

CONSERVATION OF MEDICINAL AND AROMATIC PLANTS IN EUROPE - A REVIEW OF CURRENT PROGRESS

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INTRODUCTION

Studies on the uses of natural genetic resources in different cultural environments show a strong relation between dietary habits and health of local population. Many wild plants were used by indigenous peoples both as a food and medicine (Johns, 1999; Pieroni and Heinrich, 2003; Rivera *et al.*, 2005). Besides characterization of environmental factors that affect existence and distribution of natural genetic resources, the knowledge on traditional habits, of ethnobotanical and general ethnographic characteristics of a particular area all serve as a professional ground for prospecting for those wild genetic resources that can be of use in a diet and/or medicine of local inhabitants (Heinrich, 2002; Heinrich, 2003; Bremner *et al.*, 2004; Heinrich *et al.*, 2005). The existence of traditional medicine basically depends on plant species diversity and the related knowledge of their use as herbal drugs. In addition, both plant species and traditional knowledge are important to the herbal medicine trade and the pharmaceutical industry, whereby plants provide raw materials and the traditional knowledge prerequisite information (Tabuti *et al.* 2003). Together with growth in global demand for medicinal plants and in local demand for plant based traditional medicines, the pressure on the existing populations of medicinal plants has increased tremendously during the last few decades (<http://www.tifac.org.in/offer/tlbo/rep/S061.htm>). Historically, most of these plants grew in wild as a natural component of vegetation of a particular region. The necessary plant material (roots, barks, leaves) have been collected and sold by the local people to the traders and the industry and exporters purchased them from traders. Since there was no scientific system of collecting or regenerating these plants in past, several plants have either been completely lost or have become endangered.

In order to stop further biodiversity loss of natural resources of medicinal and other socio-economically important plants, modern scientific methods must evaluate remaining stocks of these populations in their natural habitats and secure their sustainable and permanent use (Johns and Eyzaguirre, 2000; Johns and Eyzaguirre, 2002; Johns, 2002; Troppman *et al.*, 2002) in order to conserve an essential part of our natural and

cultural heritage.

The main general aim and long-term goal of conservation of target species in their natural habitats is to protect, manage and monitor the selected populations in the direction of maintenance of the natural evolutionary processes, thus allowing new variation to be generated in the gene pool that will allow the species to adapt to changing environmental conditions such as global warming, changed rainfall patterns, acid rain or habitat loss (Heywood, 2004).

In many countries the excessive collection of wild plants was often combined with a loss of habitat that resulted in a severe decrease of certain plant species. For that reason domestication of wild medicinal and other socio-economically important plants is necessary to allow intensive production to meet high demand - especially in the period of global trade, massive and expanding markets for medicinal and herbal products. In the history of human civilisation domestication of wild edible plant species and their agricultural production was the key anthropogenic contribution to the production of agricultural surpluses, capable of supporting urban communities. The maintenance and sustainable management of natural habitats - ecosystems and biological resources is possible only after the basic decision change from wild-gathering to agricultural production of any raw materials that has been subjected to the growing commercial demand.

MAP biodiversity conservation in the light of global strategies and of EU legislation

When considering conservation and use of plant genetic resources of potential use in food and agriculture (that have been assigned also as neglected, underutilized species, minor crops or medicinal and aromatic plant species), community legislation that has an immediate legal effect on the member states shall take into account relevant international processes, developments and agreements, in particular as regards: the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture, the FAO's Global Plan of Action for the Conservation and Sustainable Utilisation of Plant Genetic Resources for Food and Agriculture, the European Plant Conservation Strategy and programmes implemented under international frameworks such as the European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR), and the Consultative Group on International Agricultural Research (CGIAR).

The Convention on International Trade in

Endangered Species (CITES), which laid down provisions for the protection of endangered species of flora and fauna, represents controls on international trade in specimens of these species and is the basis of a worldwide policy on protection of endangered species (Council Regulation (EC) No. 338/97, Commission Regulation (EC) No. 939/97, Commission Regulation (EC) No.1808/2001, Commission Regulation (EC) No 1497/2003, Commission Regulation (EC) No 834/2004).

Council Regulation (EEC) No 2092/91 of 24 June 1991 on organic production of agricultural products (Annex I, point 4) lays down provisions on sustainable collection of edible plants and parts thereof, growing naturally in natural areas, forests and agricultural areas, postulating that the collection should not affect the stability of the natural habitat or the maintenance of the species in the collection area. In addition, the German Federal Agency for Nature Conservation (BfN), WWF and TRAFFIC and the Medicinal Plant Specialist Group (MPSG) of the IUCN Species Survival Commission have developed a strong base of expertise and knowledge and prepared practical standards and performance criteria in the field of sustainable medicinal and aromatic plant wild-crafting (Klingenstein *et al.*, 2004). Their efforts have resulted in an International Standard for Sustainable Wild Collection of Medicinal and Aromatic Plants (ISSC-MAP) (Final draft of April 2006). However, when wild collecting is the source for covering the demand on the expanding market of raw materials, especially in the period of lacking the attention to illegal and unsustainable trade, one of the major concerns still remains the risk of the loss of the plant species' ability to regenerate, when quantities of harvested material exceed the population limit.

On 26 June 2003, EU farm ministers adopted a fundamental reform of the Common Agricultural Policy (CAP, Official journal L270 – 10/21/2003). On September 29, 2003, the Agriculture Council formally adopted the legal texts of the June 2003 CAP Reform agreement. The CAP's objectives include helping agriculture to fulfil its multifunctional role in society: producing safe and healthy food, contributing to sustainable development of rural areas, and protecting and enhancing the status of the farmed environment and its biodiversity. The reform will completely change the way the EU supports its farm sector (Council regulation (EC) No. 1698/2005).

The International Treaty on plant genetic resources for food and agriculture came into force on June 2004. Each country that ratifies the Treaty will develop the legislation and regulations, needs to implement the Treaty. Treaty's objectives are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and

equitable sharing of benefits derived from their use for sustainable agriculture and food security, in harmony with the CBD and GSPC. The Treaty resumes the GSPC's definition of sustainable management and use of plant diversity that should integrate social and environmental considerations, such as fair and equitable sharing of benefits and the participation of indigenous and local communities. All actors involved benefit, in many ways:

- farmers and their communities, through Farmers' Rights;
- consumers, because of a greater variety of foods, and of agriculture products, as well as increased food security;
- the scientific community, through access to the plant genetic resources crucial for research and plant breeding;
- international Agricultural Research Centres, whose collections the Treaty puts on a safe and long-term legal footing;
- both the public and private sectors, which are assured access to a wide range of genetic diversity for agricultural development;
- the environment, and future generations, because the Treaty will help conserve the genetic diversity necessary to face unpredictable environmental changes, and future human needs.

Long-term goals in this field are managed by numerous global strategic documents, which were used in preparation of international conventions or national programs, i.e. World Conservation Strategy (1980, IUCN, UNEP, WWF), Caring for the Earth (1991, IUCN, UNEP, WWF), Global Biodiversity Strategy (1992 WRI, IUCN, UNEP) and especially directives for conservation of medicinal plants: Guidelines on The Conservation of Medicinal Plants (1993, WHO, IUCN, WWF), where the significance of ecology, identification and traditional use of plants, as well as cultivation and conservation of plants both *in situ* and *ex situ* are strongly emphasized (Skoberne, 2002). Together with WHO Guidelines on good agricultural and collection practices (GACP) for medicinal plants (WHO, 2003) these guidelines offer the background supporting documents for many national and international initiatives, programs and frameworks, aimed at improving the knowledge on distribution, abundance, sustainable management and use of medicinal plants worldwide.

In April 2002 the European Plant Conservation Strategy (EPCS) was recognised as a contribution to the Global Strategy for Plant Conservation (GSPC), adopted by the CBD (Decision VI/9). The European Plant Conservation Strategy (EPCS) is a joint initiative of the Council of Europe and Planta Europa Network, and will significantly help to raise the profile of the Planta Europa Network's efforts to protect plants in Europe. It contributes also to the Convention of Biological Diversity and the Pan European Biological and Landscape Diversity Strategy (PEBLDS). The Planta Europa Network, at its 4th

Planta Europa conference (Valencia, September 2004), set itself a challenging agenda to be achieved by 2007. Among seven 'Critical Targets', which were identified to provide the framework for Planta Europa activities in next three years, the target 7 applies to the identification of best practice for conservation and sustainable use of medicinal and other socio-economically important plants and the promotion to relevant policy makers. This critical target corresponds to Target 3.1 of the EPCS.

The role of ECP/GR in conservation and sustainable management and use of MAPs

Conservation programs, aimed at conserving of natural heritage, at improvement of the knowledge on the MAPs genetic variability and improving biological knowledge, including MAPs-related user safety, as well as sustainable management and use of MAPs should be promoted in the EU countries.

The International Plant Genetic Resources Institute (IPGRI) is committed to promote the use of biodiversity for the greater well-being of people. Although medicinal plants are not a preponderant part of IPGRI's Agenda, the Steering Committee of the European Cooperative Programme for Plant Genetic Resources Networks (ECP/GR), which operates through nine broadly focused networks (<http://www.ecpgr.cgiar.org/Index.htm>), agreed on the establishment of the Medicinal and Aromatic Plants Working Group (MAP WG) (in October 2001) in order to facilitate European collaboration in the field of conservation of natural resources of MAPs and their sustainable use. Up to now the ECP/GR MAP WG met twice, the first meeting was held in Gozd Martuljek, Slovenia, in September 2002 and the second in Strumica, Macedonia, in December 2004. After the 1st meeting, the selection of 10 target species/genera that will be used as model species (*Achillea millefolium* agg., *Artemisia absinthium*, *Carum carvi*, *Gentiana lutea*, *Hypericum perforatum*, *Melissa officinalis*, *Mentha* spp., *Origanum vulgare*, *Salvia officinalis*, *Thymus* spp.) has been made, enabling development of specific MAP descriptors. MAP descriptor lists, harmonized with EURISCO descriptors, have been prepared and proposed to the members as a working scheme during the second meeting. The members, interested in the same species/genus, work on characterization of specimens *in situ* and on evaluation of accessions within their gene banks. The reports, obtained after evaluation of morphological, cytological and genetic characterization *in situ* and evaluation of accessions *ex situ* in each of the member countries will be presented during the next meeting of the WG, which is planned for 2007.

The Group is expected to contribute to the development of the conservation strategy of MAPs

at the European level. Legislative limitations, implemented by EU trade regulations on endangered MAPs and low knowledge of biological conditions and biodiversity status urge for coordinated action and involvement of European experts and scientists. Efforts are to be carried out in partnership with a variety of actors (at local, national and international level) and deploying a variety of tools that contribute more effectively towards the common scope – conservation of MAPs and their habitats in the European region.

The inventory and monitoring of endangered MAP species and their *ex situ* maintenance, the study of intra-specific diversity, the assessment of threats, preparation of relevant descriptors and successive evaluation of ecotypes are just some of the research programmes that would contribute to the knowledge on current gene pools of MAPs and the degree of vulnerability in individual countries. The field work should be restricted to the areas, which have been assessed at the national level of the relative importance for each natural habitat type in member countries.

Best practice for the conservation and sustainable use of medicinal plants (and other sociologically important plants) that in majority occur outside protected areas (protected area *per se* already represents a protection measure) would be the study and identification of risks of biodiversity loss, promotion of appropriate conserving measures to relevant policy makers and policy-based conservation actions.

Monitoring the impacts with bad influence on the status of the endangered species could be considered as an important factor in notification of biodiversity drop. Plant species can be endangered due to the loss of habitats because of natural succession (reforestation) or due to direct extermination (collecting, meliorations, agricultural activities, infrastructure, etc.). For the conservation of the natural species populations some extra measurement are needed. The *in-situ* and *ex-situ* measures should be coordinated, especially the propagation of the plants for the reintroduction and establishing of suitable environmental conditions for their further domestication. The study of the level of endangerment of species populations are the basis for their effective conservation. For threatened species (whether of known economic importance or not) ecogeographical surveying should be undertaken, the extent of the genetic representation in the natural habitat assessed, actions undertaken to control or remove the factors that cause the threats and the detailed management or recovery should be planned and implemented through natural resource managers, local communities and policy makers.

Seed material from rare and vulnerable species should be collected and transferred to appropriate *ex situ* collections, where the plants should be propagated. Thereafter, morphological, cytological, usage and chemical characteristics of plants in different

developmental stages would be recorded. In case of not threatened species ecogeographical surveying should be undertaken to establish the amount and distribution of genetic variation, potential changes in population size in natural habitat (*in situ*) as well as to assess the conservation needs. Domestication of wild species that indicate a trend in economic importance should be promoted, independently on the species endangerment status.

In this context one of the most important scopes of the ECP/GR MAP WG are to develop professional standards/criteria, which could be of immediate use in member countries in order to follow up current status of MAP populations in their natural habitats and which would point out, which of the measures should be addressed to the management of target species in order to control/prevent its biodiversity loss.

ECP/GR MAP WG results (2002 – 2006)

The MAPs WG working plan covers activities related to documentation, characterization/evaluation, *ex situ*, *in situ* and on farm conservation of MAPs. Harmonization of methodologies for evaluation of natural plant populations and their habitats is based on the principles of a descriptor system. Descriptors needed to be set up on the basis of observations and measurements of floristic and phytocoenological data, morphological, chemotaxonomic, cytological and genetic variables. These should meet the criteria of population characters significance and distinctiveness.

A descriptor-based approach consists of five categories of descriptors, with the following descriptor categories:

1. *Passport and Collecting descriptors* describe all parameters which have been obtained during inventarization and/or survey (mapping) of genetic resources and provide basic information for managing of accession, including registration, identification, ethno botanical and ethnographic data. Collecting descriptors comprise all data registered at field working, and which describe natural habitats together with natural genetic resources.

2. *Management descriptors* consist of prescriptions and technical instructions for preparation of genetic material and conditions for long-term maintenance of accessions. Protocols for preparation (pre-condition) of genetic material, its maintenance and multiplication (regeneration), based on international standards and regulations, are to be set up.

3. *Environment and Site descriptors* explain environmental (geographic, soil-pertaining, topographic, phytocoenological, micro-climatic) and habitat-specific parameters, which are important for distribution and assessment of abundance of populations, characterization, evaluation as well as for assessment of useful properties of a particular genetic source, which can

be attributed to the interaction between ecotype and environment.

4. *Characterization descriptors* express morphological, taxonomic, cytological, chemical, production (biomass/m²) characteristics of respective specimens (20 – 25 entities per population) of genetic source and are crop-specific. Characterization descriptors have been prepared for 10 model species that MAP WG selected for the study during the first phase.

5. *Evaluation descriptors* will be used in *ex situ* evaluation of genetic resources of a specimen under study (20– 25 entities per population) and consist of observations/measurements of plant biomass (fresh and dry in g/plant), of regeneration potential (weight of 1000 seeds, possibility for vegetative propagation), of earliness (measured by developmental stage), of determinations of the contents of the secondary metabolites and of evaluation of sensitivity of a genetic source for abiotic and biotic stress factors, with a characterization of a stress factor.

The WG members agreed that development of relational databases would advance the work on evaluation of MAP species. All data collected in the process of inventarization, mapping and evaluation of natural genetic resources and of genetic resources *ex situ* would be jointly interlinked by relational pointers into such an information database (national and/or international).

SUMMARY

Conservation directives of ECP/GR MAP WG, which are congruent with Global Strategy for Plant Conservation (GSPC) and European Plant Conservation Strategy (EPCS), are presented. *In situ* conservation of MAP genetic resources in member countries will help to maintain the biodiversity of endangered, rare and vulnerable species. Domestication of these species is an important task of conservation programs and involves regeneration of the collected seed material of surveyed populations in order to assure the MAP material for their characterization, evaluation and cultivation in the future.

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