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Full Length Research Paper

Threatened medicinal plants in Castilla y León (Spain)

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544 vascular plant species are used traditionally as medicinal in Castilla y León. 8 of these species are protected on different scales. Sometimes this protection establishes limits to their harvest, such as: *Arnica montana*, *Gentiana lutea*, *Nacissus pseudonarcissus*, *Sideritis hyssopifolia*. These species are collected from wild populations with the risk of genetic erosion and loss of populations. *Arnica montana* and *Gentiana lutea* are highly demanded, and collected from wild populations in this region. Their distribution habitats in peat bogs and mountain pasture are also affected, diminishing their presence due to different reason. In Castilla y León crops of medicinal and aromatic plants spread over 970 ha, representing 0.03% of the cultivated land. This area has been reduced by 36% in the last few years whereas the demand for such plants has increased by 10%, in the last 15 years. Some protected species are not used traditionally by people to treat their common illnesses. However, high harmful demand comes from drug companies which are carrying out excessive picking. In the region, it is necessary to create crop policies for other species which are not listed as protected but their demand is increasing, such us: *Hyssopus officinalis*, *Jasonia glutinosa*, *Lavandula latifolia*, *Origanum vulgare*, *Salvia lavandulifolia*, *Satureja montana*, *Thymus* spp. The infusion consumption of medicinal plants in this region was about 198 tonnes yearly. 290 t are collected in the wild according to data from the services of environmental management; however, it is estimated that this amount is twice as much.

Keywords: threatened species, medicinal plant, medicinal trade, wild recollection, plant conservation, threat factors, trade volume

INTRODUCTION

Medicinal and aromatic plants have contributed over centuries for alleviating human aliments. Early medicaments of civilized society were derived from plants. The tradition of using indigenous knowledge to treat human diseases gradually shifted to obscurity with development of modern-day science, especially in parts of World witnessing rapid technological developments. In areas, where impact of modern science was unnoticeable the traditional system of medicine continued to play dominant role in health maintenance. In spite of the near universal availability of western pharmaceuticals, some 80% of the world's population relies in part or wholly on traditional medicine for the majority of their health needs (King, 1996). The failure of promises of modern medicines on the treatment of new diseases and chronic illnesses has provoked that people in development countries started exploring age-old traditions. In this context, the plant based medicines, once lost in the oblivion, came occupy important place in the health management of modern man. Increasing popularity of herbal medicines has greatly increased world demand of medicinal raw material (Lange, 2004).

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Most of the raw material (90%) continues to be derives from wild resources. In majority of the cases wild-collection exceeds the sustainable quantity available from the natural resources thus threatening plant species. This situation has compelled almost all developing countries to enact laws governing the production and distribution of medicinal plants material to safeguard the survival of species in nature for future generation. The value of traditional healing practices and pharmacopoeias gain favour in the western world, the combined forces of destructive forest exploitation and eroding ethnobotanical knowledge appear to undermine their anticipated contribution to drag development and to the health of rural tropical people (Plotkin 1993). In Spain, collected about 195 different medicinal species, of which 9 is with serious maintenance problems (Blanco and Breux, 1997). The international trade is dominated by only few countries. About 80% of the world-wide imports and exports are allotted to only 12 countries with the dominance of temperate Asian and European countries. Whereas Japan and the Republic of Korea are the main consumers of pharmaceutical plants, and China and India are the world's leading producing nations, Hong Kong, the USA and Germany stand out as important trade centres (Lange, 2004).

The commercial extraction of useful parts as a conservation strategy is based on the argument that forest conservation must be able to offer economic incentives to local rural people in order to counter the threat of destructive land uses such as logging, shifting cultivation ranching (Amacher, 2002; Nepstad and Scwartzman, 1992).

The increasing commercial collection, largely unmonitored trade, and habitat loss lead to an incomparably growing pressure on plant populations in the wild, so, world-wide and estimated 9,000 medicinal plants species are threatened.

Tea (*Camellia sinensis* (L.) Kuntze) and coffee (*Coffea arabica* L.) are the quintessential social drinks. But tea is not particularly popular in many parts of Spain, and in fact when people refer to it is talking about a number of species indicated in the field or grown in gardens with pleasant herbal teas that can prepare belong to the genus (*Bidens*, *Helychrysum*, *Jasonia*, *Sideritis*, *Teucrium*), other species that are popular as the social drink are chamomile infusions, belonging to the genera (*Achillea*, *Anthemis*, *Chamomila*, *Chamaemelum*, *Matricaria*, *Santolina*, *Tanacetum*).

Now is generally accepted that plants may be used both as medicine and food; moreover, it is difficult to draw a separating line between these two categories (Etkin, 1996; Rivera et al., 2005).

The aim of this paper is to show the situation where certain species are used medicinally in Castilla y Leon, pointing to their threats and assessing the impact that has on their wild harvest wild populations. It also provides data on the original area occupied, collection, consumption and trade of medicinal plants in the region of Castilla y León.

Area studied

Castilla y León spans a total surface of 94,147 km^2. It is situated in the North Iberian Peninsula (Figure 1), the South West of Europe. It is a scarcely populated territory. Two thirds of its 2.6 million inhabitants dwell in rural settlements. It is therefore a rural society, whose economy is maintained by agriculture and natural resources.

It is an inland region. Climate in Castilla y León has rains irregularly distributed and draught during the summer, which corresponds to Mediterranean climate. However, the geographical features contribute with continental nuances. In Northern outlying mountain areas, an Atlantic climate is found and on the highest elevations it turns into alpine. Rainfalls range from 400 to 1,500 mm/year. As a consequence of its climate, vegetation in Castilla y León has Mediterranean and Atlantic species that use to thrive closely because of slopes in mountain areas. In Mediterranean forest *Quercus ilex* L., *Quercus faginea* Lam., *Quercus suber* L., *Castanea sativa* Miller, *Pinus pinaster* Aiton, *Pinus pinea* L. and *Juniperus thurifera* L. are dominants. In the Northern Atlantic areas, *Quercus pyrenaica* Willd., *Quercus petraea* (Mattuschka) Liebl., *Fagus sylvatica* L. and *Pinus sylvestris* L. can be found. Riparian vegetation is characterized by species belonging to Salicaceae family.

MATERIAL AND METHODS

It has conducted a review of medicinal species used in Castilla y León, with reference to the compilation work of Santos (2003), has been selected species are in turn protected by Decree 63/2007 (BOCyL, 2007) and by Decree 341/1991 (BOCyL, 1991). Of these species have evaluated the area occupied in the region, the amount collected, information of trade and impact of wild harvest on local populations of these plants. For data collection have been consulted on agricultural statistics yearbooks, interviews with sellers and collectors of medicinal plants, as well as queries on the web. We visited the markets of 20 villages of Castilla and León, these towns correspond with capital municipality with a population between 2.000 to 10.000 inhabitants. In these markets we interviewed 14 vendors, in some places we find the same vendors ranging from a local market to another. Each location was visited three times, once a year during 2009-2011, between the months of May to October.

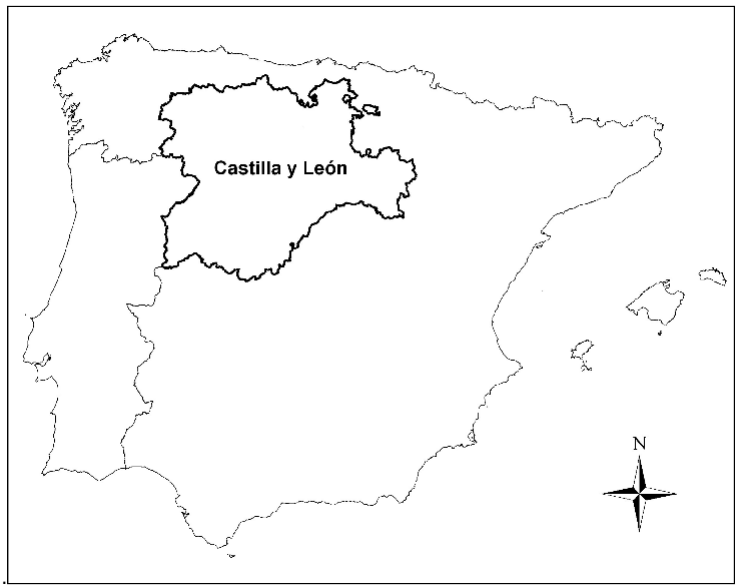

Figure 1. Location of Castilla y León region in Spain

Table 1. Ecological characteristics, distribution area, protection category and area occupied by threatened medicinal species in Castilla y León

	Ecology	Distribution area	Protection	Limit exploitation	Engaged area (ha)
Arnica montana	Heathland and damp grazing land	Northwest León and Zamora	Regularizated exploitation	2 kg	400
Gentiana lutea	Heatland and grazing land	Regional mountain perimeter	Regularizated exploitation	2 kg	1200
Ilex aquifolium	Cold woods	Regional mountain perimeter	Regularizated manegement		850
Iris spuria	Damp grazing land	Soria, Zamora	Special attention		5
Lycopodium clavatum	Heathland	Northeast León	Special attention		4
Menyanthes trifoliata	Peat bog	Norh León, SW Ávila	Special attention		4
Narcissus pseudonarcissus	Damp grazing land	Regional mountain perimeter	Regularizated exploitation	20 flowers or bulbs	3000
Sideritis hyssopifolia	Stony grazin land	North and East	Regularizated exploitation	2 kg	8000

RESULTS AND DISCUSSION

The sale of medicinal plants in local markets is prohibited by Law 16/2006 (BOE, 2006), however, it is easy to find a booth selling these products to market holidays in so-called "medieval markets", where next to the name of the plant indicates the medical benefit, this aspect is banned, the sale without indicating their medical benefit claim can be tolerated as a spices or food use. The vendors come from the Valencia and Andalusia, where are installed wholesale companies selling medicinal herbs. The products they sell are not labeled, the place of origin is varied and not exposed plant collected locally. The sales volume is difficult to estimate, but it is estimated that 10% of the plants consumed annually purchased in these markets (Herrero and Santos, 2009), reaching the amount of 20 t.

In Castilla y León we found 8 species of medicinal use presented a threat, still protected by their limited presence in the region or excessive pressure harvester. None of these species is cultivated in the region. In the Table 1 presents data on the ecology, legal issues and area occupied of protected medicinal plants in Castilla y León. Some of these plants are sold through wholesalers.

Currently there are crops of *Arnica montana* L. in Central European countries: France, Germany, Hungary (Lange, 1998), but wild collection is an important part of this commercial product. Wild arnica comes primarily from countries as Romania and Spain, the Galicia region

Table 2. Amount collected annually and average value of threatened medicinal plants in Castilla y León, during 2009-2012 triennium.

	Valuation	Collected quantity
Arnica montana	52 €/kg	700 kg
Genciana lutea	43 €/kg	4,000 kg
Ilex aquifolium	10 €/kg	5,000 kg
Iris spuria	No trade	
Lycopodium clavatum	No trade	
Menyanthes trifoliata	No trade	
Narcissus pseudonarcissus	3 € /dozen	15,000 flowers
Sideritis hyssopifolia	20 € /kg	1,200 kg

and province of León. The demand for arnica has been increased by 10% annually in recent years (Romero, 2008). The specie is regarded as critically endangered in Belgic, Bosnia, Croatia and Luxembourg; endangered in Belarus and the Netherlands; vulnerable in Estonia, Latvia, Lithuania, Portugal and Romania; and near threatened in Denmark and Norway (TRAFFIC Network, 2009). In Castilla y León its collection is limited. Their trade is regulated and their habitats protected under EU directives.

Gentiana lutea L. is another plant collected in the wild with an extraction volume of 4,000 kg dry weight, is harvested in Northwest of Leon, is sponsoring a local association formed from such exploitation for the purpose of ordering his removal. It is important for maintenance bury some sprouts of extracted root, and not to harvest more than 50% of plants (Moré et al., 2007).

Iris spuria L., *Lycopodium clavatum* L. and *Menyanthes trifoliata* L. not harvested for commercial, are harvested for subsistence only. Medicinal properties are unknown by most people, we have no data on their collection, which in any case is limited to consumption, impacts on local populations is difficult to evaluate, the main threat is due to the disappearance of their habitat, loss of interior wet areas and bogs.

The holly (*Ilex aquifolium* L.) was protected in Castilla y León in 1996, since 2001 allowed the collection of twigs from silvicultural treatments, these sticks are sold mainly for ornamental purposes, such use is not common in the region, and its florist trade destination are the regions of Catalonia, Valencia and Murcia. This use is beneficial to the conservation of holly trees (Oria de Rueda, 1991; García González, 2001). The amount of material sold for ornamental purposes is estimated at 5 t fresh weight. Its medicinal use is not very popular, other more common plants cover their therapeutic properties. Superstitious basis is used in veterinary medicine, stimulating the vomit in empty stomach, passing a stick over stomach of cows. Table 2 shows the average volume of medicinal plants collected each year and the average price achieved in the retail market during the 2009-2011 triennium.

In Castilla y León is currently devoted to the crops of aromatic and medicinal plants 970 ha, are cultivated: lavandin, lavender, mint, fennel and anise. Until 3 years also were cultivated 40 ha of chamomile. This area represents 0.03% of agricultural area in the region. 180 ha of organic crops are contributing 50% of the raw materials of the largest company of phytotherapy of Spain (Esteban, 2009). Although the cultivation of these plants is considered as an alternative to traditional crops and surplus of the EU. 40% of the surface of the region is intended to grow cereal grain. Farmers are reluctant to introduce medicinal and aromatic crops, due to inexperience, lack of agricultural technology and uncertainty of the market, despite the constraints agronomic are favorable for these types of crops (Gómez Orea, 1999).

The collection of wild plants in the region requires official authorization of the Department of Environment of the Junta de Castilla y León, Law 3/2009 (BOE, 2009), until 2002 was reflected in the statistical yearbooks of the surface land that was collected to use herbs, these data have ranged between 60 and 290 t (Junta de Castilla y León, 1997-2006), however these figures are approximate, and only counted the collection made by companies or individuals that supply wholesalers, however, we must bear in mind that most of the harvesting is done by individuals for personal consumption. The data used in the wild plant extracts are not very reliable and no longer included in the agricultural yearbooks. According to market estimates, and taking into account the size of the plant collection region of Castilla y León extracts could reach the amount of 15,000 ha and 600 t of plant.

The quantity of medicinal plants consumed in Castilla y Leon was 198 t, in the form of tea, chamomile and mint, under these names include many species, 38.4% corresponding with others aromatic and medicinal plants drunk as infusions, coffee consumption is 4,362 t, the consumption of spices and reaches 4,057 t. Table 3 presents data on infusion consumption Castilla y León, during 2009-2011 triennium.

Table 3. Infusion beverage consumption in Castilla y León, during 2009-2011 triennium (Alimarket source).

Consumed product	Volume (t) 2009	Volume (t) 2010	Volume (t) 2011
Spices and condiments	4,030	4,043	4,057
Coffea	3,925	4,110	4,362
Tea	59	61	63
Camomila	46	43	48
Ment	19	19	21
Other infusions	67	70	76

A plant included under the tea rock name is *Sideritis hyssopifolia* L. which together with its medicinal value is also useful ornamental, is sold as typical in the North of Palencia and Northwest of León area, as a bundle of twigs with about 100 inflorescences.

Are unaware of many aspects of reproductive biology of these species, this work is preliminary and necessary before we can make concrete recommendations on its management, we must implement methods of study focused on population dynamics and monitor the effects of the removal. Such plants usually geophytes, phanerophytes or hemicryptophytes with longer life cycles and asexual reproductive strategies, occupy areas threatened mostly located in fragile ecological environment, stonelands, peatlands, wet grasslands, wild harvesting is still a threat in its population variability. Would need to know more about the reproductive biology of these species in order to make a more responsible mining, and using technical and non-harvest periods to facilitate the regrowth as evidenced Kindscher et al. (2008) on wild harvest of *Echinacea angustifolia* DC. in USA as well as criteria for management of habitat in which these plants grow, in order to further its use. It should establish standards for responsible harvesting.

For example, a bundle of rock tea is a withdrawal of the seed bank of about 40,000 seeds, these bundles consist of about 100 inflorescences and dry weigh approximately 20 g.

Iris spuria, *Narcissus pseudonarcissus* L. and *Sideritis hyssopifolia* not listed in the guide of Spanish phytotherapy (Vanaclocha and Cañigueral, 2003), however, such as medicinal plants are used as ethnobotanical data. *Lycopodium clavatum* compound is marketed as a presentation composed by two non-regional laboratories, *Menyanthes trifoliata* is sold as a simple presentation by 2 laboratories, one located in the region, and presentation composed by 8 laboratories outside the region. The markets that supply of this raw material are located in Belarus, Slovenia and Romania. *Ilex aquifolium* is sold as a presentation composed by a laboratory non-regional. *Arnica montana* and *Gentiana lutea* are sold as simple and composed presentation by a laboratory in the region and 15 non-regional laboratories. The region has 7 laboratories that produce herbal products and only 1 sold some of these endangered species.

In Castilla y León of the 455 vascular species known as medicinal, 50 of which are collected in a more usual (Herrero and Santos, 2009). Among the species widely used in infusion *Jasonia* glutinosa (L.) DC., called tea rock too, which enjoys great popularity among the rural population in its range of distribution, only present in the Eastern region, it is estimated that 750 kg are harvested annually in fresh weight. Other species that are subject to an intense and wild collection is necessary control the extraction volume are: *Hyssopus officinalis* L., *Lavandula latifolia* Medik, *Origanum vulgare* L., *Salvia lavandulifolia* Vahl, *Satureja montana* L. and various species of *Thymus*.

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