



Conservation and sustainable uses of medicinal and aromatic plants genetic resources on the worldwide for human welfare



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ABSTRACT

Plants have been used since ancient times to heal and cure diseases and to improve the health and the wellbeing of the populations. Medicinal and aromatic plants still form the basis of traditional or indigenous health systems of the populations in most of the developing countries, as reported by the World Health Organization (WHO).

As a result of the expanding interest in medicinal and aromatic plants, new income generating opportunities are opening up for rural populations. With many of the MAPs gathered from the wild, the recollection and sale of MAPs is providing a complementary source of income for many poor rural households.

Currently, we are facing an incomparably growing pressure on plant populations in the wild due to the increasing commercial recollection, largely unmonitored trade, and habitat loss. Profound knowledge of the features of the (international) trade in botanicals (size, structure, streams, commodities, traded quantities and their origin) is (1) essential for assessing the trade's impact on the plant populations concerned; and (2) required for conservation concepts and measures which have to meet future supply and the provisions of species conservation.

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1. Medicinal and aromatic plants and human welfare

The biological resources of medicinal and aromatic plants have been used extensively for health care and healing practices across history and cultures.

Long before the rise of pharmaceutical development, societies have been drawing on their traditional knowledge, skills and customary practices, using various resources provided to them by nature to prevent, diagnose and treat health problems.

Today, these practices continue to exist in health-care systems and support local communities in many places around the world (Traffic International, 2015a, WHO, 2013). In socioecological contexts such as these, several resources used for food, cultural and spiritual purposes are also used as medicines (Unnikrishnan and Suneetha, 2012).

In time, the usage of specific medicinal plants for the treatment of certain diseases was an empiric framework, presently became

a result of scientific knowledge. Nowadays, almost all pharmacopeia's in the world prescribe plant drugs based on plants, with real medicinal value (Petrovska, 2012).

Traditional medicine practices provide more than health care to these communities, it is considered a way of life. Despite noteworthy the advances in public health, modern health-care systems worldwide still do not adequately meet the health-care needs of large sections of the population across the globe and the health and development goals of many communities remain unrealized (Kim et al., 2013). So consequently, health-seeking behaviour in both urban and rural contexts around the world is increasingly becoming pluralistic or a mix of different medical systems.

In regions of Asia, Africa, Latin America and the Middle East, 70–95% of the population depend on traditional medicine for primary health care. In countries like Canada, France, Germany Italy, also report that 70% to 90% of their population has used traditional medicine as “complementary”, “alternative” or “nonconventional”. Also the percentage of people using traditional medicine has increased: 40–50% in Germany, 42% in USA, 48% in Australia and 49% in France. In conclusion, eighty percent of the population in those countries, largely rely on plant based drugs for their health

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care needs and it is estimated that in the next decades a similar percentage of the world population may still rely on them (FAO, 2005).

It is formally recognized the existence of complementary and alternative medicine (CAM) practitioners, trained in the traditional medical systems such as Ayurveda, Traditional Chinese Medicine, Kampo, Siddha, Tibetan medicine, Unani and several others (Payyappallimana, 2010).

Many pharmaceutical drugs used today, are derived from plants that were initially used in traditional medicine systems (Fabricant and Farnsworth 2001), according to WHO, approximately 25% of these are plants. Thirty percent of the drugs sold worldwide contain compounds derived from plant material (FAO, 2005).

Health-related traditional knowledge has been commonly accessed for developing new medicines, although knowledge, practices and resources have often been misappropriated (Timmermans, 2003). The extent to which traditional medicine can guide drug discovery has been subject to controversy, contributing to fluctuations in investment in bioprospecting informed by ethnobotanical data (Saslis-Lagoudakis et al., 2012).

Plants used in traditional medicine are important for local health practices and also for international trade, based on their broader commercial use and value (Fabricant and Farnsworth 2001). Globally, it is estimated that 60,000 species are used for their medicinal, nutritional and aromatic properties and, every year, more than 500,000 tons of material from such species is traded (UN COMTRADE, 2013).

It is estimated that the value of the global trade in plants used for medicinal purposes may exceed US\$ 2.5 billion, and is increasingly driven by industry demand (UN COMTRADE, 2013). The global market for traditional medicine was estimated at US\$ 83 billion annually (2008), with a rate of exponential increase.

A complete list of all plants used in traditional medicine does not exist, but at least 30,000 species of plants with documented use are included in the Global Checklist, with a Natural Products Alert Database (NAPRALERT), a responsibility of WHO Collaborating Centre, at the University of Illinois in Chicago.

Searchable databases for health-related traditional knowledge, which ensure the protection of related resources and knowledge, are currently being developed. A unique database project is the Traditional Knowledge Digital Library, which was developed through collaboration between the Council for Scientific and Industrial Research, the Indian Ministry of Science and Technology, and the Ministry of Health and Family Welfare. The Traditional Knowledge Resource Classification, an innovative structured classification system, has been developed for about 25,000 subgroups related to medicinal plants, minerals, animal resources, their therapeutic uses, clinical applications, methods of preparation, modes of administration, etc.

These registers, led by Non-Governmental Organizations (NGOs) attempt to rally community members to discuss and document their knowledge and practices in different categories of resource use or practices based on two premises: (1) that by documentation, they establish prior art over the knowledge and resource use, and (2) it promotes greater use and practice of the knowledge within the community, eventually reinforcing such use as strong social traditions. These documents therefore can be viewed as legal tools to foster protection of the rights of the communities. These databases are useful for exemplifying the value of encouraging the development and improvement of community knowledge registers and biocultural protocols, and linking them with national databases for protection (Ningthoujam et al., 2012).

Furthermore, traditional medical knowledge can inspire industrial research and development processes in bioresource-based sectors, which require mechanisms to secure appropriate attribution and sharing of rights and benefits with knowledge holders, as

set out in the text of the Convention on Biological Diversity (CBD) and the Nagoya Protocol on access to genetic resources and equitable sharing of benefits arising from their commercial utilization.

The demand for herbal medicines is rising drastically, fuelled by factors such as cost-efficacy and higher perceptions of safety. In countries like India, it has been estimated that approximately 80% of medicinal plants are collected from the wild, leading to an increasing pressure on natural resources (FRLHT, 1999; FRLHT, 2009). Due to overharvesting and habitat loss, approximately 15,000 species (or 21%) used in the global medicinal plant species are now endangered (Schippmann et al., 2006). With rising demand and reducing populations, problems of substitution, adulteration and mistaken identities between species are also on the rise.

2. Conservation and sustainable uses of medicinal and aromatic plants

Globally, an estimated 60,000 species are used for their medicinal, nutritional and aromatic properties, and every year more than 500,000 tons of materials from such species are traded (WHO, 2015).

2.1. Trade of medicinal and aromatic plants

In 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 (Barata et al., 2011a).

In the last three decades a substantial growth in herb and herbal product markets across the world is verified, according to the Secretariat of the Convention on Biological Diversity, the global sales of herbal products totalled an estimated value of US\$60,000 million in 2002 (FAO, 2005).

Every year, half a million tonnes of dried medicinal and aromatic plants (MAP) are traded internationally and also unknown, but substantial quantity is traded on national and local markets. More than 50% of the plants are harvested from the wild, and the demand for MAP is increasing world-wide (Traffic International, 2015b).

Herbal treatments are the most popular form of traditional medicine and are highly lucrative in the international marketplace. Western Europe alone, annual revenues reached US\$ 5 billion in 2003–2004 (World Health Organization, 2008; Chaudhary et al., 2010).

The trade in pharmaceutical plants is dominated by only few countries with three international trade centers Germany, USA and Hong Kong. Twelve countries make up 80% of both the exports to and the imports from the world market. The major markets are in the developed countries, while the bulk of pharmaceutical plants are exported from developing countries, not or only little processed and of wild origin (Barata et al., 2011a).

The trade also provides a source of income to millions of households involved in collection, with women often playing the major role, and supply industrial production of a wide array of medicinal and household products. Although accurate data is lacking, available information indicates that trade is increasing.

According to Traffic International 90% of MAP native to Europe are wild collected for commercial use. The reason lies in lower prices of wild collected plant material when compared to that of cultivated plant material. The overall volume of wild collected plant material in Europe is estimated to be about 20,000–30,000 tons annually (Baričević and Zupančič, 2000).

Thus, only a scarce 10% of raw materials result from a cultivated source, even this could result in a more consistent quality and less risk of adulteration, than their wild counterparts.

Overharvesting, land-use change, and climate change are among the major drivers of the decline in wild plant resources, including those used commercially for food and medicinal purposes (Hawkins, 2008; FRLHT, 1999; FRLHT, 2009; Ford et al., 2010; Reyes-García, 2010).

2.2. Actions towards MAP conservation and sustainable use

In 2002, a global Plant Conservation Strategy was launched that set a long term task, no species of wild flora should be endangered and at least 30% of all based plant based products should derived from sources that are sustainable managed.

In Europe, at least 2000 MAP species are used on a commercial basis, of which 1200–1300 are native to Europe (Barata and Asdal, 2012).

The increased global interest in the use of MAP, and the increasing demand on raw materials by various processing industries (pharmaceutical, food, cosmetic, perfume, etc.) have resulted in the increasing demand for MAP, placing pressure on natural resources, since most species used are still collected in the wild. Uncontrolled over-exploitation of wild plants, their habitat-loss and alteration are the main reasons why medicinal plants, their study, evaluation, utilization and conservation have become essential parts of the programmes of expanding market (Barata et al., 2011b). Collecting from the wild still plays a vital role in the trade of MAP in Europe, as prices from this material are much lower than the material of cultivated origin (Moré et al., 2013). Overharvesting, habitat alteration, and climate change are among major drivers of declines in commercially important wild plant resources used for food and medicinal. This poses a threat, both to the wild species and to the livelihoods of collectors, who often belong to the poorest social groups. There is a clear need to continue efforts at developing assessment methods and indicators for conservation and sustainable use (WHO, 2015).

Currently, we are facing an incomparably growing pressure on wild plant populations

So a profound knowledge of the features of the international trade in botanicals (size, structure, streams, commodities, traded quantities and their origin) is:

- Essential for assessing the trade's impact on the plant populations.
- Required for understanding conservation concepts, apply measures and strategies, to meet future supply needs and make provisions of species conservation.

So, *in situ* and *ex situ* conservation (field, seed and *in vitro* collections), complementary conservation strategies, are being implemented in Europe and other continents in the world for plant genetic resources in general, and MAP species in particular.

2.3. Working group on medicinal and aromatic plants

Recognizing the importance of the MAP conservation, the Steering Committee of the European Cooperative Programme for Plant Genetic Resources (ECPGR), during its eighth meeting, in October 2001, agreed on the establishment of the Medicinal and Aromatic Plants Working Group (MAPWG).

The Working Group (WG) 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. The scope of activities is the Conservation of MAP species in Europe; Inventory of MAP genetic resources; Characterization and Evaluation of MAPs; Development

of descriptors at Genus level; Documentation of *ex situ* collections and *in situ* populations.

During the last MAPWG meeting held in 2009 (Kuşadası, Turkey), the main decisions were and are being implemented: crop-specific characterization and evaluation descriptors for ten target species descriptors, documentation of *ex situ* collections and *in situ* populations, following the EURISCO procedures.

The list of priority species was agreed by WG, to serve as models and for which species-specific descriptor lists were developed and published: *Achillea millefolium* agg., *Artemisia absinthium*, *Carum carvi*, *Gentiana lutea*, *Hypericum perforatum*, *Mentha piperita* and *M. spicata*, *Melissa officinalis*, *Origanum* spp., *Salvia officinalis*, *Thymus vulgaris* and *T. serpyllum*.

A common project: conservation and characterization of oregano (*Origanum vulgare* L.) wild populations in Europe, involving 19 countries from the WG, was implemented. The main objectives were, to make an inventory and to survey native populations of wild oregano, to characterize their genetic and chemical variability, and to find out the distribution pattern of taxonomically defined populations in European countries. A genetic gradient could be observed from east to west, but not from south to north. The oregano populations from the Iberian Peninsula are very closely related to each other and form a quite distant group from the other European populations. However, a clear gradient from east to west could be observed. Interestingly, Norwegian and Finnish oregano populations have different origins in the Mediterranean and are not as closely related as their geographical distance would assume (ECPGR Medicinal and Aromatic Plants Working Group).

3. Conclusions

It is possible to define a MAP Programme for the *in situ* and *ex situ* conservation, ethnobotany, characterization, evaluation in support of the promotion of their sustainable utilization.

Developing the necessary methodologies for implementing an effective training on wild harvesting of non wood forests products (NWFP), focusing specially in medicinal and aromatic plants (MAPs) is a goal for FairWild Standard implementation.

Established networks make possible to increase the extent and effectiveness of the knowledge about this important pool of genetic material and engage in systematic morphological characterization and biochemical evaluation. The acquired integrated and complementary knowledge will allow for and the support of MAP future actions, associating the understanding and management of biodiversity and genetic resources conservation and utilization (Barata et al., 2011a).

Being a repository of unforeseen potentialities, Medicinal and Aromatic Plants Genetic Resources should be studied and preserved for the benefit of present and future generations, as they are crucial to support human wellbeing by contributing also in the increase of income of the rural populations.

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