

MEDICINAL AND AROMATIC PLANTS – PORTUGAL

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Summary

In recent years, the use of medicinal and aromatic plants (MAP) has increased greatly all over the World and Europe in particular, putting pressure on natural resources. The

European Plant Conservation Strategy (EPCS) states that 90% of MAP species native to Europe are still collected from the wild.

The use of plants for medicine is by far the biggest use of plants in term of the number of species specifically targeted. Plants provide the predominant ingredients of medicines in most traditional healing systems and have been the source of inspiration for several major pharmaceutical drugs.

Although much of the trade is not or is poorly recorded or documented, according to several reports, the scale of trade in MAP species ranges from local to international. Due to the lack of information, decision makers usually have little awareness of the significance of trade and consumption of medicinal plants and the impact that collecting from the wild has on natural habitats.

Portugal has made considerable contributions to the knowledge and use of MAP. Recently, pluridisciplinary research teams have implemented networks that allowed an integrated approach, ranging from ethnobiology and technical knowledge to sustainable conservation and use.

1. Introduction

What are Medicinal and Aromatic Plants (MAP)?

Medicinal plants are plants that provide people with medicines - to prevent disease, maintain health or cure ailments. In one form or another, they benefit virtually everyone on Earth.

Aromatic plants are used for their aroma and flavour possesses aromatic compounds, most of which are essential oils which are volatile at room temperature. These compounds are synthesized and stored in special structures called glands which are located in different parts of the plant such as leaves, flowers, fruits, seeds, barks and roots. These essential oils can be extracted by various physical and chemical processes such as steam distillation, hydrodistillation and expression, in the case of *Citrus* fruits. *Enfleurage*, the process that uses odourless fats that are solid at room temperature to capture the fragrant compounds exuded by plants, and solvent extraction are also used to isolate volatile compounds. Essential oils and volatiles are mainly used as flavours and fragrances. However, from ancient times, these plants have been used as raw materials for, namely, cosmetics, pharmaceuticals and botanical pesticides.

MAP can be divided into four groups based on how they are utilized:

- *As raw materials for essential oil extraction:* This is the major use of MAP in the world
- *As spices:* These are plants in which their non leafy parts are used as a flavouring or seasoning.
- *As herbs:* These are plants in which their leafy or soft flowering parts are used as a flavouring or seasoning.
- *Miscellaneous group:* These are MAP used in some ways other than the ones mentioned above, for example: as medicines, cosmetics, dyes, air fresheners,

disinfectants, botanical pesticides, herbal drinks/teas, *pot pourri* and insect repellents.

People have made extensive use of MAP from immemorial times; and there are traditional uses of MAP in traditional societies, as well as in modern societies. The Egyptian, the Persian, and the Babylonian were known to grow and use MAP in making perfumes and other scented waters from the distillation of rose petals and orange blossoms. In traditional societies, like China, a large amount of documentation and knowledge over this species is well recognized and their use in traditional medicine is by far the largest used by the population, in some of the countries it is up to 70%.

In modern societies and in the last decades, the use of MAP has been more common and seems to be related to the implementation of the traceability and safety of the natural products' methods. There has been an increasing interest in the use of plant derived medicines, in countries like Germany, United Kingdom and also in Portugal, as well as in most of the European Union (EU) member countries. Best confidence and availability of plant derived medicine to a larger group of people, has promoted the use of such products.

Due to this increasing demand of MAP, two main questions arise: what are the sources for these materials and, does offer covers demand?

As for the first question, there is no doubt that the large majority of the material comes from wild collecting. As for the second, Europe is responsible for one third of the annual importation and one fifth of the annual global exportation. Europe is divided into source and consumer countries. In Europe, at least 2,000 MAP plant *taxa* are used in commercial basis, of which, two thirds, 1,200-1,300 species are native to Europe.

The Mediterranean region is one of the major centres of plant diversity, where nearly 25,000 species occur, half of which are endemic to the region. Is one of the most important centres of origin and diversity of cultivated plants, identified by N.I. Vavilov (Russian botanist, geneticist and plant explorer best known for having identified the centres of origin of cultivated plants). The Mediterranean flora is particularly rich in MAP, especially the family *Labiatae*, *Umbelliferae* and *Compositae*, and the region is also regarded as one of the main centres of diversity of medicinal and aromatic plants.

Portugal, crossroad of peoples and cultures which, allied to geographical factors, has given rise to very diverse environmental niches, is cradle to a rich flora, comprising 3,800 described species of which, 500 are of aromatic and/or medicinal potential. These species are distributed mainly by the families *Apiaceae*, *Asteraceae*, *Cupressaceae*, *Hypericaceae*, *Lamiaceae*, *Lauraceae*, *Leguminosae*, *Liliaceae*, *Malvaceae*, *Myrtaceae*, *Oleaceae*, *Pinaceae*, *Rosaceae* and *Rutaceae*. Some of these species are endemic, sometimes with very vulnerable ecological niches. Many of these species are the subject of monographs in European and Portuguese pharmacopoeias.

Portugal's contribution to the knowledge of the medicinal properties of plants and its applications took very early a prominent status. Garcia de Orta, a Jewish Portuguese doctor who lived in India during the 16th century, revealed his remarkable knowledge

of Eastern spices and drugs in his work “Colóquios dos simples e drogas he cousas medicinais da India” (“Conversations on the simples, drugs and medicinal substances of India”), published at Goa in 1563. Garcia de Orta was the first European author to write about botany, medical matters and tropical medicine, describing the Asiatic cholera for the first time.

The treaty, in the form of a dialogue between Garcia de Orta and Ruano, a doctor recently arrived in Goa, includes 57 chapters addressing approximately the same number of oriental drugs, mostly of plant origin, detailing the names and properties of plants, case studies of different diseases and other Indian medical knowledge. The work, written in Portuguese, was translated into Latin and other languages, providing the earliest systematic exploration of Indian medicine by a European.

The International Regulatory Cooperation for Herbal Medicines (IRCH), a global network of regulatory authorities responsible for regulation of herbal medicines, was established in 2006, with the mission to protect and promote public health and safety through improved regulation for herbal medicines. The network’s membership is open to any national regulatory authority and regional/sub-regional bodies, responsible for the regulation of herbal medicines.

According to The World Wide Fund for Nature (WWF), in Europe, over 340 medicinal and aromatic plant species are fully or partially protected by the combined legislation of Bulgaria, France, Germany, Hungary, Spain and Turkey.

In spite of the tangible and intangible values of this worthy resource of plant species with medicinal and aromatic properties, the pressure put on wild populations by the direct collecting of plants or plant parts, jeopardises its own existence. The Food and Agriculture Organization of the United Nations (FAO) in its Second Report on the State of the World’s Plant Genetic Resources for Food and Agriculture, lists seven countries that provided examples of genetic erosion in the medicinal and aromatic plants’ group.

On what global germplasm holdings is concerned, the same report shows that a total of 160,050 accessions of medicinal, aromatic, spice and stimulant crops are maintained in genebanks worldwide, while botanical gardens, globally, have about 1,800 medicinal plant *taxa* represented in their collections. As for the group of medicinal plants alone, 65% is morphologically characterised, while 64% and 24% are, respectively, agronomical and biochemical evaluated.

The components that differentiate MAP plants from the others, giving it therapeutic value and aroma, are the active principles. Among these are: the alkaloids, toxic compounds that act on the central nervous system. They may have varied therapeutic activity as that of the opium that is used as a narcotic, the action of quinine on fever, the broom action as a heart regulator, the tea as a diuretic. The alkaloid content in plants increases until the flowering and declines rapidly after that; the glycosides, only in special cases are close to alkaloid medicinal properties; the essential oils, appear in many plants with a characteristic aroma, generally pleasant, which may be obtained by distillation; the tannins, with anti-diarrhoeal action, are easily oxidized; the bitter principles, from various sources, usually glycosidic, have a bitter taste, and by

stimulating secretion of gastric juices create conditions for improving the appetite; the mucilage, hydrocarbons that increase in volume by hydration are used as laxatives, lubricants or anti-inflammatory drugs.

Today's knowledge of MAP plants in Portugal continues to be an important subject in the botanical and biochemical research, with a considerable number of scientific publications. In other domains as the genetic resources conservation, phytotechniques and biotechnology, the levels of knowledge vary from basic to advanced knowledge. The sustainable use of MAP in Portugal is integrated in wider strategies, such as the European Union (EU) and natural resources policies.

2. Plants, People and Culture

The symbiotic relationship of Man and plants is old as humankind itself. Since its origins that Man has depended upon plants and plant products for food, shelter, energy and health. With the evolution of Man and the subsequent development of civilisations, plants and plant products progressively gain other niches of importance, of intangible nature, such as of cultural and religious significance.

The scientific study of the relationships that exist between people and plants is called Ethnobotany (from "ethnology" - study of culture and "botany" - study of plants).

Considered the first ethnobotanical treaty, "De Materia Medica" was published in A.D. 77 by the Greek doctor Dioscorides. The illustrated book, a catalogue of about 600 plants in the Mediterranean, includes information on how the Greeks used the plants, especially for medicinal purposes, also containing information on how and when each plant was gathered, whether or not it was poisonous, its actual use, and whether or not it was edible (it even provided recipes). Dioscorides also stressed the economic potential of plants.

Although modern humans have emerged some 150,000 years ago, it was only about 11,000 years ago that humans started to tend plants deliberately for the production of food. With the spread of farming technologies throughout the world, humans gradually changed from hunter-gatherers to food producers through the practice of the science/art of agriculture. However, it was only in the 15th Century that the term agriculture, of the Latin *agricultūra*, from *ager*, "a field", and *cultūra*, "cultivation", was coined.

Ever since the onset of the practice of agriculture, the bond between Man and plants never ceased to tighten. With the domestication of crops, many plant species became dependent on human intervention for their survival while human dependency on plants became more and more critical, nowadays relying on a small number of crops for global food security. In spite of the estimated number of described plant species amounting to 268,000 (estimate of the International Union for Conservation of Nature - IUCN), according to the FAO, only 30,000 are edible and only about 7,000 species of plants have been cultivated for consumption in human history.

Many plant species combine alimentary, seasoning, aromatic and, medicinal characteristics which are historically and ethnobotanically known. Anthropological and

ethnobotanical research shows evidence that plants, and especially medicinal plants, would have been used as votive offers to Gods, in the form of feasts, rituals and art as earlier as the Holocene.

The dogma "Let food be thy medicine and medicine be thy food" embraced by Hippocrates nearly 2,500 years ago is attracting renewed interest. New designations have emerged to classify the beneficial effects of the use of some plants or plant parts and products. The term "functional foods" was first introduced in Japan in the mid-1980s to define foods or dietary components that may provide a health benefit beyond basic nutrition. Clearly, all foods are functional, as they provide taste, aroma, or nutritive value. Within the last decade, however, the term "functional" applied to food, has adopted a different connotation, that of providing an additional physiological benefit beyond that of meeting basic nutritional needs.

Even today, plants provide for primary needs as well as social needs, such as body painting, make-up and ornaments, and are also common symbols and emblems (like elements in national flags) and have also been employed in ceremonies and religious rites, fulfilling transcendental needs.

Within the plant species, plants with therapeutic and aromatic properties have received, since antiquity, special attention by Man and, at present, more than 100 countries have regulations for herbal medicines.

More recently, in 1996, the adoption of the FAO Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture, although of voluntary compliance, also advocates encouraging and promoting a pooling of efforts at the global level, to strengthen the institutional capacity as well as actions for the safeguarding of genetic resources and traditional knowledge, including that related to MAP.

2.1. Traditional Uses in Modern Societies

Herbal medicines include herbs, herbal materials, herbal preparations, and finished herbal products that contain parts of plants or other plant materials as active ingredients. Herbal treatments are the most popular form of traditional medicine and are highly lucrative. In Western Europe alone, annual revenues reached US\$ 5 billion in 2003-2004.

At present, 80% of the population in developing countries relies largely on plant based drugs for their health care needs and the World Health Organization (WHO) has estimated that in coming decades a similar percentage of the world population may well rely on plant-based medicines. According to an FAO report on trade in medicinal plants, thirty percent of the drugs sold worldwide contain compounds derived from plant material.

The same report reveals that, in 2002, Europe, as a whole, imported a value of 462.8 million US\$ in medicinal plants while, for the same period, exported a value of 1034.8

million US\$, with values, imports and exports, showing a significant increase along the period under analysis, 1991-2002.

2.2. Traditional Uses in Traditional Societies

Traditional medicines, including herbal medicines have been used and continue to be used in most of the countries around the world. The WHO states in its last report that, in most of the developing world, especially in Asia, Africa, Latin America and the Middle East, 70-95% of the population depend on these traditional medicines for primary health care. In some industrialized nations, use of traditional medication is equally significant; Canada, France, Germany and Italy for instance, report that between 70% and 90% of their populations have used traditional medicines under the titles “complementary”, “alternative”, or “nonconventional”. The global market for traditional medicines was estimated at US\$ 83 billion annually in 2008, with a rate of increase that has been exponential.

From an ethnobotanical point of view, the use of aromatic, medicinal and condiment plants is an integral part of Portuguese culture, with many references to its use in different situations. In fact, the knowledge of these plants documented in ethnobotanical studies is much more recent as shown by the bibliographic sources. However, the empirical knowledge is well established among rural communities to whom, until about 3 decades ago, the access to conventional medicine was difficult due to socio-economic reasons. These communities, given the circumstances and adversity, had the talent to understand the potential of the plants they had available by integrating them in cooking (as a spice, flavouring, preservative) and in the medicinal use (topical applications, infusions, teas) in humans and animals.

Gender is an important determinant of the extent and nature of the diversity and a key aspect of sustainable crop production and food security. Women, most frequently than not, hold the responsibility of managing home gardens which includes, besides a wide array of vegetables and fruits, spices and medicinal plants.

An extensive ethnobotanical work was done in Portugal in the last five years and yielded interesting results that confirmed many assumptions and estimates, the first being the confirmation that traditional knowledge in general and on MAP in particular, is held by women. The second confirmation was that the traditional knowledge (TK) is held, predominantly, by older people, again, mostly women, being the higher number of respondents between 60 and 80 years of age. The third point is that, in average, the people with knowledge on the identification and use of MAP have low level of formal education, with most of the respondents being illiterate or having only attended primary school.

The results produced emphasises the fragility of the wild populations of plant species with therapeutic and aromatic properties, jeopardised by genetic erosion and the associated knowledge that is primarily held by, predominantly women, but also men, aged and with low formal education level. Since the TK is transmitted from one generation to the next by the word of mouth, the prevailing situation bears witness that, not only the plant material is endangered but the associated TK as well is in risk of

being lost, thus the necessity and importance of the continuation of the collecting and documentation of plant species with therapeutic and aromatic properties as well as the traditional knowledge associated to their identification, conservation and uses.

In spite of the importance vested by MAP in the sustainable rural development, livelihood of rural populations, public wellbeing, economy and culture, the European Union is drastically reducing access to the vast majority of herbal medicinal products as of 1st May 2011 through the application of the Traditional Herbal Medicinal Products Directive (THMPD), Directive 2004/24/EC of the European Parliament and of the Council of 31 March 2004 amending, as regards traditional herbal medicinal products, Directive 2001/83/EC on the Community code relating to medicinal products for human use.

Under this regulation, all herbal medicinal products are required to obtain an authorisation to be marketed within the EU. All those products that were already in the market before this Directive came into force could continue to be traded until 30 April 2011, under the transitional measures defined in the THMPD. After this date, all herbal medicinal products must have prior authorisation before they can be sold in the EU. For those herbal medicinal products that were not on the market before 30 April 2004, an authorisation must be obtained to allow the product to be marketed. Herbal medicines must be now manipulated following the Good Manufacturing Practice (GMP) to ensure the quality of the final product as well as demonstrate its safety.

This situation, as 1st May 2011, means that, under the THMPD, a company needs to demonstrate the safety and efficacy of the herbal medicine through traditional use within the EU for at least 30 years or 15 years within the EU and 30 years outside the EU. There is concern that some herbal remedies of 30 years ago, which are no longer widely used, could still be sold but that valid new herbs which cannot meet the 30 year rule may not be authorised for sale. The applied rule could also mean that it may not be possible to license some traditional herbal medicines which were in common use more than 30 years ago, but have since fallen into disuse.

According to some authors, this simplified medicinal product registration scheme offered by the THMPD although providing an additional regulatory route, specifically intended for botanicals associated with traditional systems of medicine, a series of eligibility and technical challenges, as well as prohibitive costs, prevent a very large number of traditional medicines from being registered under the scheme.

In Portugal, the law DL 118/2002, published in 20 April 2002, defines the legal framework for the protection of plant genetic resources and the associated traditional knowledge.

Box 1. Impact of EU and national legislation on MAP utilization

Another important measure to help to reduce, or even halt, the negative impact of the collecting from the wild of populations of plant species with therapeutic and aromatic properties is the promotion of its cultivation. This measure, while alleviating the

pressure on the wild populations of MAP species, is also an important measure to ensure the regular supply of quality material to manufacturers and an important element towards the valorisation of the rural areas and the improvement of livelihoods of small-scale farmers through the provision of diversified sources of income and the promotion of more eco-friendly agricultural practices.

3. Medicinal and Aromatic Plants' Natural Resources

Medicinal and aromatic plants are characterized by producing a wide variety of natural compounds, which are, in many cases, produced by specialized secretory structures. Seemingly showing no direct function in growth and development of the producing plant, these natural compounds are, for this reason, also known as secondary metabolites. These natural products are, nevertheless, extremely important for plant fitness and survival, namely as pollinators attractants, as herbivores deterrents or as defence against pathogenic microorganisms.

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Glossary

Proprietary medicinal product :	Any ready-prepared medicinal product placed on the market under a special name and in a special pack.
Medicinal product :	Any substance or combination of substances which may be administered to human beings with a view to making a medical diagnosis or to restoring, correcting or modifying physiological functions in human beings is likewise considered a medicinal product.
Essential oil :	An essential oil is internationally defined (AFNOR and European Pharmacopoeia), as the product obtained by hydro-, steam- or dry-distillation of a plant or of some parts of it, or by a appropriate mechanical process without heating, as in the case of <i>Citrus</i> fruits.
Traditional Knowledge :	Traditional knowledge (TK) is the information that people in a given community, based on experience and adaptation to a local culture and environment, have developed over time, and continue to develop. This knowledge is used to sustain the community and its culture and to maintain the genetic resources necessary for the continued survival of the community.
Genetic resources :	Genetic material of actual or potential value (as defined by the CBD, 1992)

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Biographical Sketches

Ana Maria Barata is an agronomist by training. She is the director of the Portuguese Genebank, Portugal, which holds the mandate for plant genetic resources conservation, and maintains a gene bank of several crops, Medicinal and Aromatic plants included. She is involved in policy development of PGR and in genetic resources management aspects, and participates in various international programs on this issue. She is the Chair of MAPWG, in the European Cooperative Programme for Plant Genetic Resources and also the vice Chair of the MAP group in the International Horticultural Society. She is particularly interested in complementarities between *ex situ* and *in situ* conservation approaches for plants, in particular MAP species.

Filomena Rocha is responsible for Documentation and Information of Plant Genetic Resources in the Portuguese Genebank (BPGV). Organized and participated in many germplasm collecting missions of cultivated and wild species in Portugal, Medicinal and Aromatic plants included. It has integrated the research team of several projects nationally and internationally and has authored or co-author of several publications. It was responsible for installation and maintenance of field collections of medicinal and aromatic species and developed the morphological characterization and preliminary evaluation of the genus *Capsicum* and specie *Origanum vulgare* L. subsp. *virens*.

Violeta Lopes. Agronomist, with expertise in Germplasm Collection, Conservation, Characterization and Utilization of forage and pasture species and medicinal and aromatic plants, in the Portuguese Genebank, particularly in valorization of genetic resources. It has integrated the research team of several projects nationally and internationally and has authored or co-author of several publications.

Eliseu Bettencourt is currently on leave of absence from the “Instituto Nacional de Recursos Biológicos - I.P. Between 1985 and 1994, for a total of six and half years, was consultant to the International Board for Plant Genetic Resources (IBPGR), today Bioversity International, and the Food and Agriculture Organisation of the United Nations (FAO) in the area of documentation and information on plant genetic resources.

Since 1977 until 2006 participated in many germplasm collecting missions resulting in the collecting, conservation and documentation of several thousand accessions of crops and crop wild relatives.

Member of the Portuguese Delegation representing the country for the revision of the International Undertaking which led to the adoption of the International Treaty on Plant Genetic Resources for Food and Agriculture in 2001. Implemented, jointly with IPGRI (1999-2001), a project “The Lusophone Initiative on Plant Genetic Resources - A collaboration between Portugal, IPGRI and the Lusophone Countries of Africa” involving the five Lusophone countries of Africa, in the area of capacity building in PGR.

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