Novel characterization of crop wild relative and landrace resources as a basis for improved crop breeding'

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Landraces

Issue 2 October 2013

Conserving Europe's plant genetic resources

for use now and in the future

PGR Secure – EU Seventh Framework Programme, THEME KBBE.2010.1.1-03, GA 266394

PGR SECURE

Landraces

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Contents

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Editorial

Welcome to Issue 2 of Landraces. This newsletter is addressed you by the European Community funded project, "Novel characterization of crop wild relative and landrace resources as a basis for improved crop breeding" (PGR Secure, GA n. 266394) which started on 1st March 2011.

Landraces provides a medium to advertise information about the conservation and use of crop landraces; including updates on the activities of PGR Secure but also more general articles on landraces conservation and use. We intend to anticipate that anyone with an interest in landraces, whether conservationist, breeder, farmer, policy-maker or educator will benefit from this publication, both by spreading news about their own activities and by learning about other initiatives.

This second newsletter is subdivided into different sections. The first section includes information on National and Regional in favour PGR conservation like: i) the new Italian Guidelines for conservation and characterization of animal, microbial and plant biodiversity of agricultural interest; ii) a new law of the Azerbaijan Republic on protection, sustainable and utilization of Crop Genetic Resources; iii) the Regional laws to protect Genetic Resources in Italy. The following section reports some PGR Secure Project achievements: the first Italian official inventory of LR and a contribution on new niche product developed in Finland based on a barley landrace. The third section is addressed to other European experiences concerning LR inventorying, characterization and use. Finally, the last section reports two articles concerning LR outside Europe

Above: the "flowering of Castelluccio di Norcia" – pictures taken in Castelluccio di Norcia (1452 m a.s.l.) - (PG-Italy), growing area of homonymous lentil LR. (Photo: Renzo Torricelli)

The new Italian Guidelines for conservation and characterization of animal, microbial and plant biodiversity of agricultural interest

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Introduction

The Italian Ministry for the Environment, Land and Sea has suggested, through the development of the National Strategy for Biodiversity (NSB), several lines of action in respect of environmentally friendly agricultural policies for the management and conservation of biodiversity. This goal of environmental protection is also geared with the European "Common Agricultural Policy" (CAP). Both are very important tools in order to ensure in the coming years a true integration of "development objectives of the country and the protection of its biodiversity."
The NSB is mainly organized around three key themes:
• biodiversity and ecosystem services;
• biodiversity and climate change;
• biodiversity and economic policies.
The conservation of biological diversity is one of its most important goals, both in terms of species and genes, of ecosystems and communities, for the sustainable use of its components and the fair and equitable sharing of benefits arising from the utilization of genetic resources and the transfer of technologies related to it.
The NSB highlights some problems of the agricultural sector and focuses on specific objectives, such as:

- to promote the conservation and sustainable use of agricultural biodiversity, and the preservation and dissemination of forestry and agricultural systems with high natural value;
- to preserve and restore ecosystem services in the agricultural environment;
- to promote the safeguard of the territory (particularly in marginal areas) through integrated policies that promote sustainable agriculture and benefit biodiversity by contrasting abandon and marginalization of agricultural areas.

The National Plan for Agricultural Biodiversity

The conservation, characterization and use of genetic resources for food and agriculture are relevant issues in the context of the NSB. That is way a National Plan for Agricultural Biodiversity (NPAB) focussed on food and agriculture was adopted by the State-Regions Permanent Conference on 2008.
Many landraces are still maintained on-farm in Italy, including not only of all the main crop species but also neglected and underutilized species. A recent inventory listed over 1300 LRs in central Italy alone (Negri *et al.*, 2012).
These LRs are maintained for various reasons, including better quality than commercial varieties, better performance (yield or persistence) under harsh agro-environmental conditions, traditional uses such as particular traits appreciated by the farm family (Negri, 2003).
The NPAB provides a great local relevance of all actions undertaken to protect biodiversity .

Figure 1: Vineyards in Asti - Italy (Photo A. Schneider)

According to the contents of the NPAB, a Working Group on Agricultural Biodiversity (WGAB) was established on 2010 and was given the task of defining:
a) the descriptors for the characterization of plant varieties, (Fig. 1) animal breeds/local populations (Fig. 2) and micro-organisms (Fig. 3); b) a common and shared methodology for research and characterization of varieties, breeds and populations in order to allow comparison of data in the various Italian territories;
c) guidelines for proper *in situ* conservation, on farm and *ex situ* conservation of plant varieties and animal breeds/populations;
d) guidelines for the proper storage of microorganisms *in situ* and *ex situ*; e) the definition of risk of extinction and genetic erosion through thresholds and criteria for the main species of plants, animals and microbes for food and agriculture.

Figure 2: Istriana sheep breed

The Group has prepared *three separate manuals with guidelines for the in situ, on farm and ex situ conservation and characterization of animal, microbial and plant biodiversity of agricultural interest*. Each manual is available separately .

In this respect it should be noted that:

The guidelines are addressed to the Italian Regions and their technicians, which in turn will use them to guide farmers and other stakeholders in conservation strategies through common, standardized and shared methodologies (Fig. 4).

Each book is scientifically rigorous, but at the same time easy to read and clearly outlining all actions that an operator must carry out to achieve the conservation of biodiversity of agricultural interest.

Figure 3 – Collection of microorganisms in laboratory (Photo A. Benedetti)

The manuals provide a framework for scientific and technical reference, consistent with both national and international principles, and with the specific objective of promoting, in the case of plant genetic resources for food and agriculture, the implementation by Italian Regions of the International Treaty on Plant Genetic Resources for Food and Agriculture (Law of ratification of the International Treaty n. 01/2004).

The chapters developed in each manual include:

- brief introduction to the concept of species / variety / breed in reference to the field in question and the definition of agro-biodiversity as accurate as possible;
- the definition of risk of genetic erosion;
- a glossary;
- the identification of protocols for characterization and conservation, with the indications of the various operational phases for each specific sector (animal, microbial and plant);
- some characterization studies for the protection and exploitation of typical local species;
- the referenced bibliography.

The concept of the Local Variety adopted

Although different definitions of local variety already existed in the Guidelines for the proper *in situ, on farm* and *ex situ* conservation of plant varieties, the WGAB adopted the following: "A variety or local crop that reproduces by seed or by vegetative process is a variable population, which is identifiable and usually has a local name. It lacks "formal" genetic improvement and is characterized by specific adaptation to the environmental conditions of the area of cultivation (tolerant to the biotic and the abiotic stresses of that area) and is closely associated with the traditional use, knowledge, habits, dialects and celebrations of the people who developed and continue to grow it. " (Lorenzetti and Negri, 2009)

Figure 4 - Technical visit of the cereal's field within the initiatives of the participatory plant breeding promoted by the SOLIBAM EU-project (www.solibam.eu) (Photo O. Porfiri)

The adoption of the definition was reached after a constructive and interesting discussion held among the members of the WGBA. It endorses the concept that the conservation of local varieties can happen only in bio-territories with agronomic techniques dictated by local rural tradition, in very close relationship and mutual dependence among those who conserve ex situ (in gene banks) and those who protect and promote conservation on farm (farmers / breeders / keepers) (Fig. 5).

They are not necessarily maintained under “traditional farming systems”, but are “maintained because of tradition”, especially related to food. However, most of them, especially garden and neglected crops, are highly threatened because they are cultivated primarily by aging farmers (Negri, 2003; Galluzzi *et al.*, 2010).

The possibility of recovery and reintroduction of a traditionally recognized local variety in its bio-territory is closely related to the enhancement of production by the same farmers / livestock keepers. Financial support from the local government agencies would encourage present and future efforts of farmers towards cultivation and conservation of local varieties at risk of extinction, which are generally not valued within the current commercial circuits.

Figure 5: The calloused hands of elderly farmers in the region Umbria, careful guardians of a precious landrace of cowpea (the “fagiolina” of Lake Trasimeno) (Photo O. Porfiri)

A Summary of the Italian Guidelines for Conservation of Plant Genetic Resources for Food and Agriculture that was submitted by the Italian Government to the International Treaty for the implementation of Article 6, is downloadable from:
http://www.planttreaty.org/sites/default/files/Submission_Italy.pdf.

Conclusion

The WGAB has attempted to "typify" the various possible contexts as well as to describe the implementation of the various interventions adopted. This is achieved by referring to issues that were previously addressed and were positively concluded. Various "typologies" have been proposed, each highlighting the respective strengths and opportunities, as well as their weaknesses and potential threats. Some of the known actions for each "typology" have been reported and specific case studies were then explained in detail and outlined as examples (http://www.reterurale.it/).

How to conserve and characterize local genetic resources for food and agriculture is now clearer than before. Through the use of the Guidelines will be possible to support the farmers as custodians of the biodiversity in agriculture as well. Yet, the Guidelines should represent a valid tool to demonstrate whether a local variety is at risk of genetic erosion or not. (Marino *et al., 2012)*

In that case the measures foreseen in the next European Union **Rural Development”s Programme** 2014 to 2020, might be used to conserve the biodiversity acknowledging to the farmers the role of custodians and their key role to maintain the agro biodiversity and to feed the present and future generations as tangible support and a pivotal role (Marino, Bravi, Porfiri 2012). These policies would narrow the gap between tradition and modernity, avoiding interruptions and using agricultural diversity as an incremental factor for local development. In this regard the conservation of PGRFA is the key to guarantee food security. Conservation, characterization and use will promote a system of safeguarding aiming to guarantee interaction and complementarities between *ex situ* and *on farm* strategies.

References

Galluzzi, G., Eyzaguirre, P., Negri, V. (2010) Home gardens: neglected hotspots of agro-biodiversity and cultural diversity. Biodiversity and Conservation 19: 3635-3654.

Lorenzetti, F., Negri, V. (2009) The European seed legislation on conservation varieties. In: (Vetelainen, M., Negri, V., and Maxted, N. eds) “European landraces: On-farm Conservation, Management and Use”. Bioversity Technical Bullettin No 15, Bioversity International publ., Rome, Italy, pp 287-295

Marino, M. *et al. (2012)* Linee guida per la conservazione e la caratterizzazione della biodiversità vegetale, animale e microbica di interesse per l'agricoltura http://www.reterurale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/9580

Marino, M., Bravi, R., Porfiri, O. (2012) Linee guida per la conservazione e la caratterizzazione della biodiversità vegetale di interesse per l’agricoltura. Dal Seme 4, 32-40.

Negri, V. (2003) Landraces in central Italy: Where and why they are conserved and perspectives for their on-farm conservation. Genetic Resources and Crop Evolution 50 (8):871-885.

About the Law of the Azerbaijan Republic on "Protection and Sustainable Utilization of Crop Genetic Resources"

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The National Parliament (Milli Mejlis) of the Republic of Azerbaijan adopted the Law on “Protection and Sustainable Utilization of Crop Genetic Resources” on December 13, 2011 that provides legal regulation on all issues related to protection and sustainable utilization of crops of Azerbaijan.

In 2012, the President of the Republic of Azerbaijan signed 2 Decrees related to application of the Law. In order to ensure the fulfillment of the decrees, 2 orders and 2 decisions were adopted by the Cabinet of Ministers. In Decision dated 13 November, 2012 the Genetic Resources Institute (AGRI) was declared the National Coordinating Institute and its GeneBank declared the National GeneBank of Azerbaijan. The National GeneBank was given special protected area status.

In order to implement proper management of plant genetic resources in the country and to carry out the coordinating functions of the AGRI, it was decided to establish the Scientific-Technical Committee (STC) (Steering Committee) on Crop Genetic Resources of Azerbaijan.

According to the decision, the National Academy of Sciences, The Ministry of Agriculture, The Ministry of Ecology and Natural Resources and The Committee on Standardization, Metrology and Patents of Azerbaijan Republic should be represented in STC. Also, by the decision of the Cabinet of Ministers, a numbers of rules (Rule on Establishing and Registration of National Collections, Rule on Import and Export of PGR, Rule on Landraces, Rule on Genetically Modified Plants and etc.) and regulations (Regulation of the National Gene Bank, Regulation of the STC, Regulation of specialized expert councils, Regulation of working groups on priority activities and etc.) were adopted.

A monitoring mechanism for the fulfillment of the Law was also developed. In this process, the main executive functions will be carried out: on crops - by the Ministry of Agriculture, on wild diversity - by the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan; both organizations will work together with Azerbaijan National Academy of Sciences. AGRI will play a key role in all these activities.

During the first months of 2013, the STC was formed and the first meeting was held on 22 February 2013. Specialized expert councils and working groups on priority activities were established and approved. The STC, the expert councils and the working groups are of officials, scientists and specialists from various ministries, boards and scientific-research institutions.

According to the instruction of the President of the Republic, the creation of the State Program (National Program) on crop genetic resources is being continued.

The national network on PGR, National Information Sharing Mechanism and its database as well as Central Data Base on PGR play an important role in the fulfillment of all these activities.

1: *Punica granatum* L.
2: *Amygdalus communis* L.
3: *Olea europaea* L.
4: *Ficus* carica L.
5: *Vitis vinifera* L. ssp. *sativa* D.C.
6 a: *Pistacia vera* L. (plant)
6 b: *Pistacia vera* L. (fruits)

Regional Laws Protect Genetic Resources in Italy

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Many landraces (LRs) are still maintained on farm in Italy because of better quality than commercial varieties, better performance (yield /persistence) under harsh pedoclimatic conditions, traditional reasons such as particular traits appreciated by the farmer family and ritual or religious use. (Negri 2003).
Extant LR belong both to all the main crop species and to neglected and underutilized species. They are not maintained under 'traditional farming systems', but 'maintained because of traditions' especially those related to food. Most of them, especially garden and neglected crops, are highly threatened because cultivated by aged farmers (Negri 2003; Polegri and Negri 2010; Galluzzi et al. 2010).
Italy was the first country in Europe to protect Genetic Resources (GR) and LRs with several National (n. 212/2001, setting a section for conservation varieties in the National Register of varieties, n. 101/2004 adopting the International Treaty, n. 46/2007 defining 'conservation varieties and terms of seed commercialisation) Laws.
However, the Italian legislative frame assigns to the Italian Regions the responsibility for plant genetic resources (PGR) conservation and several Regional Laws exist (**Fig. 1**) that are clearly aimed at protecting the local agrobiodiversity, with the declared following goals:

- to reduce the "genetic erosion threat" of local (eg. autochthonous) GR, to promote GR *in situ*/on farm conservation;
- to develop an economic interest for food products from local GR;
- to enhance information and information exchange on local GR.

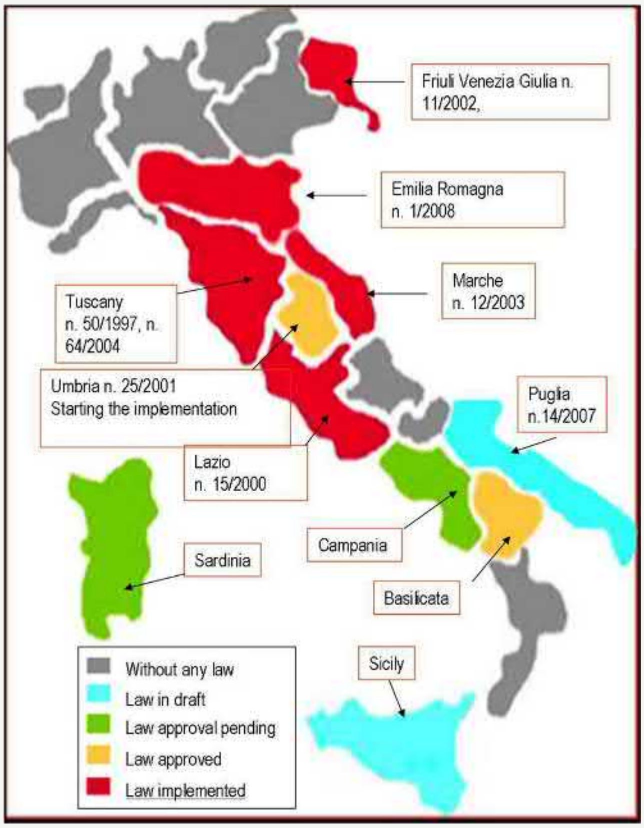

Figure 1. The Italian Regional legislative frames promote the agrobiodiversity in situ/on farm conservation

The Italian Regional Laws are quite similar each other, referring to The Lazio Regional Law n. 15 (March 1st 2000) "Protection of autochtonous genetic resources of agricultural interest", as an example (see also Costanza *et al.* 2011), its main points are Article 1 and Article 5.
Article 1 of the law states what is protected: "… autochthonous plant and animal genetic resources, including wild plants, such as species, races, varieties, populations, cultivars, ecotypes, and clones for which there is an economic, scientific, environmental, or cultural interest, threatened by genetic erosion." Where with autochthonous it is to be intended GR 'of Lazio origin or introduced and integrated into the Lazio agro ecosystem since the past 50 years'.
Among them also those that disappeared from the Region but have been maintained in botanical gardens, public or private Institutions of other regions or countries are included.

In the context of the farmer right acknowledgments, this law clearly states that "… the heritage and ownership of the genetic resources belongs to the indigenous local communities, within which the benefits must be distributed equally..." (Art. 5 ownership of genetic resources).
The law is implemented by The Lazio Regional Agency for the Development and Innovation in Agriculture (ARSIAL) with funding coming from the European Agricultural Fund for Rural Development (EAFRD, EC 1698/2005 1974/2006 Regulations) through the Lazio Rural Development Plan.
The implementation foresees several subsequent phases (Figure 2, see also Costanza *et al.* 2011):

- in an initial phase the GR is inventoried (the GR is signaled, its real existence checked by field inspections, data on the GR in the field are collected cross checking them with eventually present bibliographic records);
- in a second phase the GR is characterised for morpho-phenological traits and, eventually, also for genetic traits by using molecular markers;
- on the base of the information gathered in the previous phases, the GR identity, autoctony and threat is assessed by a scientific commission;
- only after this assessment a certain GR can be registered into the Regional Voluntary GR Register and enters into the foreseen protection scheme.

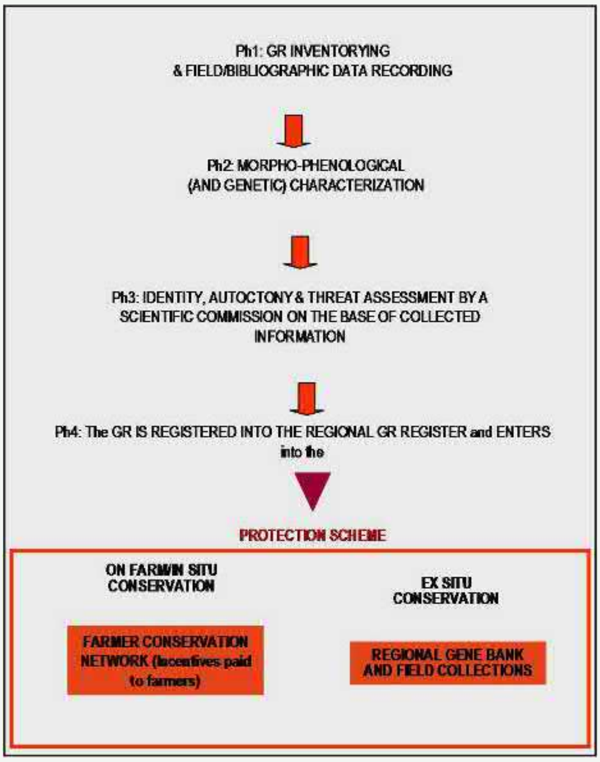

Figure 2: Lazio Regional Law n. 15 (March 1st 2000) implementation phases

Overall, it appears that the Italian Regional law frames may facilitate: the compilation of National Inventories based on the Regional inventories, which are the needed informative base for any conservation action, further registrations into the European Conservation Variety Register, wider commercialisation of seed of (some) LRs and, consequently, a wider on farm/in situ conservation.

ARSIAL has taken care of several publications aimed at disseseminating contents of the Law and its implementation results.

The Regional Voluntary Registers is an official repertory of the Lazio Region and includes one Plant and one Animal Section (see http://www.arsial.it/portalearsial/RegistroVolontarioRegionale/Default.htm).

The protection scheme is realized as *in situ* conservation by a Farmer Conservation and Safety Network and as *ex situ* conservation by ARSIAL, which collects and store propagation material in its genebank and field collections.

Members of the Farmer Conservation and Safety Network can be public and private Institutions, 'associations of interest' and single or associated farmers; the conservation activity of the network is coordinated by ARSIAL. Through the network the GR is cultivated across years in the area where it was initially found, but an enlargement of GR cultivation area through seed increase and seed exchange among local farmers is also foreseen.

The network enrolled 255 farmers in 2011 (Costanza *et al.* 2012). To maintain the GR on the farm these farmer receive monetary incentives which were established on the base of the type cultivated crop (i.e. for cereals 250-300 while for vegetables 500-600 euro/ha are paid).

Protected PGR listed in the Lazio Region Register included 172 plant LRs in 2011 (138 tree belonging to 13 different species and 34 herbaceous crops belonging to 14 species, Costanza et al 2012), Figure 3.

REFERENCES

Costanza, M.T., Barbagiovanni Miracolo, I., Taviani, P., Paoletti, S., Rea, R., Lelli, L., Garzia, J.H., Porfiri, O., Nardi, P., Tanca M. (2012) On-farm conservation of plant genetic resources in Lazio Region - Italy. Implementation of the Regional Act 1st March 2000 n.15. In: Maxted, N., Dulloo, M.E., Ford-Lloyd, B.V., Frese, L., Iriondo, J.M. and Pinheiro de Carvalho, M.A.A. (eds). Agrobiodiversity Conservation: Securing the Diversity of Crop Wild Relatives and Landraces. CAB International, Wallingford, UK. pp 118-124 . ISBN-13: 978 1 84593 851 2.

Galluzzi G., Eyzaguirre P., Negri V. (2010) Home gardens: neglected hotspots of agro-biodiversity and cultural diversity. Biodiversity and Conservation 19: 3635-3654, DOI 10.1007/s10531-010-9919-5.

Negri V. (2003) Landraces in central Italy: Where and why they are conserved and perspectives for their on farm conservation. Genetic Resources and Crop Evolution 50 (8): 871-885.

Negri V., Barocco R., Pacicco L., Veronesi F., Venanzoni R. (2011) Landraces in Europe: An Approach towards Identifying Landrace-Rich Areas as a Priority for Protection. In: (Maxted N. et al. eds.) Proc. Symposium: Towards the establishment of genetic reserves for crop wild relative conservation and landraces in Europe. University of Madeira, Funchal, Portugal, 13th- 17th September 2010.

Polegri L., Negri V. (2010) Molecular markers for promoting agro-biodiversity conservation: a case study from Italy. How cowpea landraces were saved from extinction. Genetic Res Crop Evol. 57: 867-880 DOI: 10.1007/s10722-009-9526-z.

Figure 3: "Fagiolo a Pisello" *Phaseolus vulgaris* L., grown in Colle di Tora, RI (Italy)

Progress toward an Italian conservation strategy for extant LR: the first Italian official inventory of LR

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Landrace diversity is threatened in all European countries (as well as in the entire world) (Negri et *al.*, 2009). Those countries that, like Italy, are signatories of both the Convention on Biological Diversity (CBD) and the International Treaty have an obligation and responsibility for landrace conservation. However, total landrace species, their number and location were unknown in Italy up to now, like in most countries of the world, while this basic information is needed to set any conservation action.

Within the “PGR Secure project” (www.pgrsecure.org), which aims to develop conservation strategies for European crop wild relative and landrace diversity and to enhance their use as a means of underpinning European food security in the face of climate change, the Department of Applied Biology has compiled “The First Italian Inventory of *In Situ* Maintained Landraces” (Negri *et al.* 2013). The Inventory includes all of the landraces that have been recorded by the Italian Regions and Autonomous Provinces across the last two decades and reports data available in January 2013.

It is structured on the basis of “Descriptors for Web-Enabled National *In Situ* Landrace Inventories” (Negri et *al.*, 2012) and includes, for each landrace, the scientific name of the crop, the local name, the accessions recorded, the geographic coordinates and altitude of the site where each accession is maintained *in situ* and other information. On the basis of the collected data, in order to analyse the density and the distribution of the landrace cultivation areas, the inventoried landraces were mapped by using an orthophoto map and GIS program. 4806 accessions belonging to 2365 landraces were inventoried in the entire country territory. 329 species are cultivated as landraces; among them fruit trees, vegetables, grain legumes, forage crops, cereals, ornamental plants and other species are included. The highest landrace numbers were recorded in Umbria (378), Calabria (288), Sicily (251), Basilicata (212) and Campania (203) (Fig. 1). These Italian Regions accounted for more of 50% of total recorded landraces. The landraces most frequently found are fruit trees (73%), grain legumes (12%) and vegetables (9%) (Fig. 2).

The First Italian Inventory of *In Situ* Maintained Landraces can support the development of landrace conservation activities in Italy in the following ways.

If a holistic approach to *in situ* conservation is to be used, the inventory data can be used to identify the ‘Most Appropriate Areas’ (MAA), i.e. the areas that have the highest landrace density, diversity of the territory and that also include protected areas. These areas can be proposed to the National or Regional Authorities as areas where to set up or enhance political and economic actions in favour of priority landraces and agro-biodiversity conservation (Negri et *al.*, 2009; 2011). If a conservation approach only focused on single landraces is to be used, the inventory data can be used to implement specific conservation strategies for them.

The Inventory can facilitate the registration of landraces in the European Common Catalogue of varieties as ‘conservation varieties’, which was recently suggested as a means to promote landrace *in situ* conservation (Spataro and Negri, 2013). It can also facilitate a gap analysis process aimed at identifying those LR that have not been collected yet and need to be preserved in ex situ collections.

Acknowledgments: Thanks are due to all the Italian Regions and Autonomous Provinces and to all the Officers that contributed to the compilation of the Inventory.

References

Negri, V., Barocco, R., Pacicco, L., Veronesi, F., Venanzoni, R. (2012) An Approach Towards Prioritising Landrace Rich Areas as A Priority For Protection. In Europe. In: Maxted, N., Dulloo, M.E., Ford-Lloyd, B.V., Frese, L., Iriondo, J.M. and Pinheiro de Carvalho, M.A.A. (eds). Agrobiodiversity Conservation: Securing the Diversity of Crop Wild Relatives and Landraces. CAB International, Wallingford, UK. pp 118-124. ISBN-13: 978 1 84593 851 2

Negri, V., Maxted, N., Torricelli, R., Heinonen, M., Vetelainen, M., Dias, S. (2012) Descriptors For Web-Enabled National In Situ Landrace Inventories. Pp 18 ISBN 978 88 87652 27 7 (also available at: www.pgrsecure.bham.ac.uk/sites/default/files/documents/helpdesk/LRDESCRIPTORS_PGRSECURE.pdf)

Negri, V., Pacicco, L., Bodesmo, M., Torricelli, R. (2013) The first Italian inventory of in situ maintained landraces. On CD ROM. ISBN 978-88-6074-279-7. Morlacchi Editrice, Perugia

Spataro, G., Negri, V. (2013 online) The European seed legislation on conservation varieties: focus, implementation, present and future impact on landrace on farm conservation. Genetic Resources and Crop Evolution doi:10.1007/s10722-013-0009-x

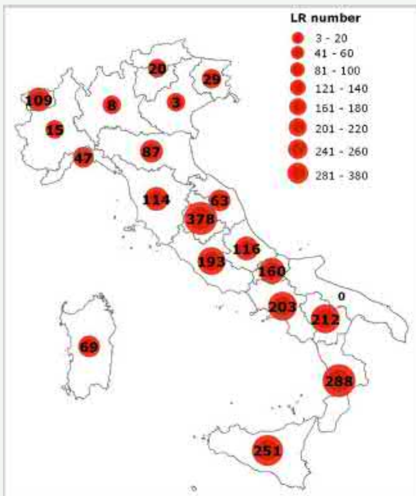

Figure 1 – Landrace number by Region.

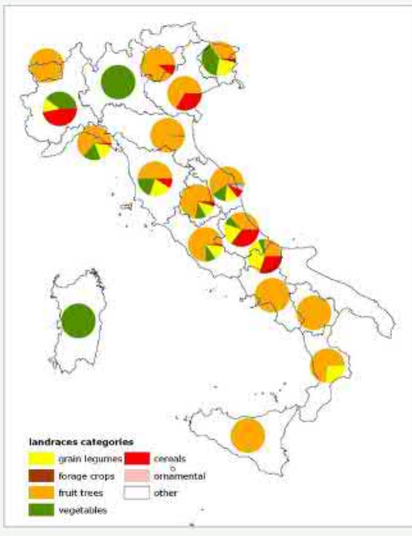

Figure 2 – Landrace crop type by Region.

Niche products from a hulless landrace barley

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[2]Central Karelia Development Company KETI Ltd.

Landrace cereals are today cultivated very small amounts in Finland. However consumers are growingly interested in foods with local and historic origin.

Marketing landrace crops, which volume is small - usually scale of home consumption - is very challenging to a farmer. Recently it has been considered the ways to increase the profitability of local and small food companies and family farms in the area of the Eastern Finland. During the project time 2010-2012 three new niche product families were developed, one of them is based on crops of a landrace barley called 'Jorma'.

Hulless landrace barley

One organic farm has cultivated the hulless barley 'Jorma' over 50 years and it is the only hulless barley still in cultivation in Finland. This particular hulless barley originates at least from the 17th century. Over 400 years old seed samples studied by MTT Agrifood Reseach Finland are the same type than 'Jorma'.

'Jorma' is named by the first name of a seed saler who received a small amount of hulless barley, selected seeds, and released it as a commercial variety in 1970s. Nowadays 'Jorma' barley is registered as a landrace following EU regulations allowing seed production.

The amount of flower and other milling output are significantly plentiful compared to barley with hulls. According to the dietary mineral and protein analysis by MTT Agrifood Research Finland 'Jorma' contains more protein, starch and beta-glucan than a barley with hulls. These nutrition qualities have balancing effects to cholesterol and blood sugar.

Promotion events and networking

The interesting origin and tested good nutrition qualities are not enough to raise the product to the grocery shelves and to a consumer's shopping basket. A novel raw material or product need to be introduced to consumers and food processors, and made them convinced about its' quality. The farmer family itself has been introducing different kind of 'Jorma' bakings in local groceries and institutional kitchens, like hospital kitchens.

The developing project of the niche foodstuff has also arranged meetings with barley processors like local mills and bakeries. These companies and the family farm have designed and carried out the 'Jorma' product family which includes different groats, flakes and flowers, pies (especially the traditional Karelian pie), unleavened barley bread and modern vegetarian sausages. 'Jorma' products are also included to the menu of a local restaurant.

'Jorma' barley is nowadays well-known and wanted in the local market. The challenge is to create a distribution network large enough and have more wide scale marketing to reach more consumers.

Figure 1 – A small local bakery bakes 'Jorma' cookies, Karelian pies and flatbread. Photo by Jorma Riikonen

Figure 2 – The old farmer Kalervo Laitinen and the 'Jorma' shootinthe flowerpot to analyse its germination in the spring before sowing time. Photo by Maarit Heinonen

Inventory of Landraces of Lemnos, a North Aegean Greek island[1]

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Introduction

The great value of agricultural biodiversity is becoming clearer to the scientific community as the need to feed the global population is becoming more urgent. Landraces (local populations, traditional cultivars or heirloom varieties) are a significant part of agricultural biodiversity. Landraces are heterogeneous, genetically rich, dynamic populations (Terzopoulos and Bebeli, 2010). They have evolved under both natural and farmers' selection and they have been subjected to selection pressures for hardiness and local adaptability (Newton *et al*. 2010). Landraces should not be considered simply as a museum exhibit, but as an important factor in the life of local communities, as well as in modern agriculture. There are many regions in the world where landraces are still in use and their products are considered valuable. Moreover, landraces possess desirable traits which can be utilized in plant breeding.

Materials and Methods

Information about the agricultural diversity of Lemnos Island was collected from three sources. Firstly, databases of individual genebanks worldwide, especially of the Greek Gene Bank, and the online plant genetic resources portals EURISCO and SINGER were searched for germplasm collected from Lemnos. Secondly, two collecting expeditions were conducted by the authors in the island, a smaller one in 2009 and a larger one in 2010. A new collection of landraces was established, and plenty of useful information – e.g. on agricultural practices, the material collected, landraces considered lost, fruit trees and vineyards – was gathered from the locals. Lastly, additional information was extracted from bibliographic references, as well as from IBPGR-supported expedition reports that included Lemnos.

Results and Discussion

Current and past expeditions on Lemnos Island

Two major explorations (in 1983 and 2006) have been organized on Lemnos by the Greek Gene Bank, in which 49 and 53 accessions (incl. crop wild relatives) were gathered, respectively. The two collections of the authors comprised 34 and 142 accessions (including 30 which were send to P.J. Bebeli and R. Thanopoulos later that year), from seven and 27 villages respectively. It is concluded that the differences of collecting results of these expeditions have many reasons and Lemnos Island, despite genetic erosion, still maintains a wide diversity of landraces.

[1])An extended summary of the article by Thomas *et al.* (2012).

Landraces of Lemnos

The island of Lemnos was famous for its cereal cultivation, with wheat being the most important crop. Farmers recalled several landraces of wheat that are now considered lost, as well as the cultivar "Lemnos" or "Limnos" (**Fig. 1**) bred during the 1920s and 1930s using genetic material of the island (Papadakis 1937), which is often mistaken as landrace. Barley, maize and rye were also mentioned by the locals.

Agrobiodiversity of pulses still exists on Lemnos. Many villagers are cultivating cowpea in their gardens, but also rare pulses were collected such as lupins, Cyprus vetch, and grass pea. An interesting case is the rediscovery of bitter vetch (*Vicia ervilia* (L.) Willd.) (**Fig. 2**), a fodder crop that had been collected during the first expedition of the Greek genebank in 1983, but not in the subsequent ones until that of 2010, when it was found in three different villages.

Interesting diversity also exists in landraces of some vegetables such as tomatoes and watermelons, while an okra landrace was found to have more common traits with other Aegean landraces than with those of mainland Greece. Sesame was providing oil to the inhabitants in the past replacing oil-olive, but now is scarcely cultivated although its oil also possesses some important health properties. Nevertheless, six accessions were collected during the 2010 expedition.

Figure 1. Cultivar "Lemnos" in a small field near the village of Dafni

Figure 2. Bitter vetch cultivated near the village of Dafni

The island of Lemnos disposes two well-known local varieties of grapevine, namely "Lemnio" considered ancient and "Muscat of Alexandria" introduced during mid nineteenth century and very well adapted to the agroclimatic conditions of Lemnos. Plenty of other grapevine varieties seem to exist on the island and some are cultivated at a very small extent.

A relatively large biodiversity of fruit trees exists in the island. Landraces of almonds and plums have been already collected and characterized by other researchers (Hatziharissis *et al.* 1986). The locals mentioned also pears, apricots, peaches, pomegranate and fig trees. Germplasm of fruit trees and grapevines needs further investigation mainly on whether it is of local origin or whether it was introduced in the past either as landrace or cultivar.

In conclusion, Lemnos Island, despite the large genetic erosion, especially in cereals and more recently also in pulses and vegetables, still possesses a significant wealth of landraces. The majority of farmers and locals are willing to help and contribute to the reintroduction of at least some landraces that are vital for the local economy, but also to participate in the *in situ* conservation of some others. The role of genebanks and universities is also vital for the *ex situ* conservation and the characterization of landraces. Lemnos has always been an agricultural place (**Fig. 3-5**). Its agricultural legacy in conjunction with the high natural biodiversity reserves could contribute to its transformation into a model agriculturally and agro-touristically sustainable island.

Figure 3. Agricultural landscape just outside the village of Varos

Figure 4. Cultivated field outside town of Moudros

Figure 5. Home garden in the village of Plaka

References

Hatziharissis, I., Tsipouridis, K., Rouskas, D., Almaliotis, D. and Stylianidis, D. (1986) Exploration and collection of *Prunus* germplasm in Greece during 1986. *International Board for Plant Genetic Resources*, Rome, Report AGPE/IBPGR 86/186, pp 19 (Unpublished)

Newton, A.C., Akar, T., Baresel, J.P., Bettencourt, E., Bladenopoulos, K.V., Czembor, J.H., Fasoula, D.A., Katsiotis, A., Koutis, K., Koutsika-Sotiriou, M., Carvalho, M.A.A., Rubiales, D., Russell, J., Dos Santos, T.M.M. and Vaz Patto, M.C. (2010) *Agronomy for Sustainable Development* 30:237–269 (doi: 10.1051/agro/2009032)

Papadakis, J.S. (1937) Les blés Eretria, Mykine, Agamemnon, Minos, G-3130, Xylokastro, Limnos, Argos, G-8557, Rieti N° 11. *Bull Sci Inst Amélior Plantes à Thessaloniki* N° 28, Thessaloniki (in Greek and French) pp 60

Terzopoulos, P.J. and Bebeli, P.J. (2010) Phenotypic diversity in Greek tomato (*Solanum lycopersicum* L.) landraces. *Scientia Horticulturae* 126 (2): 138-144

Thomas, K., Thanopoulos, R., Knüpffer, H. and Bebeli, P. J. (2012) Plant genetic resources of Lemnos (Greece), an isolated island in the Northern Aegean Sea, with emphasis on landraces. *Genet Resour Crop Evol* 59:1417–1440.

Diversity of cowpea landraces growing in Bulgaria

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Abstract

Cowpea is a warm-adapted crop which is grown and cultivated in all over the world. Collecting and preserving cowpea landraces are important sources of genetic variability for breeding purpose. The aim of the present study was to performed agronomic and morphological characterization of a small collection of cowpea landraces. Higher-yielding, earlier-maturing plants, producing bigger seeds were established as a result of field evaluation of fifteen *V. unguiculata* (L.) landraces. This preliminary investigation could be the first step towards more efficient germplasm management in order to use and preserve old varieties and populations as a source of new variation for the genetic improvement.

Introduction

Cowpea [Vigna unguiculata(L.)Walp.] a main and cheap protein source in Africa, where is one of the important legume food crops. Cowpea originate from Southern Africa (Padulosi *et al*. 1990), and according to different authors is with different number of species – 184 (Philips, 1951), between 170 and 150 (Summerfield and Roberts, 1985), 150 (Verdcourt, 1970), as well as more of them have local origin.

Cowpea is a warm-adapted crop which is grown and cultivated in all over the world. Outside Africa, the main producing areas are in Central and South America and in Asia, with several smaller areas spread over southern Europe, southern USA, and Oceania. (Quin, 1997). In Bulgaria there is not an exact record where and when cowpea was introduced and cultivated.

The cowpea is an ancient crop, might be introduced in our country from the Greeks around XVI century (Koinov, 1973). Now days cowpea is a minor crop and it is still grown in the southeastern part of the country (Dimitrovgrad, Harmanly, Lubimets) (Fig.1), although it has been cultivated for several hundred years in Bulgaria. This crop is grown mainly in home gardens. *On farm* and *in garden* species conservation is closely connected with the direct use by farmers for food or sale in local market. Crops landraces populations have survived centuries of selection for reliable production in subsistence agriculture, yielding a definite, known but probably limited benefit to the farmers that grow them (Frankel, Brown and Burdon, 1995). Landraces of cowpea are maintained and preserved mainly from old people as well as most of landraces of other crops (Negri *et al.* 2000; Negri, 2006).

Collecting and preserving cowpea landraces are important sources of genetic variability for breeding purpose. The purpose of the present study was to performed agronomic and morphological characterization in order to establish the potential capacities for growing cowpea under the climatic conditions of our country.

Material and Methods

The landraces studied in this work were collected from three regions of southeastern areas of Bulgaria during 2009 year (Fig.1) The accessions included in this study belong to cultivar group (cv.-gr.) *unguiculata* (common cowpea). The trial was set in the experimental field of the Institute of Plant Genetic Resources (IPGR), Sadovo. The accessions were sown manually in two replications with 5.6 m^2 of each plot.

The evaluation data were recorded according to the Descriptors of cowpea (IBPGR, 1983). The main characteristics evaluated were: days to flowering (DFL), days to maturity (DMAT), plant height (PH), pod length, pod width, pod thickness, number of seeds per pod (ns/s/pod), number of pods per plant (ns pod/pl), weight of pods per plant (w/pods/pl), number of seeds per plant (ns/s/pl), seed length (s/length), seed width (s/width), seed thickness (s/thick), weight of seeds per plant (w/s/pl), weight of 100 seeds (W 100s) The phonological observations were performed on all plants of each plot during the vegetation cycle. The statistical analysis was performed according to Genchev and Marinkov (1975).

Results and Discussions

Fifteenth accessions – landraces of *V. unguiculata* (L.) were sown and characterized in a period of two years, 2010-2011. The passport data and more information for cowpea landraces is available through the Internet address: http://www.genbank.at/en/ecpgr-vigna/. The climatic factors during vegetation period [av. monthly TºC and sum of precipitations (mm)] are presented in Fig. 2. The av. TºC in some days could reach 30-34 C in June and July when usually flowering and fill podding stages are raising while for other legumes (lentils, common beans) this temperature cause flower and pod abortion. Cowpea yield production is more stable and is much better compared with legume crops, mentioned above.

The earliest flowering plants need 39 days for starting this phase. The mean period for beginning of flowering stage is 47.5 days for the landraces studied (Table 1). The length of complete vegetation period for the early maturing accessions is 80 days, while for the late maturing ones is up to 90 days with mean value 86 days. The minimum plant height is 53.4 cm and the maximum is 171 cm, with average height of 93.5 cm. Among the yield components only the number of seeds/pod present low values. The number of seeds/pod, number of pods/plant, weight of pods/plant and number of seeds /plant showed higher values of variation and CV (%) of the accessions studied (Table 1). The seed size is very important qualitative character concerning consumer's interest. Farmers and consumers like legumes with bigger seeds. The seed size according to the weight of 100 seeds weight is between 13.3 and 27.1 g with mean value 18.8 g. The accessions with bigger seeds size are: A8E0492 (27.1 g), 2005-01 (26.4 g), A4E007 (25.6 g).

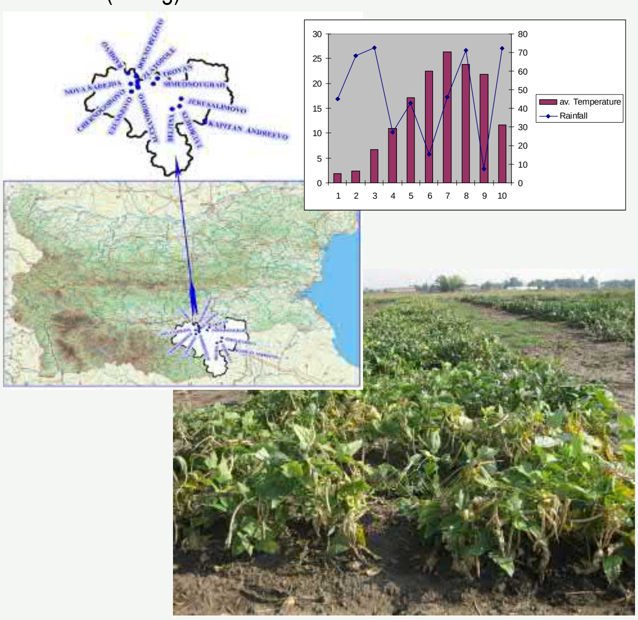

Table 1- Morphological characters observed for 15 cowpea landraces in 2010-2011

Characters	Min.	Max.	Range	Mean	CV %
DFL (days)	39	58	19	47.5	12.02
DMAT (days)	80	90	10	86	3.03
pl.height (cm)	53.4	171	117.6	93.5	36.58
pod length (cm)	10.2	16.2	6	14.4	10.20
pod width (cm)	0.7	1	0.3	0.8	11.30
pod tickn. (cm)	0.5	0.7	0.2	0.6	11.85
ns/s/pod	7.8	21.4	13.6	11.4	27.36
ns pod/pl	11.6	31	19.4	18.3	34.46
w/pods/pl (g)	10.5	40.3	29.8	20.96	42.72
ns/s/pl	67.6	179.2	111.6	116.4	33.03
s/ length	0.8	1.2	0.4	1	13.50
s/width	0.6	0.8	0.2	0.7	10.88
s/thickness	0.5	0.7	0.2	0.6	12.78
w/s/pl (g)	7.6	29.3	21.7	16	38.51
w 100s (g)	13.3	27.1	13.8	18.8	24.94

Table 2 - Yield production of each cowpea accession in 2010-2011

acc.No	kg/da	diff. St	% St	significant
St.1	157.45	0	100.00	
A7E0735	149.5	-7.95	94.95	ns
2005-01	128.6	-28.85	81.68	**
A8E0492	54.97	-102.48	34.91	***
A8E0523	139.85	-17.6	88.82	*
A8E0542	133.05	-24.4	84.50	**
A8E0551	141.3	-16.15	89.74	ns
A8E0554	48.95	-108.5	31.09	***
A8E0562	86.15	-71.3	54.72	***
A8E0563	142.5	-14.95	90.50	ns
BOE07	77.95	-79.5	49.51	***
BOE08	90.55	-66.9	57.51	***
A4E007	137.9	-19.55	87.58	*
A4E008	143.05	-14.4	90.85	ns
A9E1073	90	-67.45	57.16	***
GD 5 %	16.69***			
1 %	22.47**			
0.1 %	29.88*			

The yield production is presented in Table 2. The accessions with cat. No A7E0735, A8E0551, A8E0563, A4E008 showed non significant differences and stay in one group with St. 1. The accessions with cat. No A8E0523 and A4E007 showed proved differences comparing with St. 1. The rest accession numbers showed lower yield production.

Conclusions

Higher-yielding, earlier-maturing plants, producing bigger seeds were established as a result of field evaluation of fifteen *V. unguiculata* (L.) landraces as follows:

- St. 1, A7E0735, A8E0551, A8E0563, A4E008 yielded between 141,3 kg/da (1413 kg/ha) and 157,45 kg/da (1574,5kg/ha)
- St.1, 2005-01, A7E0735, A4E008 need between 39-42 days to start flowering stage and less than mean value 86 days for maturation.
- A8E0492, A4E007, 2005-01 produced bigger seeds (between 25.6 and 27.1g, weight of 100 seeds)

This study showed higher diversity for 15 quantitative characters of cowpea landraces. This preliminary investigation could be the first step towards more efficient germplasm management in order to use and preserve old varieties and populations as a source of new variation for the genetic improvement of economically important characters such as pods/plant; seeds/plant; seed size, seed yield. The availability of genetic variation could be used in future cowpea breeding programme.

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References

Frankel, F. A., Brown, D., H., A., and Burdon, J.J. (eds) (1995). In: The conservation of Plant Biodiversity. Ed. By Cambridge University Press. pp. 56-74.

Genchev, G., Marinkov, E. Yovcheva, F., Ognyanova, A. (1975). Biometrical methods in agriculture. Genetics and breeding. Ed. By Zemizdat, Sofia.

IBPGR, (1983). Descriptors for cowpea. IBPGR, Rome.

Koinov, G. (1973). Common Beans in Bulgaria (Bg). Ed. By Bulgarian Academy of Sciences, Sofia.

Negri, V. (2006). Landrace Conservation Case Study 2. On-farm conservation of a common bean Italian Landraces: "Fagiolo a piselo", Report of the ECP/GR Network Coordinating Groups. First meeting, 29-31, March, Bonn, Germany.

Negri, V.Tosti, N., Falcinelli,M., Veronesi, F. (2000). Characterization of thirteen cowpea landraces from Umbria (Italy): strategy for their conservation and promotion. Genet. Resour.Crop Evol 47:141-146

Padulosi, S., Laghetti, G., Ng, Q. N., and Perrino, P. (1990). Collecting in Swaziland and Zimbabwe. FAO/IBPGR Plant Genetic Resources Newsletter 78/79: 38.

Philips, E.P. (1951). The genera of South African flowering plants. Government Printer, Pretoria, South Africa.

Quin, M. (1997). Advances in Cowpea Research, edited by B.B.Singh, D.R. Mohan Raj, K.E.Dashiell, and L.E.N. Jackai. Copublication of International Institute of Tropical Agriculture (IITA) and Japan International Research Center for Agricultural Sciences (JIRCAS).IITA, Ibadan, Nigeria.

Summerfield, R.J., and Roberts, H.E. (1985). Vigna unguiculata. Pages 171-184 in Handbook of flowering, Vol. I, edited by A.H.Halvey. CRC Press, Boca aton, FL, USA

Verdcourt, B. (1970). Studies in the Leguminosae-Papilionoideae for the flora of tropical East Africa. IV. Kew Bulletin 24: 507-569.

Orkney Bere Whisky – A Single Malt From A Scottish Landrace

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Introduction

In December 2012, Isle of Arran Distillers released a single malt Scotch whisky (Fig. 1) produced entirely from malted barley of Bere (Fig. 2), a Scottish landrace. Although Bere was commonly used by early Scottish distillers for making whisky, Arran's is one of very few which have been made exclusively from Bere since the 19th century and was produced in collaboration with the Agronomy Institute of the University of the Highlands and Islands (UHI), based at Orkney College UHI. It is hoped that the whisky's release will raise the profile of this ancient crop and increase demand for it, thereby providing income for growers and helping on-farm conservation of the crop. This article outlines the history of Bere, describes the development of the whisky and identifies some of the benefits which this has brought about.

Bere – a brief history

Bere is a 6-row, spring barley (*Hordeum vulgare* L.) which has been associated with the north of Britain for many hundreds of years. It has long straw (about 1.2 m to the base of the ear) which makes it very susceptible to lodging (falling over) and, while its straw yields are good, its grain yields are about half those of modern barley varieties. Nevertheless, historically, Bere was a very important Scottish crop which was particularly valuable in the cool, wet climate of the Highlands and Islands. Its main advantage in this area was its rapid growth in late spring and early ripening which usually allowed it to be harvested before the onset of early autumn storms. It was also tolerant of nutrient-poor soils and could be grown with few inputs.

Written descriptions of Bere date back to the 1500s, but its origins must go back much earlier than this. Although a Viking introduction (c. 800 AD) has been suggested (Jarman, 1996), it could also have developed from a much earlier introduction, as barley has been grown in Orkney since the Early Neolithic (4th millennium BC). For many hundreds of years, Bere and oats were the staple Scottish cereals. As grain or malt, Bere was often used as payment for land rent or other dues. Bere was also milled into Beremeal (Theobald *et al.*, 2006) which was used for making a range of food products, including bannocks (Fig. 3), a type of flat bread. Locally produced Beremeal and oatmeal were both very important in the north of Scotland before wheat flour became more accessible in the 1800s. Bere was also an important source of straw which was used for animal bedding, feed and thatch. A major additional attraction of Bere was that it could easily be made into malt and was widely used for the production of beer (Martin and Chang, 2007) and, later, whisky (Martin and Chang, 2008).
Although whisky was originally promoted for its medicinal properties, by the end of the 16th century it was already being widely consumed in Scotland as a social drink (Moss and Hume, 2000). Consumption expanded considerably over the next two centuries and resulted in the establishment of a cottage industry of farmer-distillers (Wishart, 2010) and, gradually, in the appearance of larger distilleries.

Figure 1. Single malt Orkney Bere whisky produced by Isle of Arran Distillers.

Figure 2. Ears of Bere close to harvest. Characteristically, Bere has very long awns which extend beyond the grain. These irritate the skin and can make the crop unpleasant to handle.

In the Highlands and Islands, where other types of barley did not grow well, the large number of small-scale stills provided local markets for surplus crops of Bere and allowed its conversion into a higher value end-product (Hay, 2012). Such was the wide-scale use of Bere for making whisky, that it was even celebrated by Robert Burns, Scotland's national bard, in one of his poems ("Scotch Drink").
The transition to larger scale, legal distilling after the 1820s probably resulted in a shift away from the use of Bere towards other types of barley as distilleries required larger quantities of grain than were available locally and were able to obtain this as a result of improved transportation links. Nevertheless, Bere probably continued to be of greater importance in the Highlands and Islands and, even in the 1840s, about 26% of the barley used by Campbeltown's 25 distilleries was Bere (New Statistical Accounts, 1843).

Figure 3. A Bere bannock (right), a traditional type of flat bread made from Beremeal.

As a result of its more isolated northern location, Orkney's Highland Park distillery was probably one of the last to continue to use Bere, and its barley books show that small quantities of local Bere were still being purchased annually until 1926.
The final purchase appears to have been in 1942, when barley from elsewhere was not available because of the war.
Like other old types of cereal, Bere was replaced in most parts of Scotland by new, higher yielding varieties during the 19th and 20th centuries. By the start of the 21st century, Bere was only being grown on a small scale by a few farmers in Orkney, Shetland and parts of the Western Isles (Scholten *et al.*, 2007). In Orkney, cultivation was mainly to supply grain for milling by Barony Mill, one of the last suppliers of Beremeal. In the Western Isles, Bere survived as part of a crop mix with two other landraces – rye (*Secale cereale* L.) and small oats (*Avena strigosa* Schreb.). This mix is grown on the sandy, mineral deficient soils of the coastal machair where traditional methods of growing this crop play an important role in conservation of this habitat (Scholten *et al*., 2009).

The Agronomy Institute and Bere
The Agronomy Institute opened in 2002 at Orkney College UHI as a research centre for promoting the development of new crops in the Highlands and Islands. Bere has always been one of the Institute's priorities because of its traditional links with the region and potential for commercialisation. Apart from providing income for growers and local companies, it was recognised that this would also help the on-farm conservation of this valuable genetic and heritage resource. The Institute obtained its initial stock of Bere seed from Barony Mill and this was then multiplied to provide seed for agronomy research trials and grain (Fig. 4) for new market development.

A twenty first century Bere whisky
The link between Bere and Scotland's early whisky industry made the concept of developing a niche distilling market for it very appealing. There were a number of challenges in doing this, however. In particular, there was scepticism in the whisky industry because Bere was not on the UK recommended list of malting barley varieties and most distilleries would not consider it because of its high grain nitrogen and small grain size which result in low alcohol yields. Other issues were the difficulties of processing small quantities of grain and the likely high cost because of the low grain yield of Bere, the expense of malting small quantities of grain and the low alcohol yield it was likely to produce.

By 2004, the Institute had a surplus crop of Bere and had identified Isle of Arran Distillers as an enthusiastic collaborator. After securing funding assistance from the Leader+ programme, a "proof of concept" project to use Bere for producing a specialist whisky was finally ready to proceed.

Bere whisky project
In August 2004, 19 t of Bere were sent to the Inverness plant of Bairds Malt Ltd for malting (Fig. 5). Bairds were surprised that it malted as well as it did, although with a grain nitrogen content of 1.9%, the malt was predicted to give a spirit yield of only about 351-354 l/t (compared with about 410 l/t for modern malting barley). The Bere malt was then sent to Isle of Arran's Lochranza distillery and distillation was successfully completed on 20 September without any serious problems.

The Distillery Manager was surprised at the quality of the new-make spirit and considered it very different on the nose to spirit from the modern variety Optic, which was also being used by the distillery at the time. Fresh American oak bourbon casks were used for the new-make spirit in order to provide the best opportunity for the character of the Bere to appear and the casks (Fig. 6) were then stored at Lochranza.

Figure 4. Harvesting Bere at Orkney College in 2003 for Arran's Orkney Bere whisky.

Figure 5. Bere grains with rootlets emerging during malting.

Figure 6. A newly filled cask of Bere whisky in the spirit warehouse at Lochranza.

With consensus that the whisky was maturing more quickly than normal Arran whisky, it was decided to release it, initially, as a limited edition (5,800 bottles) 8-year-old single malt. Although this is young, it is giving consumers an early opportunity to taste this historic whisky. The main characteristics identified by Arran in the whisky are its malty, herbal aroma, a taste of apples, oak and spice and a finish of malt mingling with spices. In preparing marketing information about the whisky, the historical importance of Bere as a traditional Scottish crop has been emphasised while both the bottle label and box use photographs from the Orkney Archives of growers of Bere from the early 1900s (Fig. 1). The initial market response to the whisky is encouraging as there has been a very strong demand for the product and a very favourable reaction from consumers. This is therefore confirming the commercial potential of the product.

Outcomes and benefits from the Bere whisky project

At the start of the project in 2004, it was demonstrated that Bere was suitable for malting and distilling, even under 21st century distillery conditions. As a result, other distilleries have become interested in Bere and in 2007 the Institute was asked to develop an Orkney supply chain for Bruichladdich Distillery and has supplied it with about 60 t of Orkney-grown Bere annually since then. The spirit from this grain is still maturing but will be used to produce a core product for the distillery. As a result of Bruichladdich's interest in Bere, the area of the crop grown annually in Orkney has now expanded from about 5 to 25 ha. This increased area has improved the on-farm conservation prospects of Bere in Orkney and this is further strengthened by a reserve stock of grain which is held by the Institute. Currently, therefore, commercialisation of Bere has been successful at helping to conserve it *in situ* and is resulting in income for growers and distilleries. It is clear, however, that specialist whisky production can result in much wider economic benefit than might initially be expected. Thus, income has also flowed to agricultural contractors, hauliers, maltsters, marketing and art and design companies, bottlers, wholesalers and retailers. This can make an important contribution to the sustainability of peripheral, rural areas. Whisky sold in the UK is also subject to duty (£26.81 per litre of pure alcohol) and value added tax (20%), making the Government another major beneficiary. Other benefits, although less quantifiable, accrue to the hospitality and tourism sector as whisky and distilleries are an important attraction for tourists visiting Scotland. For distilleries, the main advantages of specialist whiskies, like Orkney Bere, are: i) they can be sold at a higher price and possibly also at a younger age than mainstream whiskies; and, ii) they help distilleries to remain interesting and distinct which is important as the malt whisky market is becoming increasingly competitive.

Conclusions

The Bere whisky project has demonstrated "proof of concept", that this important Scottish landrace can be used to make a high-value niche market whisky which has been enthusiastically received by consumers. Furthermore, a number of benefits have been identified from the project, especially related to the wide range of financial beneficiaries in remoter parts of Scotland. The project has also shown that commercialisation can help the on-farm conservation of Bere and it is likely that similar projects could be developed with landraces in other areas to help their conservation. Success will be most likely, however, where landraces are used to develop high-value products.

References

Hay, R. (2012) Bere barley: rediscovering a Scottish staple. *Review of Scottish Culture* 24: 126-139.

Jarman, R.J. (1996) Bere barley – a living link with the 8th Century? *Plant Variety and Seeds* 9: 191-197.

Martin, P.J. and Chang, X., (2007). Bere and Beer. *The Brewer & Distiller International* 3: 29.

Martin, P.J. and Chang, X. (2008) Bere whisky – rediscovering the spirit of an old barley. *The Brewer & Distiller International* 4: 41-43.

Moss, M.S. and Hume, J.R. (2000). From Usquebaugh to whisky: to 1787. In: *The Making Of Scotch Whisky, A History of the Scotch Whisky Distilling Industry*. Canongate Books Ltd, Edinburgh. Pp 22-43.

New Statistical Accounts (1843) Parish of Campbelton, p 464 http://stat-acc-scot.edina.ac.uk/link/1834-45/Argyle/Campbelton/7/464/

Scholten, M., Maxted, N. and Ford-Lloyd, B. (2007) *UK National Inventory of Plant Genetic Resources for Food and Agriculture*, www.grfa.org.uk/media_files/publications_plant/pgrfa_full_report.doc (accessed 22 March 2007).

Scholten, M., Spoor, B., Green, N. (2009) Machair corn: management and conservation of a historical machair component. *The Glasgow Naturalist* 25: 63-71.

Theobald, H.E., Wishart, J.E., Martin, P.J., Buttriss, J.L. and French, J.H. (2006) The nutritional properties of flours derived from Orkney grown bere barley (*Hordeum vulgare* L.). *Nutrition Bulletin* 31: 8-14.

Wishart, D. (2010) The heritage of Scotch whisky. In: Allhoff, F and Adams, M.P. (eds.) *Whiskey & Philosophy*. John Wiley & Sons, New Jersey. Pp. 57-71.

On-farm management of seeds diversity in Benin: patterns, constraints and perspectives

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Background

Genetic resources for food and agriculture are the biological basis of world food security and directly or indirectly, support the livelihoods of over 2.5 billion people (FAO, 1998). Among the well known Plant Genetic Resources (PGR) are crop landraces undergoing rapid genetic depletion worldwide. Traditional landraces have evolved and adapted to the local farms for many generations. Their loss not only means a loss of biodiversity, but also an abrupt end to the evolutionary processes in the farming community. Fortunately, this situation is increasingly raising attention due in part to recent international agreements such as the Convention on Biological Diversity (CBD) and the work of the FAO Commission on Genetic Resources for Food and Agriculture. On-farm (*in situ*) conservation of landraces refers to plants or its wild relatives that are conserved in the very place where they developed their present-day characteristics. In the framework of the abovementioned Convention ratified by the Republic of Benin on June 30, 1994, a three-months study has been conducted nationwide in Benin. The purpose was to have insight into and document traditional knowledge and good practices of small scale farmers related to on-farm management of seed diversity. The study emphasizes the key-role of on-farm seed diversity in the agricultural production and the livelihood of rural population. It also stresses the need to establish a policy to enable sustainable management of traditional land races in Benin. The table 1 shows the major categories of crops and seeds

Overview on seeds diversity in Benine

From our investigations, five categories of seeds were found, namely: cereals seeds (rice, maize, sorghum, and millet) (Fig, 1 and Fig. 2), legume seeds (groundnuts, soya beans, beans) (Fig. 3), roots and tubers seeds (cassava, yams, sweet potatoes), vegetables (tomatoes, peppers, lettuces, onions (Fig. 4 and Fig. 5) and fruits seeds. Moreover, it has been reported that while part of them came from the formal certified seed sector, most was provided by informal seed networks thereby playing a key-role in the agricultural production and in the food security of populations. Yet, this diversity is subject to lack of database, pests damages, lack of research on on-farm crop genetic-diversity, management and mismanagement of the whole seed sector.

Seeds policy in Benin

In Benin, the seed sector is organized around six essential pillars: the national seeds committee, the national seed program, the national laboratory for analysis and certification of seeds, the national catalogue of species and varieties, and technical rules of production, control and certification.

Table 1: Major categories of crops and seeds

Categories	Crops	Production areas	Types of seeds
Cereals	Maize	The overall country	Both Traditional and certified
	Rice	Center and northern part of Benin	Both Traditional and certified
	Sorghum	Northen part	Both Traditional and certified
	Millet	Northen part	Both Traditional and certified
Legums	Beans	The overall country	Both Traditional and certified
	Groundnuts	Center and northern part	Traditional
Roots et tubers	Cassava	The overall country	Both Traditional and certified
	Yams	Center and northern part	Both Traditional and certified
	Sweet potatoe	The overall country	Traditional
Vegetables	Tomato	The overall country	Both Traditional and certified
	Pepper	The overall country	Both Traditional and certified
	Gombo	The overall country	Traditional
Fruits	Orange	Southern part	-
	Mango	The overall country	-
	Lemons	-	-
	Ananas	Southern part	Traditional

Source: 2nd report PGR, 2007, Benin.

Figure 1. Landraces of maize, (Photo taken by Assogbadjo)

Figure 2. Seeds of millet, (Photo taken by Assogbadjo)

In this organization, research centers (National Institute of Agricultural Research and the Laboratory of Genetics and Biotechnology of the University of Abomey-Calavi) develop varieties for certification by the national laboratory for analysis and certification of seeds. Certified seeds are then made available for farmers by their peers involved in seeds multiplication.

However, aside the formal seed sector lays the informal seed sector providing the overwhelming part of seeds used for food production.

Both of these sectors are hindered by numerous limits. In fact, the formal sector is faced with the reluctance of local famers due to the high-costs of improved varieties, the relatively low number of varieties taken into account, the restriction of the sector to improved varieties, and conflictual roles among actors. On the other hand, the informal sector is faced with quality and reliability issues (Lafia, 2006).

Figure 3. Soya seeds, (Photo taken by Assogbadjo)

On-farm management of local seeds diversity

In Benin, in spite of the event of the formal certified seed sector, many rural farmers continue to use traditional seeds or other planting materials to meet their seed needs (Lafia, 2006). They have their own method of selection and conservation of seeds. From our investigations, we noted that this method varies slightly from one crop to another. Indeed, seeds were collected at maturity on apparent healthy plants and saved from season to season by individual farmers. As with selection, storage and conservation methods varied with crops. As such, seeds were stored either in packages and suspended at kitchen roofs (in the case of maize for example) or in grain and bottled (case of peppers, tomatoes, etc).

Yet, there can also be significant amounts of exchange between neighbors and relatives. They are also purchased when necessary. On-farm management of local seeds diversity is predominant in the Benin seed sector since conversely to the cotton culture, no organized provision system exists for food crops.

Figure 4. Tomatoes seeds (Photo taken by Assogbadjo)

Formal versus traditional seeds systems in Benin

The main features describing the formal certified seed sector in Benin are the fact that it is based on several selections, resistance tests to pests, mandatory seed certification and a distribution of seeds through formal channels. It is also based on a very few varieties. Conversely, the traditional seed sector encompasses the vast majority of species better suited to farming environments and socio-economic conditions of farmers. Henceforth, new options should be developed to promote participatory selections involving both researchers and local farmers. On the other hand, research in Benin should also include more varieties such as those of Neglected Underutilized crops.

Fig 5. Local variety of Onion, (Photo taken by Assogbadjo)

References

Aly D.M., Dah-Dovonon Z.J., & Dansi A. 2007. Deuxième rapport sur l'état des ressources phytogénétiques pour l'alimentation et l'agriculture au Bénin. 59 p

Lafia M., 2006. Contribution à l'étude des systèmes semenciers traditionnels au Bénin : cas du maïs, du sorgho, du niébé, du soja, et du goussi. Thèse de DEA, FSA/UAC. 103 pages

Sthapit B., Shrestha P., & Upadhyay M. 2007. On-farm management of agricultural biodiversity in Nepal. *Good practices*; 80p

Maize landraces and indigenous peasants from Lacandon Jungle, Mexico

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Introduction

Maize, scientifically known as *Zea mays*, has a rich relationship with human beings that began about 9000 years ago (Matsuoka *et al.*, 2002). This relationship continues today; thus maize has become a cosmopolitan crop cultivated worldwide. It is a versatile product being used for different purposes, as a global commodity, a model organism in basic plant research and a companion entity in social processes such as African slavery and colonialism (Warman, 1995; Marglin, 1996; MacCann, 2005). This is certainly true in Mexico, the birthplace of maize, where it was domesticated and diversified. Maize has been a main staple food crop in Mexico for many centuries. The bond between Mexicans and maize is intertwined in a way that reflects, according to Bonfil, they cultivate themselves through cultivating maize (Esteva, 2007a:11). Mexico has diverse maize cultivars that are grown in a variety of methods that reflect cultivation methods are due to the presence of a wide variety of ecological zones[1] in the country, which have unequivocally played crucial roles in a variety of global processes that have shaped the history of Mexico[2]. Similarly, the different maize landraces that are currently being cultivated in the tropical, temperate and semi-arid areas of the country are the products of these different historical processes (Wellhausen *et al*, 1952).

There have been many maize of pre-Columbian origin, *mestizo* races that were generated after the Spanish Conquest, modern cultivars that were developed when Mexico became independent and improved varieties or hybrids that were developed during the Green Revolution[3]. Nowadays maize is produced with cutting-edge technologies in certain regions of the country by large scale entrepreneurs while in other areas maize is still being cultivated by indigenous peasants using landraces (Vega and Ramírez, 2004). Indeed, indigenous peasants are considered as 'local stewards' of the maize diversity, at the same time, maize landraces become their companions. I will illustrate how maize has become a source of an indigenous Mexican's life with special emphasis of *Tzeltal* peasants of the Lacandon Jungle of Mexico.

Tzeltal peasants of the Lacandon Jungle and their maize landraces

Tzeltal is an indigenous group belonging to the great Mayan family (Gómez, 2004:5) that goes back to Pre-Columbian Mayan civilization[4]. They are currently concentrated in mainly two areas of the southern state of Chiapas, the Highlands and the Lowlands. where the Lacandon Jungle is located. This jungle has a rich biodiversity[5], dominated by tropical, subtropical and temperate forests, with enormous sources of watershed and energy and thus is conceived as a green lung of the country (INE, 2000). It is also the place where Tzeltal peasants cultivate maize in a production system known as *milpa*[6] by slash-and-burn for self-consumption purposes. Thus, the landraces that they cultivate have become a part of their collective and personal history as peasants that typically interwoven with their life stories when they talk about maize landraces. There are different types of landraces named based on different characteristics, color, being the most important one. The *c'anal* is a maize type with small yellow kernels (Fig. 1). On the other hand, the *sacwa* is a small white kernel maize type (Fig. 2). The *chaparro* (short) type has white kernels with a small plant stature (Fig. 3). The red husks and stalks gave the *tsajal pat* type its name (Fig. 4) and the *ic'wa* type has purple-black kernels (Fig. 5). These are not the only attributes that distinguish maize landraces and many other distinctions may become evident from the maize collective history of *Tzeltal*.

Figure 1. *Bac c'anal ixim*

Figure 2. *Bac sacwa*

Figure 3. *Chaparro*

Figure 4. *Tsajal pat*

Figure 5. *Ic'wa*

1) Toledo and Ordóñez (1998) divide Mexico into different ecological zones that are: tropical hot and humid, tropical hot and sub-humid, template humid, template sub-humid, arid, semiarid, wetland and transition between sea and land.

2) These historical processes started since the flourishing of different Mesoamerican Civilizations (such as the famous Mayan and Aztec), the conquest-colonialism of European Civilization for 300 years and the 200 years shaping and reshaping the Mexican nation interacting with global processes such as the Modernization, Industrialization and recently Globalization.

3) There are some examples of each one. The *Nal tel* landrace is a Precolombian race from the Mayan Culture and the *Tuxpeño* is a Mestizo race covering the tropical humid areas of Mexico (Wellhausen et al.;1952). *Celaya* is a modern landrace that was cultivated in the productive area of El Bajío before the arrival of hybrids and improved varieties (ibid). The H-515 is a quite known hybrid from the tropics developed by Mexican National Research Centre (Morris, 2001). Finally transgenic varieties with BT1 gene have been found in farmers' fields although their cultivation is restrictive to research and testing purposes (Quist and Chapela, 2001).

4) This civilization inhabited several areas of southern Mexico centuries ago.

5) It contains the greater quantity of the tropical trees of the country as well as 33% of the diversity in reptiles, 80% of that of butterflies and 32% of birds of Mexico (INE, 2000:12).

6) *Milpa* is a very diverse and complex traditional agroecosystem where maize is cultivated, associated and intercropped with other plants like beans (*Phaseolus* spp.), pumpkins (*Cucurbita* spp.) and chili (*Capsicum* spp.) (Aguilar et al., 2007:84)

The history of maize together with the life of *Tzeltal* peasant ancestors, who were cultivating maize in the Lacandon Jungle, started when the Spanish conquerors arrived convincing them to abandon their dwellings by manifesting the Bible and sword. In that way they became landless servants and later as laborers in the states nearby the Jungle between the period 16th and the mid-20th centuries (Vos, de,1980; Legorreta, 2008). From these times as laborers, is *c´anal ixim*, as Don Jorge de Pichucalco indicated as his grandparents cultivate it when they were laborers in Rancho El Rosario (see Fig. 6). This material is heavy in the hands as it is on an empty stomach and has tightly closed husks that protect the kernels. From the same period is the emergence of another landrace, *sacwa,* which was cultivated by the grand parents of Don Manuel de Amador Hernández when they were laborers in the Rancho Santa Rita (see Fig. 7). This variety exhibits a tightly closed husk, a trait that was more prominent in *c´anal ixim*. However, the dough made from these kernels is fairly fine enough to make local foods such as *tortillas* and *pozol*.

During the mid-20th century (Vos, de 2004:137-180), *Tzeltal* laborers returned to the Lacandon Jungle and commenced their life by making *milpa*. As the land was fertile, other activities such as pig farming and cattle production became important activities. From these times, a maize cultivar was introduced known as Chaparro (Fig. 8), an improved material brought by a pork trader from a neighboring state, as Juan from San Martín highlighted, that it has emerged as a landrace by a creolization process. This cultivar is shorter than the previous ones with a short husk that insufficiently protects the cob. In other way, *Tzeltal* people's life has also challenges, which range from isolation and confinement of the area to presidential decree that make their homeland a contentious territory. This adjudication has made them away from legal rights to own land and defined several restrictions for the management and utilization of land and natural resources. They have been confronting these difficulties by different ways. One of them represent their participation in organizations that fight for their rights such as the *Asociación Rural de Interés Colectivo Unión de Uniones Independiente y Democrática* (*ARIC UU ID*) and *Ejército Zapatista de Liberación Nacional* (*EZLN*)[7].

Participating in these organizations implies that visiting different places and having access to new materials. That was what happened for the introduction of *tsajal pat* (Fig. 9), brought by Mariano de Salvador Allende from a maize field in Nueva Palestina (more than 100 km of distance) during his trip to resolve the land-ownership conflict. The red kernels of this landrace are used to prepare a remedy that heals kidney problems and there are old stories about maize divine origin.

Figure 6. *Tzeltal* girls showing *k´anal ixim*

Figure 7. *Tzeltal* women showing *sacua*

Figure 8. *Tzeltal* girl showing *k´anal ixim*

Figure 9. *Tzeltal* woman showing *tsajal pat*

[7)]The Zapatista Army of National Liberation (*EZLN*) is an insurgent social movement against Mexican Government that became public in 1994. Most of its members are indigenous living in the Southern State of Chiapas Mexico and got involved as a way to fight against their living conditions (Montemayor, 2009). Several authors explained that this movement appeared of the union between leftish political groups of the *Fuerzas de Liberación Nacional* and several indigenous peasant organizations (in the Lacandon Jungle it was the ARIC UU) (Legorreta, 1998:159-255; Harvey, 1998; Vos, de., 2004:325-358). For the *Tzeltal* Peasants of La Mera Selva, the *EZLN* is a sister organization that appeared from the division of the ARIC UU when the former became public in 1994. Nowadays it is considered a social movement that proposes alternative ways of government based on Indigenous Autonomy.

CONCLUSION

For *Tzeltal* peasants, maize is not only the main staple food crop but also a companion. They have developed a close relationship with maize that it becomes evident through their history together. In that sense, landraces, *c´anal ixim* and *sacua* have been with them since peasants were landless workers of states. Later, during the twentieth century, when they moved back to the Lacandon Jungle and started pork production, *chaparro* was introduced by a trader from a neighboring state. During the same time *tsajal pat* appeared in their history when they were organizing themselves to fight for their land. All these maize landraces were well adapted to the existing environmental conditions of this Jungle and have been cultivated by *milpa* system. Moreover, these landraces form part of *Tzeltal* peasant's social and cultural life in a way that they became a part of their identity. Therefore, a key element of these maize landraces conservation is not just limited to the scientific fact of their well adaptiveness to the local climates but fairly relates to the social fact of an interdependence that has persisted for a long time between these landraces and *Tzeltal* peasants.

References

Aguilar, A., Illsley C., and Marielle C. (2007) Los sistemas agrícolas de maíz y sus procesos técnicos. In Esteva, G. and Marielle, C (eds.). *Sin maíz no hay país*. Dirección General de Culturas Populares, México D.F. Pp. 83-122.

Esteva, G. (2007) Introducción. In Esteva, G., and Marielle, C (eds.). *Sin maíz no hay país.* Dirección General de Culturas Populares, México D.F. Pp. 11-14.

Gómez M., M. (2004) Tzeltales. México D.F.: Comisión Nacional para el Desarrollo de los Pueblos Indígenas y Programa de las Naciones Unidas para el Desarrollo.

Harvey, N. (1998) *The Chiapas rebellion: the struggle for land and democracy*. Duke University Press. Durham, NC.

INE. (2000) *Programa de Manejo Reserva de la Biósfera Montes Azules*. E. y. C. Dirección de Publicaciones de la Dirección Ejecutiva de Participación Social. Instituto Nacional de Ecología. México.

Legorreta D., M. d. C. (1998) *Religión, política y guerrilla en Las Cañadas de la Selva Lacandona*. Cal y arena. México, D.F.

Legorreta D., M. d. C. (2008) *Desafíos de la emancipación indígena. Organización Señorial y Modernización en Ocosingo, Chiapas (1930-1994).* Colección Alternativas. CEIICH-UNAM. México D.F.

MacCann, J. (2005) *Maize and grace: Africa's encounter with a new world crop, 1500-2000.* Cambridge, Mass: Harvard University Press.

Marglin, S. A. (1996) Farmers, Seedsmen and Scientist: Systems of Agriculture and Systems of Knowledge. In Apffel – Marglin, F. and Apffel-Marglin, S (eds). *Decolonizing knowledge : from development to dialogue.* Oxford: Clarendon Press.

Matsuoka, Y., Vigouroux, Y., Goodman M.M., Sánchez G., J., Buckler E., and Doebley, J. (2002) *A single domestication for maize shown by multilocus microsatellite genotyping*. Proceedings of the National Academy of Sciences 99:6080-6084.

Montemayor, C. 2009. *Chiapas, la rebelión indígena de México*. De Bolsillo. México, D.F.: Random House Mondadori, S.A. de C.V.

Morris. (2001) Assessing the Benefits of International Maize Breeding Research: An Overview of the Global Maize Impacts Study. In Pingali P.L. *1999–2000 World Maize Facts and Trends. Meeting World Maize Needs: Technological Opportunities and Priorities for the Public Sector*. CIMMYT. Pp. 25-34.

Quist, D., and I. H. Chapela. (2001) Transgenic DNA introgressed into traditional maize landraces in Oaxaca, Mexico. *Nature* 414:541-543.

Toledo, V. M., and M. Ordóñez. (1998) El panorama de la biodiversidad de México: Una revisión de los hábitats terrestres. In R. T.P., R. Bye, A. Lot, and F. J. (eds). *Diversidad biológica en México*. Pp. 739-757. Instituto de Biología, UNAM. México, D.F.

Vos de, J. (1980) *La paz de Dios y del Rey: La Conquista de la Selva Lacandona 1525-1821*. Colección Ceiba. Gobierno del Estado de Chiapas. Tuxtla Gutiérrez, Chiapas.

Vos de, J. (2004) *Una tierra para sembrar sueños: Historia reciente de la Selva Lacandona 1950-2000*. Fondo de Cultura Económica. México, D.F.

Warman, A. (1995) *La historia de un bastardo: maíz y capitalismo*. Fondo de Cultura Económica. México.

LR Resources

On this page you will find a number of resources to aid and inform the national LR conservation strategy planning process. For one-to-one guidance on any aspect of national LR conservation strategy planning, please contact Valeria Negri: vnegri@unipg.it.

LR conservation planning aids

A list of data sources that can be consulted to aid the development of a LR in situ conservation strategy
A Training Guide for *In Situ* Conservation On-Farm (2000) Technical skills and tools to build institutional capacity and partnerships to implement an on-farm conservation programme
Law and Policy of Relevance to the Management of Plant Genetic Resources (2005) Introduction to international legal and policy instruments relevant to professionals who manage, conserve and use plant genetic resources for food and agriculture and/or have policy-making responsibilities.
The International Treaty on Plant Genetic Resources for Food and Agriculture: Implementing the Multilateral System - Learning Module **(2010)** A module for professionals who work in plant genetic resources to understand the impact and working of the multilateral system of access and benefit-sharing of the International Treaty and to use its standard material transfer agreement (SMTA) to enhance transfer of plant genetic resources.
Draft PGRFA Conservation Toolkit: 'Conservation and Sustainable Use of PGRFA: a Toolkit for National Strategy Development' aims to help nations to systematically formulate national strategies for the conservation of LR and LR by leading the user through the various steps of the process and providing supporting reference material. Please note that this publication is currently undergoing review and major modification and will be formally published by FAO later in 2012.
NEW: Italian guidelines to conserve and characterize biodiversity which is useful for agriculture _ summary [IN ENGLISH]

LR data

Resources with a specific focus on in situ LR data.
http://www.arsial.it/portalearsial/RegistroVolontarioRegionale/Default.htm
http://germoplasma.arsia.toscana.it/Germo/
For a guide to searching for LR *ex situ* conservation data that can be used for searching landraces in situ as well as for carrying out a gap analysis, please consult the
http://eurisco.ecpgr.org/
The EURISCO web catalogue receives data from the National inventories, and provides access to all ex situ PGR information in Europe

LR information management

in situ LR descriptors: http://www.pgrsecure.bham.ac.uk/sites/default/files/documents/helpdesk/LRDESCRIPTORS_PGRSECURE.pdf

NEW: to easily record the information on in situ LR and build up an inventory, the PGR Secure project team also prepared a Database for recording national in situ LR inventory data (PGR_Secure_LR_data_recording_tool.mdb) that can be downloaded along with the manual (LR_data_recording_tool_MANUAL.pdf). Click here to download the tool (MS Access database and user manual zipped, 4.1MB).

LR publications

Agrobiodiversity Conservation: Securing the Diversity of Crop Wild Relatives and Landraces (2012)

LR networks

http://www.ecpgr.cgiar.org/networks/in_situ_and_on_farm/on_farm_wg.html
http://www.bioversityinternational.org/announcements/on_farm_conservation_neglected_and_underutilized_species_and_climate_change_a_new_international_effort.html

LR project websites

From the links below, you will find a number of project websites which are related to a different extent to LR and LR use.
An Integrated European *In Situ* Management Workplan: Implementing Genetic Reserves and On-Farm Concepts (AEGRO)
http://portal.geographie.uni-freiburg.de/forschungsprojekte/indigenoveg/
http://www.diverseeds.eu/
http://www.ensam.inra.fr/gap/resgen88/
www.solibam.eu/
www.urbesproject.org

LR conferences/workshops

From the links below, you will find a number of resources associated with future and past conferences/workshops, such as Powerpoint presentations, posters, reports and other related publications.
Towards the establishment of genetic reserves for crop wild relatives and landraces in Europe, Funchal, Madeira, 13–16 September 2010
Conservation strategies for European crop wild relative and landrace diversity, Palanga, Lithuania, 9–11 September 2011

Other useful links

http://www.bioversityinternational.org/
http://www.cgiar.org/
http://www.fao.org/

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