. The purpose of this regulation is to maintain the quality of seeds in the market.

Landraces and varieties developed by farmers do not normally meet these requirements and therefore seeds of these varieties cannot be sold in the market. Another limitation for small farmers to commercialize the seeds of their varieties is that they cannot afford the costs and long procedures required by the registration process. In addition to limiting the opportunities for farmers to obtain revenues from the varieties they produce, this situation threatens the availability of landraces and exchange between farmers, decreases the genetic diversity of the seeds available in the market and, ultimately, affects the biodiversity of agriculture *in situ*. All these elements are relevant for the maintenance of home gardens as reserves of agricultural biodiversity.

In order to address these problems, the Commission has been working on a proposal which accords especially favourable treatment to the inclusion of the so-called conservation varieties in the national catalogues of varieties of agricultural plant species, and their commercialization.[8] This favourable treatment consists of: 1) a certain degree of flexibility in the level of uniformity that is required in these varieties; and 2) an exemption from official examination if the applicant can provide

[8] Some months after the ECPGR Workshop on home gardens in Europe, the Commission approved the definitive text of the Directive 2008/62/EC of 20 June 2008 providing for certain derogations for acceptance of agricultural landraces and varieties which are naturally adapted to the local and regional conditions and threatened by genetic erosion and for marketing of seed and seed potatoes of those landraces and varieties.

It is worth mentioning that at the beginning of 2008, the European Commission (Directorate General for Health and Consumer Protection) decided to conduct an external evaluation of the EU legislation on the marketing of seed and plant propagating material, with the aim of reforming such legislation in the near future. The final report of the evaluators will be followed by an action plan early 2009. The impact of current legislation on the conservation of genetic diversity is one of the issues to be addressed by the evaluation

sufficient information for the decision on the acceptance of the conservation variety through other means, namely: the description of the conservation variety and its denomination; the results of unofficial tests; and knowledge gained from practical experience during cultivation, reproduction and use.

In order to be accepted as a conservation variety, the landrace or variety should be of interest for the conservation of plant genetic resources, adapted to local and regional conditions and threatened by genetic erosion. When a coun§try accepts and registers a conservation variety the seed may only be produced and marketed in the region of origin, and subject to quantitative restrictions (no more than 10% of the seed of that species used yearly in the country).

The draft directive has already received some negative criticism, mainly because of the fact that only varieties threatened by genetic erosion can be accepted as conservation varieties and because these can be only distributed in the region of origin. If the directive is finally passed, EU member countries will still have a considerable amount of work to do in translating the general provisions of the directive into concrete legal and administrative measures at a national level. It is expected that some unclear issues, such as the definition of "threatened by genetic erosion," will be clarified during this national implementation process.

Some fear that the inclusion of traditional varieties in the formal system of seed marketing and distribution might be accompanied by stricter controls over informal seed systems, threatening traditional ways of seed exchange and related informal methods of seed quality control. This would be particularly serious for the maintenance of genetic diversity in home gardens, which is very much based on informal seed production and exchange systems.

Home gardens as elements of the landscape: The European Convention

No other region in the world has been subject to human intervention to the same extent as Europe. The European landscape is the result of the interaction between humans and the environment over centuries. Unlike other parts of the world, very few sites in Europe maintain the same biotic and abiotic components that were present centuries ago. As a result of its longstanding management of the land, farming in Europe has co-evolved with its ecology, landscapes and other environmental resources. Today, many of Europe's species, their characteristic habitats and the resultant landscapes are dependent on continued management to sustain their diversity. Therefore, it is not surprising that the first international agreement focusing exclusively on the protection of the landscape, understood as a combination of human and wild components, was adopted by European countries and for the European region.

The European Convention on Landscape was adopted in 2002 under the auspices of the Council of Europe, and entered into force in 2004. Today, 27 European countries are Parties to the Convention. Through the ratification of this legal instrument, these countries committed themselves to recognizing landscapes as an essential component of people's surroundings, an expression of the diversity of their shared cultural and natural heritage, and a foundation of their identity. They agreed to establish and implement policies aimed at landscape protection, management and planning through the adoption of specific measures, and to integrate landscape

into their regional and town planning policies, and their cultural, environmental, agricultural, social and economic policies.

The conservation of home gardens as important elements of the landscape is very much in line with the objectives of the Convention. Several countries and regions are integrating landscape as an asset in their environmental and development policies and they are expected to take home gardens into consideration in those regions where they have become elements of the culture and natural heritage. In addition, the Council of Europe constitutes a forum for the discussion and exchange of ideas on landscape protection. The role of home gardens in landscape design could be included as one of the topics of these discussions.

Including policy aspects in a research agenda on home gardens

Policy aspects related to the conservation of home gardens and their agricultural biodiversity can be analyzed from different perspectives. The following are some possible areas of work for a research agenda on European home gardens:

- Explore the impacts of current European legislation on agricultural biodiversity and, in particular, small-scale systems like home gardens
- Study how home gardens can benefit from national measures implementing such legislation
- Identify obstacles and gaps in current legislation and analyze how this legislation can be adapted to meet the needs of small farmers
- Explore and exploit the advantages for home gardeners to work together when, for example, asking for financial support from the CAP, applying for a quality mark or influencing the political agenda on the conservation of biodiversity
- Identify ways to provide scientific insights to current policy discussions on biodiversity, agriculture and landscape, in order to ensure that the importance of home gardens is noted.

Legal instruments mentioned in the paper

Commission Directive 2008/62/EC of 20 June 2008 providing for certain derogations for acceptance of agricultural landraces and varieties which are naturally adapted to the local and regional conditions and threatened by genetic erosion and for marketing of seed and seed potatoes of those landraces and varieties (Text with EEA relevance). Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:162:0013:01:EN:HTML. Date accessed: 25 February 2009.

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A voice from the informal sector

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On 18-20 May 2007, 150 participants from 25 countries met in Halle near the Leibniz Institute of Plant Genetics and Crop Plant Research (IPK) in Gatersleben under the headline "Let's free diversity" to demonstrate against the field trials of genetically modified wheat in the immediate vicinity of a genebank of worldwide importance. One of the main issues under discussion was the risk of genetically modified organisms (GMOs) endangering conservation work by contaminating conservation varieties.

Another issue was that the European Commission Directive on the marketing of seeds and propagating material for agriculture, horticulture and forestry currently under discussion is considered too restrictive. Article 13 (region of origin) and article 14 (quantitative restriction) prevent and do not promote the conservation of diversity as was actually planned by the Convention on Biological Diversity (CBD) and described in the Global Plan of Action in Leipzig 1996.

One of the outcomes of the meeting in Halle was the decision to create a European Cooperation for Peasants Seeds (ECPS). This network was to be founded in Rome in October/November 2007.

Cooperation between the formal and informal sector

Most NGOs in the field of genetic diversity conservation are specialized in keeping diversity on farm and follow mainly on-farm strategies. They manage to maintain plant genetic resources in an agricultural or private garden environment by working in considerable networks. Béla Bartha presents the ProSpecieRara database that serves to manage and coordinate their conservation network and could be useful to other organizations also working in the field of on-farm conservation. In several regions activists can base their work on existing, traditional structures, but in other regions these structures no longer exist and new methods and incentives have to be found to reintroduce conservation varieties into a marketing system.

To reactivate the propagation of traditional varieties, good quality seed production must be assured. Incentives like labelling to add value and certify the special product in order to enhance the quality of conservation work could be developed. Marketing partners must be assured of the sustainable availability of products made from traditional varieties and all kinds of promotion activities must be undertaken to raise public awareness in order to create broader demand for the products.

The central task of a genebank is to conserve diversity and to provide seed of good quality. On the other hand, keeping diversity in huge informal networks on farm is a very efficient way to involve as many interested people as possible and to promote awareness of the need to conserve diversity. However, it is difficult to maintain the quality of a variety. If we want to combine the two aims of conserving diversity and providing quality seed, NGOs and the institutional sector have to cooperate.

In future, greater efforts will have to be undertaken to involve NGOs already in the field of protecting biodiversity and the environment in European conservation

programmes, in which they might take care of complementary tasks like the evaluation of conservation varieties for the market and developing promotional strategies for them. These complementary tasks must be an integral part of the developed project.

The following is a list of European NGOs that were present at the meeting in Halle and are very active in conserving diversity on farm or in lobbying for the promotion of diversity in agriculture.

Austria
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Possible incentives for home garden maintenance: comparing possibilities and raising awareness among farmers

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Diversity in Italian home gardens

Home gardens can be broadly defined as micro-environments within a larger farming system (Eyzaguirre and Watson 2002). Such micro-ecosystems contain high levels of species diversity and may contain species or varieties that are different from those found in the surrounding macro-system (Hodgkin 2002).

Horticultural crops, aromatics, trees, ornamentals and medicinal plants can be found in Italian home gardens in different combinations. For each crop, besides commercial cultivars, also landraces, and sometimes hybrids between landraces and/or cultivars, can be found in home gardens (Negri 2003) (Fig. 1).

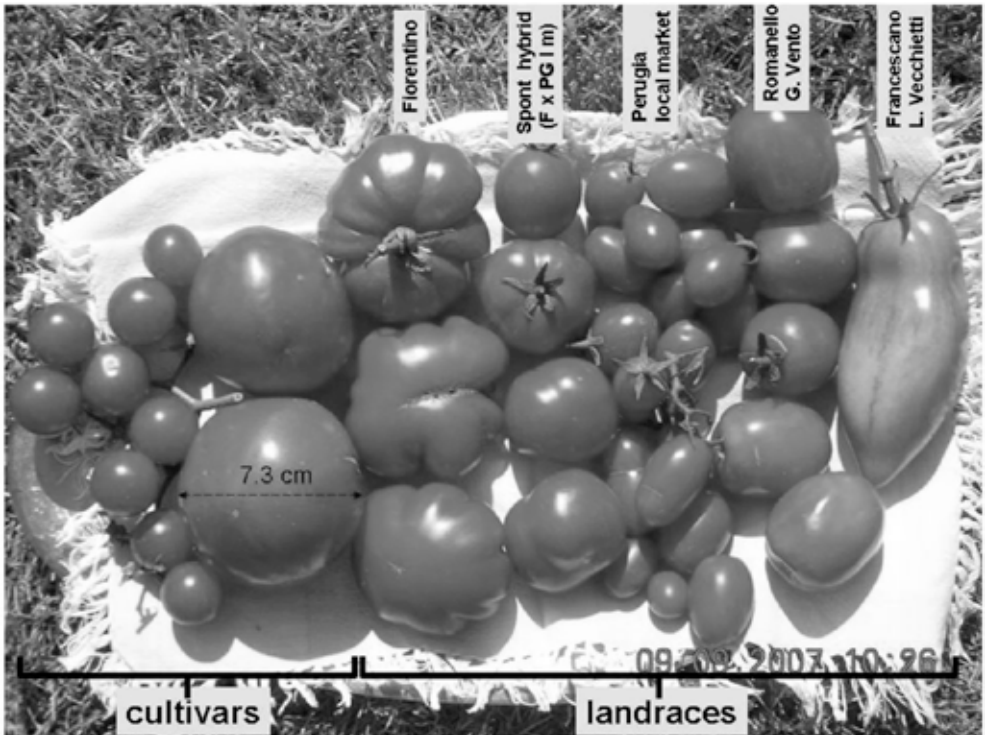

Fig. 1. Cultivars, landraces and hybrids between landraces of tomato found in a single home garden in central Italy.

Landraces are vital plant genetic resources, which are currently highly threatened. Landraces of seed-propagated crops can be defined as variable populations which are named, lack formal improvement, are characterized by specific adaptation to the environmental conditions of the area of cultivation (tolerant to the biotic and abiotic stresses of that area) and by relatively low but stable yields which are closely associated with the traditional uses, habits, dialects and celebrations of the people who developed them. They represent a subset of biodiversity that has been created through the joint action of the environment and people for human use. The tight intertwining of the biological and cultural heritage and the complexity of the system where landraces have evolved, and are still evolving, is their most unique and intriguing trait. Landraces harbour genetic diversity of interest for future breeding work, for diversification of production, and developing new farming systems and new quality products.

Landraces were considered by many people to be abandoned and extinct, but a ten year collection in Central Italy showed that over 400 landraces can still be found on farm and in home gardens (Negri 2003). About a third of them provide products that are sold on the wide or local market, while two-thirds of the landraces are grown for family use only and are only found in home gardens (Negri 2003) (Fig. 2). In Umbria (central Italy), the most common species maintained in home gardens as landraces are: celery (*Apium graveolens* L.), rape and turnips (*Brassica rapa* L.), broccoli, cauliflower and kale (*Brassica oleracea* L.), chickpeas (*Cicer arietinum* L.), pumpkin (*Cucurbita maxima* Duch. ex Lam.), lettuce (*Lactuca sativa* L.), grasspea (*Lathyrus sativus* L.), tomato (*Lycopersicum esculentum* Mill.), beans (*Phaseolus vulgaris* L and *P. coccineus* L.), and cowpea (*Vigna unguiculata* (L.) Walp.). In addition, many fruit landraces belonging to different species can be found, for example figs (*Ficus carica* L.), apples (*Malus pumila* Mill.), olives (*Olea europea* L.), pears (*Pyrus communis* L.), almonds (*Prunus amygdalus* Batsch), peaches (*P. persica* (L.) Batsch), sweet cherries (*P. avium* L.), plums (*P. domestica* L.) and apricots (*P. armeniaca* L.), just to mention the main species (Dalla Ragione and Dalla Ragione 1997). However, statistics about the abundance of landraces are not available.

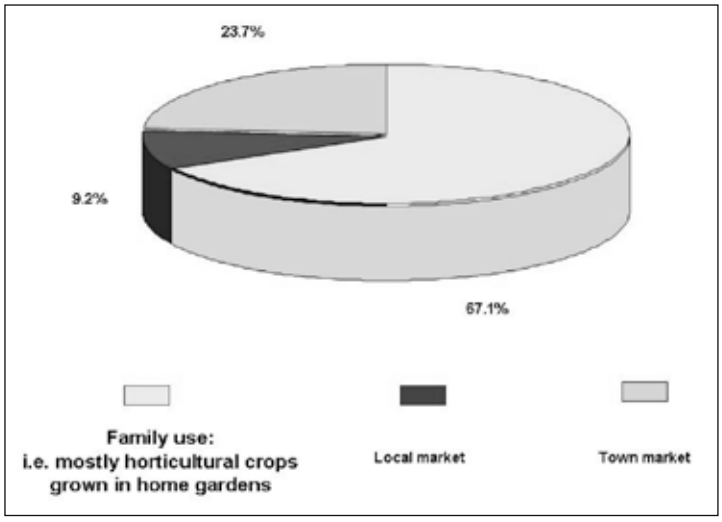

Fig. 2. Prevalent destination of landraces used as food in central Italy.

Some home gardens maintain more than one landrace for each species (Fig.1) and up to twelve landraces belonging to different species were collected from a single farm (Negri 2003).

Where garden crop landraces can be found and who grows them

Farmers and farmer families are the main actors in conservation in Italy, while amateur conservation activities such as those promoted by NGOs like 'Seed Savers' and 'Civiltà Contadina' have negligible importance.

Landraces of garden crops are prevalently found at lower altitudes (average elevation 512.4 m asl). They are mostly grown by elderly farmers (average age = 63.6 years), running small farms (average farm area = 11.7 ha) and under traditional farming systems, which nonetheless include the use of mechanical tools for soil preparation and the use of chemical fertilizers.

A large number of publications, mostly published in Italian, document that a wide morphological and physiological diversity exists among landraces of the same species collected in Italian home gardens.

Reasons for maintaining landraces in home gardens

The reasons why a family chooses to grow landraces, as recorded in Negri (2003) and other unpublished research findings, are the following:

- They are relevant in the family context (e.g. they offer an opportunity to the elderly to feel useful to the family and to spend their time productively)
- They are maintained because of family traditions and sentimental value (e.g. they are required to prepare dishes which belong to the family tradition or are simply maintained because they represent a family heritage)
- They are appreciated more than commercial varieties (e.g. they have a better taste)
- They perform better than commercial cultivars under limiting conditions (e.g. poor soil, extreme temperatures, scarcity of water)
- They lack uniformity, which is an advantage for family production, especially as far as ripening time is concerned
- Since they are reproduced almost every year and under the control of the family, there is a guarantee of perfect germinability and adherence to the standards requested by the family itself.

The latter aspects, which are important for the family's local, possibly marginal growing conditions and use, are not always assured by commercial materials bought on the market where mainly hybrid cultivars are sold. Dealers may sell a variety whose indicated ripening period sometimes does not correspond to the reality under the local growing conditions. Hybrid cultivars have been developed for large scale horticultural production. Breeding aims in this case are high yield under high input conditions and uniformity, while no, or very little, attention is paid to performance under difficult environments or to taste.

It appears that, although not being maintained in traditional farming systems *sensu strictu*, landraces survive in Italy *because of* traditions, especially those related to food.

Focusing on example cases of landraces and incentives for maintaining them recorded in the region of Umbria in central Italy this paper describes:

- how some home garden landraces were rescued from extinction
- possible incentives for home garden maintenance of landraces
- problems related to home garden maintenance of landraces.

Incentives to preserve home garden diversity: some case studies

The cowpea from the Lake Trasimeno area, Perugia ('*Fagiolina del Trasimeno*')

Cowpea ('fagiolina') landraces were found during a germplasm exploration and collection mission carried out in 1994 (Negri and Tosti 1997). At that time, most farms produced cowpea in home gardens for their own use and the total area under cowpea cultivation was estimated at less than a couple of hectares. Only one farm produced a few kilograms of a small white-seeded landrace for the town market in Perugia. At this market, product demand largely exceeded production because of the unique shape and colour of the seed and consumers' opinion that the landrace had a better taste than the common cowpea.

Financial support was initially given by the 'Provincia di Perugia' (a body linking fifty-nine towns around the city of Perugia in the Region of Umbria) to carry out a morphological, organoleptic and genetic characterization of cowpea landraces in the area, to support the *ex situ* conservation of these in the genebank of the Department of Applied Biology at the University of Perugia, to conduct seed multiplication and distribution to farmers interested in reintroducing the cultivation of these cowpea landraces to their gardens, and in general to increase farmer awareness about potential benefits offered by this crop.

Clearly distinguishable cowpea types were detected in the area (Negri et al. 2000; Tosti and Negri 2002, 2005), which are outlined elsewhere in this publication (Negri and Polegri, pp. 55-61).

The research results were presented to farmers and farmer associations in a series of meetings and seminars during which seed samples were also distributed. Following this initial set of rescue measures, the Lake Trasimeno Regional Park and the Region of Umbria funded other studies on these populations, aimed at increasing their distribution and promoting their commercialization. In particular, funds were provided to set up a disciplinaire for applying for a Protected Designation of Origin (PDO) certification. This is a quality mark awarded by the European Union to products which have specific, certified traits. The farmers are currently evaluating the possibility of applying for the PDO.

The Lake Trasimeno *Fagiolina* aroused the interest of various actors: the Slow Food movement, which recorded it among its Presidia; local Gourmet Academies, which organized dinners where dishes based on this bean were prepared; and private subjects, such as farmers with agro-tourism activities, chefs and hotel-keepers, who included it in their menus. In this way, the Lake Trasimeno *Fagiolina* became a must in many top restaurants, even outside Umbria, in a few years. In addition, it has recently been registered in the list of typical Umbrian products (the so called 'basket of typical products of Umbria') which has been prepared by the Region of Umbria.

The initial promotion of research and awareness-raising among farmers triggered a virtuous process of conservation that has resulted in an increase of the area under cowpea cultivation to ten hectares and has significantly increased the income of farmers cultivating the crop. The market price of the small, white-seeded type has greatly increased in the regional capital Perugia from 6 euros/kg in 1994 to the present 20-22 euros/kg. Now other types of *Fagiolina* are also cultivated for the market, although sold at slightly lower prices.

A consortium of *Fagiolina* growers has been established in order to better commercialize the crop, which now takes advantage of a registered name and a logo (Fig. 3). Also worthy of note is that some farmers have introduced the crop starting from local material to other areas of Umbria outside the Lake Trasimeno area. At present the Lake Trasimeno cowpea appears to have avoided the risk of extinction.

Fig. 3. '*Fagiolina del Trasimeno*' is now a registered name.

Black celery from Trevi ('*Sedano nero di Trevi*')

A 'black' landrace of celery (*Apium graveolens* var. *dulce*) is grown in Umbria (Italy) near the small town of Trevi. The term 'black' refers to the wild physiological characteristic of maintaining green petioles (not self-blanching) if not subjected to an agronomic whitening treatment. The cultivated area is small (2 ha, approximately) so production is limited and mainly destined for

local restaurants and families and the local 'black celery fair' held in October. During the fair, where celery is sold at an open air market, the farmer producing the best products wins an award (Fig. 4). The fair has been organized by the local association 'Pro-Trevi' with the support of the Municipality since 1965 with the purpose of re-launching production of the landrace. A study to describe the morphological and genetic diversity of this celery type and to assess if it is distinguishable from cultivars was recently funded by the Region of Umbria (Castellini 2005, Negri et al. in press).

Fig. 4. The fair of *Sedano Nero di Trevi* in Umbria with the 'winner' of the year (courtesy of Dr. Gildo Castellini).

The survival of this landrace, once only cultivated in home gardens for local use, has been largely due to this initiative by the local authorities, but it can also be partly ascribed to the request for traditional, local products which consumers consider of superior quality and which are sold on the regional gastronomic circuit. For this purpose this landrace has also been registered in the list of typical local products of the region.

Cave di Foligno bean (*'Fagiolo di Cave di Foligno'*)

This *Phaseolus vulgaris* L. landrace represents another example of survival linked to the existence of a local fair. The production is limited to a few home gardens who sell their excess production at the local fair. However in this case, support for local production is not as well organized as in the previous cases and there is little information available among ordinary people about this landrace.

Lessons learnt

In summary, it can be said that all these home garden landraces have been helped to survive through the intervention of a wide cast of actors:

- Local authorities (Region, Provinces, Municipalities) who provided money for:
  - studying them for morpho-physiological and genetic characterization and distinctness
  - boosting seed production and distributing the seeds among farmers
  - promoting the product itself
  - organizing local fairs
- Local 'Academies of Taste' (Gourmet Academies)
- Organizations such as Slow Food
- Local associations of citizens, farmers, chefs and hotel-keepers, who in different ways have increased knowledge and appreciation about the crop.

In the case of *Fagiolina*, it has allowed the crop go beyond mere survival and even be transformed into an open field crop reaching a market.

It should be noted that these promotion activities have served to stimulate renewed interest and action to rescue other garden crops. Recently Lake Trasimeno Regional Park has funded a project to catalogue, multiply and distribute landrace seeds to farmers. The crops involved are tomato, brassicas, beans, chickpea, lettuce and other horticultural crops. The same project plans to set up web pages on local home garden landraces to be published on the Regional Park web site. In addition, many ordinary people have become interested in local varieties, such as farmers working in agriculture with aims other than crop income, for example those who run educational farms or employ disabled people, and an increasing number of requests for landrace seeds now come from this sector.

Another result of the activities mentioned above is an incentive for home garden landrace conservation because of *indirect* promotion of their cultivation. Individual families are becoming aware that these landraces:

- represent their heirloom
- are more flavoursome
- can be sold to friends or local shops at a good price if excess is produced
- can make nice presents for friends at Christmas and other celebrations.

As a consequence people are stimulated to maintain their own landraces or, in some cases, to reintroduce them into their home gardens. It appears then that financial incentives given by local authorities can trigger a virtuous process for the safeguard of landrace home garden diversity.

'The problem' in local diversity maintenance and its possible solution

However, while local promotion can help save some landraces from extinction (i.e. those that have potential for sale on local or wider markets), it is not possible to give financial support to all the landraces grown in home gardens, which represent the great majority of all landraces present in the territory. Most of them, those still confined to family home gardens, remain highly threatened. There are several

interconnected reasons which underlie this threat. First of all, very few people remain in the country and/or take care of a home garden nowadays. When this is the case, it is practically only the elderly who take care of planting the home garden from home-reproduced seeds, while the younger members of the family, often only engaged in gardening activities part time, prefer to buy plantlets or seeds from the market, where mainly commercial varieties are found. In addition, loss of skills (for example seed harvesting, cleaning and preserving skills or grafting techniques) and the current loss of family traditions contribute to the threat of extinction facing home garden diversity.

In other words, the modern social context appears to be *the problem* facing the home garden conservation of landraces. In my opinion, the most effective tool to promote much wider home garden conservation (and conservation in general) is *increased public awareness* about the importance of home gardens and the services that biodiverse agro-ecosystems offer.

Families with home gardens, farmers and the public in general should be made aware that their lives depend on the life of all other living beings, that maintaining agro-biodiversity is important for the future, that they are the upholders and managers of a large part of it, and finally that local agro-biodiversity is also a part of their cultural heritage. We need to reinforce the links between people and their environment and plant genetic resources, to teach children about the importance of biological resources and to foster pride among young people with regard to their natural and cultural heritage. Ethical reasons justify this approach (Negri 2005).

In promoting increased awareness we should appeal to the sense of belonging to the environment, 'the land', as Aldo Leopold (1949) calls it. Leopold says that: 'We abuse the land because we regard it as a commodity belonging to us. When we see the land as a community [of soils, water, plants and animals] to which we belong, we may begin to use it with love and respect'. Education at every level, but in particular that given in Agricultural Faculties, has a role to play in this context. Local Authorities, Extension Service Agencies, Farmer Associations and journalists could also contribute to waking public opinion to the importance of agro-biodiversity (see also the contribution by Silveri and Manzi, this volume, pp. 26-36).

Finally, such an increased awareness will also help in achieving freedom from a seed market which offers, at relatively high prices, materials which are not always well suited to the local growing conditions.

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Appendix I. A concept note to establish a research "budget-line" in the EU Framework Programme "Food, Agriculture and Fisheries, and Biotechnology"

Subject: Home Gardens

As evidenced during an ECPGR workshop on Home gardens in Europe, held in Ljubljana, Slovenia, 3-5 October 2007, a review of existing knowledge revealed that traditional crop varieties and landraces of Europe's horticultural crops, legumes, and grains are still extensively held and planted by farmers and gardeners throughout Europe, and they are found in the home gardens of rural households. From fruit trees, beans, tomatoes, peppers, celery, leafy kales, roots and tubers, even maize and wheat, there is a rich diversity of traditional varieties still available in countries where modern commercial varieties dominate the seed systems, crop fields, and commercial orchards.

Scientists from national genetic resource institutes and universities concerned to maintain and use the unique genetic diversity in crop landraces for new uses and crop adaptation to changing conditions such as climate change, have been surprised and pleased to see that these invaluable crop resources are still being maintained. However, reports from researchers, gardener seed clubs, and NGOs in countries ranging from Austria, Italy, Germany, Hungary, Spain, Switzerland, Portugal, Norway and UK, indicate that these repositories of crop diversity are at risk. European home gardens represent a small but significant niche and patches are maintained to meet the specific cultural values and needs of households concerned to keep alive their local traditions, local tastes, food quality and even food safety and health. Demographic and cultural change including continuing decline in the number of family farms and migration away from rural areas; perverse incentives, globalization and simplification of diets and tastes are threatening diversity in home gardens, both in terms of numbers of species cultivated and the diversity within local varieties that are maintained.

At the same time, several features of European home gardens including their predominantly organic farming methods, the way they link local people to traditional local cultures, to association between local agro-ecosystems and natural landscapes, and the healthy properties of the traditional crops grown such as kales, fruits, beets, (that contain anti-oxidants, and other protective properties) have fostered a growing interest in home gardening among a broad range of people in Europe. Gardeners' networks, NGOs such as Garden Organic in the UK and Pro Specie Rara in Switzerland, local authorities and agricultural associations in Abruzzo, Lazio, Tuscany and Umbria in Italy have demonstrated the importance of maintaining the garden biodiversity by supporting initiatives led by farmers and gardeners themselves. Further systematic efforts are required to support home gardens as critical resource for agro-biodiversity in Europe by underpinning the link between local cultures, local crop varieties, and local products. The rising public concern with food and environmental quality and distinctive landscapes can help to reinforce a sense of pride in the diverse local cultural landscapes that European

communities have shaped and maintained over thousands of years. Home gardens are also places where European farmers experiment and adapt crops to meet new conditions, needs, and tastes. This function can only become more important in the future as immigration and climate change create new markets and challenges.

The workshops expert participants representing 22 European countries agreed that research is needed to elucidate the unique aspects of home gardens, how and why diversity has been maintained, and how that diversity may be related to plant genetic conservation and enhanced utilization. Specific research questions were suggested as follows:

- Systematic descriptive survey of home gardens in Europe, including crops, production systems, environment features, genetic diversity, selection procedures, as well as social dynamics, seed exchange systems, etc.
- Identification of potential risks/threats to home gardens
- Analysis of multi-functionality of home gardens and, in particular, their role in the well being of the gardeners and their community:
  - Food-nutrition
  - Recreation
  - Health
  - Education
  - Landscape
  - Environmental benefit
  - Ecotourism
- Study of local and cultural aspects of home gardening
- Comparison of genetic diversity maintained in genebanks and managed in the public breeding sector, with home gardens diversity
- Identification of socio-economic aspects of home gardening, including issues of gender, age, policy, markets, new uses/niches.

It was also pointed out that home gardens existence is in line with the following elements of the European Policy:

- Integrated farm management and organic agriculture
- Preservation of landscape and historical features
- Conservation of high-value habitats and their associated biodiversity
- Protection and promotion of the diversity of cultural expressions
- Improving the quality of life in rural areas and diversifying the rural economy.

In conclusion, the following lines of research are suggested:

- Analysis of European home gardens and their services (diversity richness, environmental, cultural, social and economic value)
- Formulation of appropriate conservation strategies to ensure that these unique diversity rich agro-ecosystems (home gardens) continue to exist in the future.
- Exploration of the potential for enhanced or novel markets for home garden produce as a means of ensuring the sustainability of home garden diversity.

Thus, through description, conservation and use, to ensure that the informal European seed maintenance and supply of home gardens be preserved for future generations.

Appendix II. Acronyms and abbreviations

ABCD	Alp-Balkan-Carpath-Danube area
AFLP	Amplified Fragment Length Polymorphism
ANOVA	Analysis of Variance
ARSIAL	the Regional Agency for Agricultural Development and Innovation in Latium
ARSSA	Regional Agency for Agricultural Development Services in Abruzzo
BaMET	Balanced MultiEthnic Territories
CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
DBA	Department of Applied Biology (University of Perugia)
EEA	European Environment Agency
EEU	Elementary Ethnobiodiversity Unit(s)
EI	Ethnic Islands
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GGC	Geographic Component
GMO	genetically modified organisms
GPS	Global Positioning System
HEC	Human (Ethnic) Component
HSL	Heritage Seed Library
IITA	International Institute of Tropical Agriculture
IPK	Leibniz Institute of Plant Genetics and Crop Plant Research
ISF	Research Institute for Fruit Trees, now CRA-Centre for Fruit Tree Research
n.d.	no date
NGO	non-governmental organization
PCP	Phaseolus cultivation practice
PDO	Protected Designation of Origin
PGR	Plant Genetic Resources
PHC	*Phaseolus* Component
PhDM	*Phaseolus* Diversity Model
QTL	Quantitative Trait Loci
SAMPL	Selectively Amplified Microsatellite Polymorphic Locus
SAPARD	Special Accession Programme for Agriculture and Rural Development
UPGMA	Unweighted Pair Group Method with Arithmetic Mean

Appendix III. Agenda

ECPGR Workshop on Home gardens in Europe
3-4 October 2007, Ljubljana, Slovenia

Wednesday 3 October 2007

14.30-14.45	Welcome address and introduction to the home gardens workshop (*L. Maggioni*)
Session I.	**Background studies: home garden definition, status and contributions to agrobiodiversity (Chair: V. Negri)**
14.45-15.05	International case studies and tropical home garden projects (*P. Eyzaguirre*)
15.05-15.30	State of the art in scientific research about home gardens: international and European experiences (*G. Galluzzi*)
Session II.	**Local and national activities involving home gardens (Chair: V. Negri)**
15.30-15.45	Home garden studies in the Tyrol region of Austria and ethnobotanical tools for the investigation of their diversity (*C. Vogl*)
15.45-16.00	The Heritage Seed Library and home garden conservation activities in the UK (*B. Sherman*)
16.00-16.30	*Coffee break*
16.30-16.45	Fruit tree germplasm conserved in home gardens in Lazio (*P. Engel)*
16.45-17.00	Local germplasm conserved in Abruzzo home gardens and overview of conservation activities at the regional level *(D. Silveri*)
17.00-18.00	**Discussion**

Thursday 4 October 2007

Session III.	**Crop genetic diversity in European Home gardens (Chair: N. Maxted)**
09.00-09.20	Infraspecific variablity in *Phaseolus* taxa: an indicator of crop diversity in Central-European home gardens. A methodological approach (*A. Szabó*)
09.20-09.40	Genetic diversity of *Vigna* in home gardens of Umbria (*V. Negri*)
09.40-10.00	**Discussion**
10.00-10.30	*Coffee break*
Session IV.	**Policy issues related to home gardens (Chair: J. Engels)**
10.30-10.50	Seed supply and exchange in small scale farming systems (*M. Bellon)*
10.50-11.10	European legislation in support of home gardens conservation (*I. Lopez*)
11.10-11.30	A voice from the informal sector (*B. Bartha*)
11.30-11.50	Possible incentives to home garden maintenance: comparing possibilities and raising awareness among farmers (*V. Negri*).
11.50-12.30	**Discussion**
12.30-14.00	*Lunch*
Session V.	**Project proposals (Chair: P. Eyzaguirre)**
14.30-14.50	Research opportunities within the EU funding framework: possible themes, issues and outline for a coordinated European research proposal on home garden studies (*P. Eyzaguirre*).
14.50-16.00	Collective discussion (or working groups) to produce draft proposals that could be submitted to the EU.
16.00-16.30	*Coffee break*
16.30-17.00	**Closing session / Concluding remarks**
Social dinner	

Appendix IV. List of Participants

ECPGR Workshop on Home gardens
3-4 October 2007, Ljubljana, Slovenia

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