

The role and current state of gene reservation of medicinal and aromatic plants in Hungary – an overview

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Summary: As it well known the decrease of biodiversity is a large problem all over the world. In case of medicinal plants, where the huge majority of drugs are collected from natural ecosystems, the sustainable utilization of the populations and reservation of their gene-pools has an increased interest.

In Hungary, the major background of 'in situ' reservation of medicinal plant species, their natural plant associations and ecosystems is the official protection by law. Successful examples are known for the controlled utilization of medicinal and aromatic plant species grown in protected areas. Assuring the naturally occurring high degree of biological and chemical diversity of species is a special task in this field: only maintenance of valuable intraspecific races can form the real genetic basis of natural biologically active compounds.

Maintenance of chemotaxonomical gardens and gene bank collections (seed banks, tissue banks) as 'ex situ' methods of reservation is carried out on an extended range in Hungary. As the required information on storage and maintenance of many medicinal and aromatic plant species is yet missing, exhaustive research is carried out at both genebanks in Hungary, which are specialized for medicinal plant reservation (RIMAP- Budakalász, SZIU- Budapest).

Beside the static conservation methods, 'quasi-production systems' are intended to assure an up-to-date and economically possible way of dynamic reservation with sustainable utilization.

Background of conservation efforts

The biodiversity of natural vegetations assures an indispensable potential of biologically active materials.

Several years ago the World Health Organization made an attempt to identify all plants that play a role in therapy somewhere in the world. More, than 20.000 species were included on the list. In NAPRALERT (University of Illinois at Chicago) database they document ethnomedical uses alone for ca. 9.200 of 33.000 species (Farnsworth & Soejarto, 1988; Plotkin, 1988). According to these data 14-28 % of plants are giving medically utilized drugs in the world. Assuming, that the number of higher plant species on earth is 250.000 (Principe, 1988), the formerly mentioned estimation means 35-70.000 species having at one time or another been used in some culture as medicinal plant. It is reported by Farnsworth & Soejarto (1988) that 5.000 ones of 35.000 species which are growing in the People's Republic of China are used as drugs in Chinese Traditional Medicine. In Europe about 2.000 taxa are sources of official drugs in trade (Lange, 1998). About two-thirds of these are native in Europe. In Hungary the number of medicinal and aromatic plant species is comparatively high, being about 200. The number of chemotaxa, which may have even more theoretical and practical importance, is supposed to be about ten times more (Bernáth, 1996).

With the world -wide degradation of natural habitats, in case of plants, which are utilized for medicinal purposes, exploitation may even increase the risk.

The severe reduction of the Hungarian plant populations can be demonstrated by the fact that more than 30 species are under protection now, which have been gathered from natural ecosystems 20 years ago as medicinal plants. Furthermore, six of them became even very rare ones.

The effects that are causing decay of the medicinal plants can be grouped according to the action of danger (Table 1.)

Table 1 The reasons causing the decay of the medicinal plants

| Direct effects | Indirect effects |
|---|---|
| Decrease of the forest area (e.g. Valeriana spp.) | Industrial contamination and pollution (e.g. Pinus spp.) |
| Tillage of meadows (e.g. Matricaria chamomilla) | Spreading of pesticides (e.g. Marrubium vulgare) |
| Decrease of ruderal sites (e.g. Fumaria officinalis) | Artificial change of plant communities (e.g. Robinia pseudoacacia) |
| Drainage (e.g. Acorus calamus) | |
| Overloading due to collection (e.g. Adonis vernalis) | |

(Bernáth, 1988). The direct factors affect the pure existence of habitats, the indirect ones change the natural balance of complex ecological and biological circumstances. In shorter or longer periods both may lead to the extinction of indigenous populations.

To estimate the degree of danger, the following factors are advised to be taken into consideration:

- ecological circumstances and status of population in the given association and region
- life form and propagation strategy of species
- the utilized plant organ and methods of harvest
- level and tendencies of demand for its drugs
- other utilization possibilities for which the species may also be collected
- possibilities for cultivation as alternative supply of drug.

The strategy of the gene reservation

Comparing with several other plant groups, the protection of medicinal plant communities and habitats including them should be based on assurance their production capacity. Protection of endangered species is carried out by different methods, among them the following ones have currently special significance in case of medicinal and aromatic plants.

The static protection seems to be the most simple and general, however in many cases an administrative way, being able to conserve only the recent state of species or population. Methods of static reservation are usually grouped as 'in situ' and 'ex situ' ones (Fig. 1.).

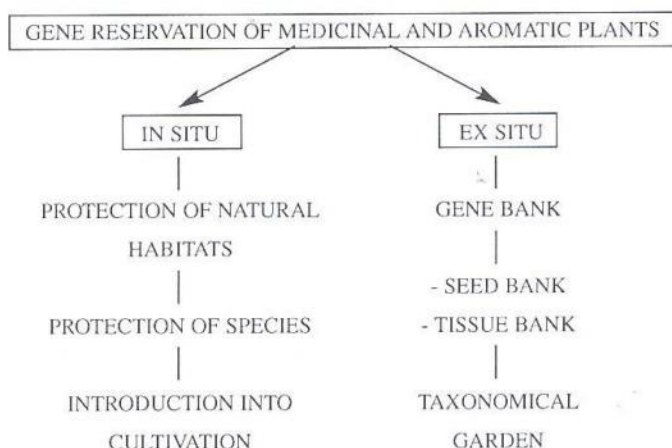


Figure 1 Main methods of gene reservation of medicinal and aromatic plants

The 'in situ' protection is widely applied, it means the officially protected status of a species or a habitat. In Hungary there are currently about 460 officially protected plant species, among them 150 may be considered as medicinal plants (Dános, 1993). 47 ones are protected at an increased degree, from which 19 should be named medicinal plants. In coincidence with the Act on Nature Protection (no. 96/LIII.) collection and disturbance of protected species is prohibited. For good cause, the Nature Protection Office may issue permissions for collecting given species, areas and periods.

The reservation of the natural ecosystems, protection of their plant communities (in national parks, reservation areas etc.) has a long tradition in Hungary (Holly & Horváth, 1995.).

In Hungary, successful examples are known for the controlled utilization of medicinal and aromatic plant species grown in protected areas (Bernáth, 1993). This method contributes to their 'in situ' reservation as well as to their practical utilization. The best known models of sustainable utilization are the collection of *Juniperus communis* in the National Park Kiskunság and collection of *Matricaria recutita* in National Park Hortobágy. The controlled collection is based on biological and chemical scientific investigations which are the basis of the further development and increase of production background. From production side, collection in protected areas may result even in higher quality drugs of lower pollution level.

The efficiency of 'in situ' reservation depends on the actual biodiversity of the species. There is only a slight practical importance of the 'in situ' protection of medicinal and aromatic plants which became extinct or extremely rare. There is little hope for their utilization as genetic background for further development, because the chemical and morphological diversity of these species is extremely restricted. It is the situation in Hungary e.g. for *Arnica montana*, *Digitalis lanata*, *Digitalis ferruginea* etc. The existence of botanical as well as chemical intraspecific taxa arise another problem in reservation. The well known biological and chemical diversity of *Achillea*, *Solidago* or *Primula* species are examples for necessary efforts, maintaining the wide range of valuable intraspecific races (Németh & Tarján, 1993).

The need for different chemotypes at the time of cultivar development and breeding is often a clear trend. Examples of it are represented by the cases of poppy or chamomile, where a changing demand can be observed for drugs containing special alkaloids, or terpenoid compounds, respectively (Bernáth, Bakó & Petheő, 1999).

Hungary is member of the International as well as European Conventions (e.g. CITES), which are destined to monitor and control the trade of endangered species in order of their protection.

An up-to-date method of 'ex situ' reservation is the establishment of chemotaxonomical gardens, living collections. Another method is represented by the gene bank reservation, which in its tight sense means seed storage banks. Although technical background of the storage is generally available, in case of medicinal and aromatic plants this task does not mean a routine method, as it is in case of many economically important traditional crops (e.g. cereals, sugar cane, etc.). The difficulties are complex:

- the number of medicinal plants in Hungary is about 200, number of known chemical intraspecific taxa may reach even the order of thousands,
- the majority of these species is less introduced taxon, for which information on production- and germination biology is missing,
- data on storage conditions are all poor, especially in case of species of the temperate region,

- incorporation of analytical-chemical investigations into the storage mechanism is unavoidable.

Two gene bank collections and chemotaxonomical gardens are currently working in Hungary, which are specialised for the reservation of medicinal and aromatic plants: in the Research Institute of Medicinal Plants (Budakalász) and at the Szent István University, Faculty of Horticultural Sciences, Department of Medicinal and Aromatic Plants, (Budapest, Soroksár). In the mentioned chemotaxonomical gardens more than 2000 item of medicinal and aromatic plant species of Hungarian origin including intraspecific chemotaxa are gathered. Beyond their reservation purposes, these specialised gardens are utilized for research and education. Furthermore, in the seed banks of the two institutions about 1500 accessions of medicinal and aromatic plant seed are currently available including seeds of wild populations, chemotaxa, cultivated populations and registered cultivars.

The up-to-date methods of biotechnology are applied more and more for the reservation of medicinal and aromatic plant species, too. It has a great importance in case of species which can not be propagated or the quality of chemotypes can not be maintained by traditional generative propagation. The microclonal propagation and reservation in tissue banks has been developed in Hungary in the last period for e.g. *Artemisia dracunculus*, *Lavandula intermedia*, *Melissa officinalis*, *Mentha piperita*, *Sempervivum tectorum* (Tóth, Bernáth & Neumayer, 1993).

From practical point of view the introduction of protected and endangered medicinal and aromatic plants into cultivation seems to be an effective reservation method, too. It presumes complex biological and chemical investigations by which the ecological requirements, biological and chemical diversity, even the effective propagation methods of the given species have to be cleared up (Németh & Pluhár, 2000).

In spite of static one, the dynamic ways of protection does not only conserve the available biodiversity, but are able to assure the further natural change and genetic development of taxa. Like the 'on-farm' maintenance of cultivated crops (Már & Holly, 1998), for the majority of wild growing medicinal plants the 'quasi-production systems' assure the only practically and economically possible way of dynamic reservation, which at the same time contribute to the sustainable use of their populations. Such efforts are known recently for *Adonis vernalis* (Neumayer & Bernáth, 1997).

The importance of reservation of medicinal and aromatic plants was recognised by the Hungarian administration and drug producers as well, and steps were made recently to increase the effectiveness of protection. It was recognised that the protection and development of plant communities

based on scientific analysis and action can contribute to holding on, even to increase the production capacity of the indigenous Hungarian flora (Bernáth, 1996).

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