Trade, Use and Conservation of Medicinal and Aromatic Plants in Lithuania

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Abstract

The trade of medicinal and aromatic plants (MAP) in Lithuania is largely based on wild-collection and import. Of all material used in pharmaceutical industry annually, 29 % is plant material coming from the wild, and 65 % is imported plant material. These imports come from more than 30 countries. The exports make up a small part of the trade and are mainly directed to the countries of the former Soviet Union. Species with a high commercial value have been started to cultivate recently. The cultivated production covers the demand for MAP raw material by only 4-6 %. The five frequently used native species in phytomedicine are: *Crataegus* sp., *Arcto-staphyllos uva-ursi, Menyanthes trifoliata, Hypericum perforatum, Thymus serpyllum*. The trade in wild plant species and their resources is regulated by the government. Active conservation of MAP is being pursued within the National Plant Genetic Resources program. Target species for conservation have been selected based on their current conservation status, trade volumes, and potential usefulness in breeding. The biological peculiarities of species and their sources of raw material determine the mode of conservation.

INTRODUCTION

Lithuania is an Eastern European country situated on the eastern coast of the Baltic Sea. The use of wild medicinal and aromatic plants (MAP) is widespread and has old traditions, especially in forested areas in South and Southeast Lithuania. The Garden of Applied Botany with a collection of MAP was established in the end of 18th century at the Vilnius University. The Department of Medicinal Plants at the University of Vytautas Magnus was founded in 1924. The first enterprise for processing raw material of medicinal plants was established in 1883 in Švenčionys and products from Švenčionys were exported to Western Europe. During the Soviet period (1940-1990) most raw materials were imported from the countries of the former Soviet Union and a certain amount were collected locally. The changes in political and economic life (Lithuania was restored to independence in 1990) have increased the demand for MAPs and therefore indicated the importance of germplasm conservation. Active conservation of MAP is being pursued within the context of National PGR program (1998-2002).

In 1995 Lithuania joined the European Plant Genetic Resources (PGR) conservation network, participating in European Cooperative Programme for Crop Genetic Resources. The Nordic Gene Bank has made substantial contributions in starting and developing plant genetic resources conservation activity in Baltic countries. In 1994, the Nordic-Baltic collaborative project on plant genetic resources for food and agriculture has been initiated and is continued till now (Weibull, 2001). The MAPs working group is one of the crop-specific working groups within the framework of this project. The new project: “Spice and medicinal plants in the Nordic and Baltic countries. Strategies for conservation of genetic resources” was initiated in 2002.

The aim of this paper is to assess the Lithuanian use and trade in MAP, and form a picture of the existing activities on conservation of MAPs germplasm.

MATERIAL AND METHODS

Statistical data on the trade activity are difficult to acquire. An analysis of

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available trade figures was done on data collected by the Department of Statistics under the Government and the Division of Plant Resources of the Ministry of Environments in 1996-2001. The list of endangered species, for which collection is under government regulation, has been compiled as a result of scientific monitoring by researchers of the Institute of Botany.

RESULTS AND DISCUSSION

The Use and Trade of MAP

A total of 1323 vascular plant taxa are known to grow naturally in Lithuania. MAPs represent a relevant part of the natural biodiversity, as about 150 taxa are still wild-harvested for medicinal purposes.

The Land Reform (started in 1991) and changes in land tenure from state to private ownership will continue to affect the collection of wild plants. The changes in distribution and survival of natural populations have been observed in recent years. The large areas of wasteland previously cultivated or owned by the military are currently used for gathering of raw material. The average annual volume of plant material coming from the wild comprises about 29 %, or approximately 85 tonnes of dry raw material. The most frequently used native species in phytomedicine are *Crataegus* sp., *Arctostaphyllos uva-ursi, Menyanthes trifoliata, Hypericum perforatum, Thymus serpyllum*, *Tussilago farfara*, *Polygonum aviculare, Urtica dioica, Frangula alnus.* MAP raw material in 95 % is used in dried form. The remaining 5 % of material is used for production of extracts and essential oils.

In recent years new private companies have been involved in the trade of MAPS, increasing the values of raw material. The joint-stock company of Švenčionys has the greatest potential for production of medicinal preparations. The trade rise of MAP has been highly influenced of the liberalization of the export-import activity. Analyzing the import-export data (Fig. 1), it is obvious that Lithuania, according to the trade estimates, could be characterized as the country mainly importing raw materials in contrast to the other Eastern and Middle European countries (Bernáth, 1999). The amount of the imported raw material has decreased in the last three years. The average annual volume of imported MAP raw material comprised about 65 % of all material used in pharmaceutical industry. Imports came from more than 30 countries. Poland, Turkey, Egypt, Ukraine, China, Germany are the main suppliers of the raw materials. Export makes up a small part of the trade and is mainly directed to the countries of the former Soviet Union: Russia, Belarus, Latvia, Kazakhstan, Estonia, and Georgia.

Cultivation is one of the solutions to the problem of over-exploitation of wild species. Cultivation can guarantee quality, uniformity of material and ensure the optimum moment for harvesting. During the recent years, an ever-increasing number of the rural populations has become engaged in growing medicinal plants. The population in rural areas accounted for 32.8 %, whereas in EU countries 17.5 % on average (Anonymous, 2002). MAPs could constitute one of the most lucrative branches of agriculture, which can assure the increase in employment and income of the rural population. The development of these non-traditional crops is far-reaching because according to the general EU policy production of medicinal plants and herbs are not quoted. Cultivation is done under contract to industrial uses. However, the area under cultivation for MAPs is extremely small. The total area of herbs is about 300 ha. The cultivated production covers only 4-6 % of the demand for raw material of MAPs. The main species of the more intensive cultivation are: *Carum carvi, Valeriana officinalis, Calendula officinalis, Chamomilla recutita*, *Mentha x piperita* and *Thymus* x *citriodorus*. The lack of advanced local cultivars limits cultivation scales of MAP. Cultivation is mainly based on Russian and Polish varieties.

The Legislation and Conservation of MAP

Medicinal and aromatic plants are affected by many ecological changes which

damage all plant communities. Changes in agriculture and market of MAP have been putting immense pressure on natural resources. The legislative framework for regulation trade and conservation of MAPs already exists in Lithuania. The trade in wild MAP species and their resources is regulated by the following legislation: Law on Protected Areas (1993), Law on Endangered Wildlife (1996), and Law on Wild Vegetation (1999), as well as Law on Plant Genetic Resources Conservation (2001). Recently, there has been a draft law on ratification of the Convention on International Trade in Endangered Species of Wild Fauna and Flora prepared. Therefore more efforts should be concentrated to ensure that these legislations properly enforced.

The Ministry of Environment regulates the gathering of wild MAP and revises the list of species, collection of which is prohibited, on the basis of research made by specialists from the Institute of Botany. The establishment of conservation status of MAP species is an important task for the conservation program. Some species of MAPs received additional protection under the law by being included in the National Red Book (Table 1). The collecting of these species is totally prohibited and these species receive additional protection under the law. The State Register (2000) of Law on Wild Vegetation lists MAP species which collecting is limited. Species of commercial interest in the MAP trade that are being gathered from wild and have existing or potential conservation problems have been identified (Table 2).

MAPs of interest for use are divided into three groups according their biological peculiarities and natural sources of raw material (Table 3):

1. Species with sufficient sources of raw material. The Law on Wild Vegetation has predicted the regulation system of exploitation common species.
2. Species with limited sources of raw material, which can be or are cultivated. Wild populations of these species are endangered in their natural habitats. The sampling of their diversity and adaptation in the field has been initiated to ensure the conservation of their germplasm and further use in breeding.
3. Species with deficient sources of raw material and narrow ecological adaptation, which are difficult to introduce into culture. Most of the species of this group are rare and endangered plants. The main factor causing the decrease of these species is changing environmental conditions.

Some different possibilities to avoid potential danger and existing threats to MAP species, including in situ and ex situ conservation, and cultivation projects. *In situ* conservation is concentrated on those species which are most endangered or indicated some conservation problems. The conservation areas are designated using the existing protected areas that contain ecological heterogeneity of the site and a broad range of germplasm material (Labokas, 1999).

The monitoring of the vitality of populations, biodiversity changes and renovation has been done with *Allium* sp.*, Arctostaphyllos uva-ursi, Arnica montana, Centhaurium erythraea, Helichrysum arenarium, Origanum vulgare, Menyanthes trifoliata.* The distribution area of *Arnica montana* originates in the European mountain region and the northern border of its distribution area crosses Lithuanian territory. In Lithuania it grows only in southern and southeastern parts of territory (Fig. 2). Observations indicate that populations of *Arnica montana* growing in optimum lichen-type pine stands are potential sources of exploitation (Radušienė et al., 1997).

The collecting of *Arctostaphyllos uva-ursi* raw material increased in former military areas where populations of high vitality have been observed. In other locations collection of raw material seriously damages the stands of this plant.

Centaurium erythraea is native in oceanic Europe and the Mediterranean, western Asia and northern Africa and is naturalized in North America. It is one of the traditional panaceas. Wild populations of centaury are highly fluctuating in size and short in age. They are greatly endangered by collecting and destruction of natural habitats. The fluctuations are predetermined by limited competitive capacity of the plant and depend highly upon environmental conditions (Radušienė, 1995). Several attempts have been made to cultivate centaury, however results were unsatisfactory.

Helichrysum arenarium is a perennial herbaceous plant native to Europe and West Asia. It is one of the more often used plants in the Lithuanian pharmacy. Gathering *H. arenarium* from the wild is entirely prohibited in several European countries (Hungary, Czech Republic, France, Germany). As the gathering from the wild has threatened the populations of this species and does not satisfy the market demand, the necessity of the cultivation and conservation of germplasm in situ and ex situ has been raised. *H. arenarium* belongs to the species of rather easy introduction and acceptable conservation in field collection.

It was recently revealed that sources of the wide-spread species, *Menyanthes trifoliate,* had a sudden, significant decrease. The vitality of this plant in most stands is medium or low. This fact indicates the changes of habitat moist conditions that threaten the populations of *Menyanthes trifoliata.*

All native species of *Allium* are subject to germplasm conservation in Europe. There are 7 spontaneous species of *Allium* in Lithuania. Three of the species, *A. angulosum, A. scorodoprasum* and *A. ursinum* are included in the Red Data Book. The first two species are rapidly threatened, while *A. ursinum* has been found in 50 localities all over the country. *A. ursinum* cover large areas (up to 10 ha) as a pure stands in broad-leaved forests or as isolated plants only. It is used as a spice in the west part of Lithuania.

Origanum vulgare L. despite its economic importance, is often referred to as an under-utilized taxon in the sense that its genetic resources and variability have not yet been fully explored. The whole genepool of oregano should be conserved to have a representation on the diversity of this species (Poludodsi, 1997). The research on germplasm conservation is very limited outside the Mediterranean region in which most resources of oregano are concentrated. The populations of oregano in Lithuania are characterized by limited distribution and by low sources of raw material. The majority of populations are concentrated in southeast and east Lithuania.

Target species for ex situ germplasm conservation have been selected basing on their current conservation status, trade volumes, and potential usefulness for future utilization in breeding (Radušienė and Vaičiunienė, 1999). Not all criteria are met in each case. The species may be, but are not necessarily the most threatened MAP plants. They are following: *Achillea millefolium, Allium oleraceum, Carum carvi, Helichrysum arenarium, Hypericum perforatum, H. maculatum, Origanum vulgare, Thymus pulegioides, T. x oblongifolium, Viola tricolor*.

The strategy for the conservation of target species is based on the following activities:

1. Collecting of wild accessions.
2. Botanical identification and characterisation.
3. Introduction into field cultivation.
4. Evaluation and selection of accessions.
5. Multiplication of selected material.
6. Seed storage.
7. Breeding projects.

It seems to be obvious that many of the indigenous species will remain collected from wild in the future as their cultivation in many cases is complicated due to their biological peculiarities or many of them are required in very small quantities. Some different possibilities to avoid potential danger and existing threats to MAP species including in situ and ex situ conservation, and cultivation projects. The germplasm conservation of MAP ought to be carried out jointly with the research and plant breeding. Natural populations are a big reserve for selection of cultivated material. With the introduction of appropriate biological and economic regulations, Lithuania could become a large supplier of MAP raw material in future.

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Tables

Table 1. MAP species included in the National Red Book.

Allium angulosum, Arctium nemorosum, Allium scorodoprasum, Allium ursinum, Allium vineale, Arnica montana, Gentiana cruciata, Hedera helix, Hypericum hirsutum, Hypericum montanum, Mentha longifolia, Polemonium coeruleum, Pulmonaria angustifolia, Salvia pratensis

Table 2. List of threatened and endangered MAP species, which collecting from wild regulates by legislations.

Plant species	Life form	Plant part used	Mode of conservation
Acorus calamus	herbaceous perennial	rhizome, leaves	in situ
Allium ursinum	herbaceous perennial	leaves	in situ
Angelica archangelica	herbaceous perennial	roots, leaves	in situ, ex situ
Arctostaphyllos uva-urs	subshrub	leaves	in situ
Centhaurium erythraea	biennial	herb	in situ, ex situ
Centhaurium pulchellum	biennial	herb	in situ
Cetraria islandica	foliose lichen	whole thallus	in situ
Chimophila umbellata	herbaceous perennial	herb	in situ
Convallaria majalis	herbaceous perennial	leaves	in situ, ex situ
Digitalis grandiflora	biennial	herb	in situ, ex situ
Helichrysum arenarium	herbaceous perennial	flowers	in situ, ex situ
Hierochloe australis	herbaceous perennial	herb	in situ, ex situ
Hierochloe odorata	herbaceous perennial	herb	in situ, ex situ
Gentiana cruciata	herbaceous perennial	rhizomes	in situ, ex situ
Lycopodium annotinum	herbaceous perennial	spores	in situ
Origanum vulgare	herbaceous perennial	herb	in situ, ex situ
Plantago arenaria	annual	seeds	in situ, ex situ
Poleminium caeruleum	herbaceous perennial	herb	in situ, ex situ
Potentilla erecta	herbaceous perennial	rhizome	in situ, ex situ
Primula veris	herbaceous perennial	flowers, leaves	in situ, ex situ
Sanguisorba officinalis	herbaceous perennial	herb	in situ, ex situ
Viola tricolor	annual	herb	ex situ
Viscum album	shrub	leaves	in situ

Table 3. Grouping of medicinal and aromatic plants of commercial interest according to the sources of raw material.

Sources of raw material	Species
Sufficient	*Achillea millefolium, Artemisia vulgare, Artemisia absinthium, Calluna vulgaris, Crategus* sp., *Epilobium angustifolium, Equisetum arvense, Filipendula ulmaria, Frangula alnus, Fragaria vesca, Glechoma hederacea, Hypericum perforatum, Humulus lupulus, Ledum palustre, Menyanthes trifoliata, Pulmonaria officinalis, Rubus idaeus, Tilia cordata, Tussilago farfara, Taraxacum officinale, Urtica dioica, Vaccinium vitis-idaea, Vaccinium myritillus*
Limited	*Arctostaphyllos uva-ursi, Arctium lapa, Arctium tomentosum, Agrimonia eupatoria, Angelica archangelica, Bidens tripartite, Chamomilla recutita, Chelidonium majus, Cichorium intybus, Convallaria majalis, Helichrysum arenarium, Inula helenium, Leonurus cardiaca, Malva sylvestris, Oenothera biennis, Origanum vulgare, Plantago arenaria, Primula veris, Plantago major, Polygonum bistorta, Potentlla erecta, Sambucus nigra, Symphytum officinale, Tanacetum vulgare, Viburnum opulus, Verbascum nigrum, Valeriana officinalis, Viola arvensis, Thymus serpyllum*
Deficient	*Acorus calamus, Arnica montana, Centhaurium erythraea, Cetraria isandica, Drosera anglica, Gentiana cruciata, Gnaphalium uliginosum, Herniaria glabra, Herniaria hirsuta, Lycopodium clavatum, Mentha longifolia, Petasites officinalis, Polygonum aviculare, Polemonium ceruleum, Viola tricolor, Viscum album*

Figures

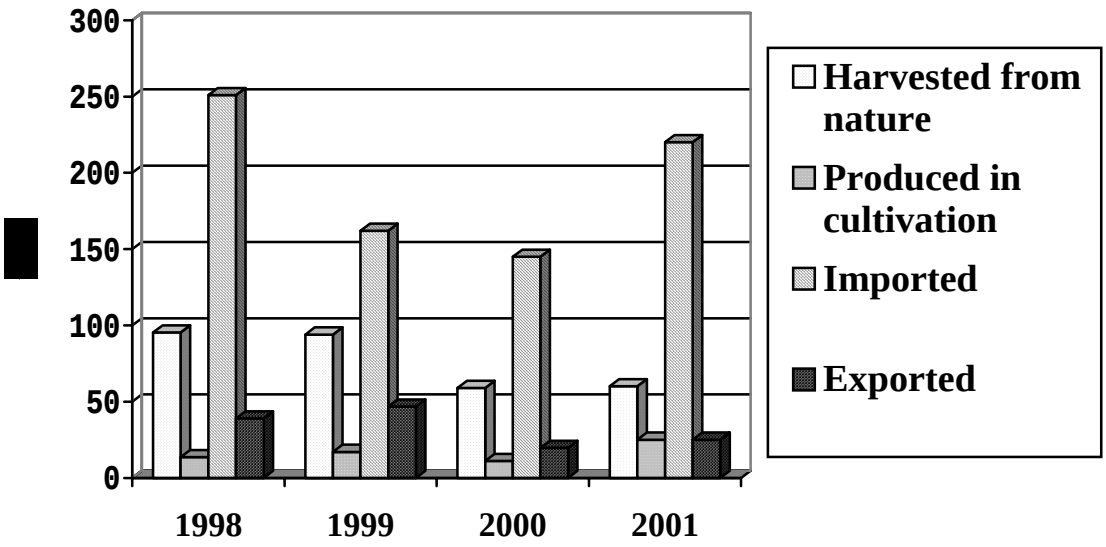

Fig. 1. Total volumes of raw material of medicinal and aromatic plants produced in natural habitats, cultivated, imported and exported in 1998-2001.

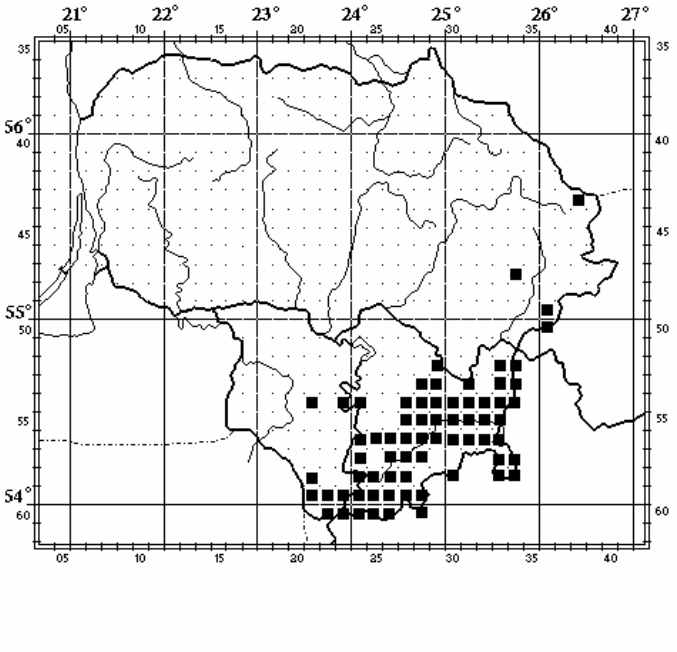

Fig. 2. Distribution of *Arnica montana* indigenous populations in Lithuania.