



Medicinal plants used for ophthalmological problems in Navarra (Spain)



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ABSTRACT

Ethnopharmacological relevance: Several plants have been found to have effective against number of ophthalmological problems in Navarra.

Material and methods: Information was collected using semi-structured ethnobotanical interviews with 686 informants in 267 locations. In order to confirm the pharmacological application of the uses more cited by the informants, a literature review was conducted.

Results: A total of 57 pharmaceutical uses were reported, for 19 plants and 13 families, mainly represented by *Asteraceae*. The most frequently used parts were inflorescences, flowers, aerial parts, leaves and flowered aerial parts. The related affections fell into eleven categories: bloodshot eyes, watery eyes and wounds, improve vision, irritated eyelids, rheums and styes, tired eyes, conjunctivitis, eyewash, ocular problems in general. The most cited plants were: *Chamaemelum nobile* (L.) All., *Santolina chamaecyparissus* L. ssp. *squarrosa* (DC.) Nyman, *Sambucus nigra* L. ssp. *nigra*, *Rosa agrestis* Savi and *Calendula officinalis* L. None of them have been pharmacologically validated by Official International Organisms. From the therapeutic point of view, *Allium sativum* L., *Foeniculum vulgare* Mill., *C. officinalis*, and *S. chamaecyparissus* ssp. *squarrosa* deserve special attention, because ethnobotanical and pharmacological studies suggest that these medicinal plants are effective for ophthalmological problems.

Conclusions: The present study constitutes a good basis for further phytochemical and pharmacological research of these four plants, which could be of interest in the design of new inexpensive, effective and safe drugs. The remaining plants are needed to be screened through standard pharmacological and clinical procedures for their activities.

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1. Introduction

According to estimations, more than 50,000 flowering plants are used for medicinal purposes throughout the world (Govaerts, 2001). Frequent ethnobotanical surveys made during past few years, indicate that useful information about medicinal uses of plants may be obtained by personal interviews and field visits with inhabitants of a particular locality (Ullah et al., 2016). There are valuable regional records of medicinal plants to treat different ailments, ophthalmologic problems, amongst them.

The eye is one of the most sensitive organs of human body and is permanently exposed to different environmental agents. The eye has several natural mechanisms to defend itself against infection or trauma. Such as, tears that keep the eye lubricated and physically clear away foreign particles, dust or microorganisms. In addition, the tears contain several substances that protect against

infection; the eyelids and eye lashes protect the ocular surface from the environment and help maintaining the surface of the eye moist. However, occasionally these defense mechanisms may be disrupted, resulting in ocular problems (Sandhu et al., 2011). From redness to loss of vision, the range of conditions and diseases that affect the eye are varied and wide. The most common ocular diseases are glaucoma, conjunctivitis, cataract, ocular allergies, ocular inflammation, retinal disorders, macular degeneration, diabetic eye problems, etc. (Rowe et al., 2004). The continuous use of screens and electronic devices can also contribute to increase the number of eye problems (Jameel and Verma, 2014). Due to side effects of drugs, now a days huge numbers of herbal drugs are used for treatment of ocular diseases; traditional uses of medicinal plants are providing clues to new areas of research; hence their importance is now well recognized (Sandhu et al., 2011).

The ethnopharmacological investigation carried out by our research group in Navarra began in 2003 and continues to the present. The high number of plants collected to date has allowed the publication of several manuscripts for various affections: digestive (Calvo et al., 2013), dermatological (Caveró et al., 2013),

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cardiovascular (Calvo and Cavero, 2014), respiratory (Cavero and Calvo, 2014), musculoskeletal (Cavero and Calvo, 2015) and neurological and mental diseases (Calvo and Cavero, 2015). The aims of the present paper are: (i) to collect information about plant species used for ophthalmological problems in Navarra; ii) to compare this information with ethnopharmacological data from other Mediterranean areas; and iii) to look for coincidences of the reported uses in the scientific literature from a pharmacological point of view.

2. Material and methods

2.1. Study area

Navarra is a territory of 10,421 km² placed to the North of the Iberian Peninsula, where three zones can be differed: the Mountain on the North, the Riverside on the South, and both separated by a zone of transition, the Middle Navarra. There are two climates, Temperate and Mediterranean. These factors provide a great biodiversity, 2650 vascular plants (Cavero et al., 2013).

2.2. Methodology

Information was collected using semi-structured ethnobotanical interviews as a technique for data collection from informants. Interviews were done since 2003–2015. Native people, 686 informants (mean age > 70 years) of 267 locations, were interviewed in Basque and Castilian, both official languages in Navarra. Interviews are generally carried out spontaneously with people who were born or have lived most of their lives in the region studied. The search for the informants in this study was performed by contacting participants through the following approaches: (a) town halls; (b) geriatrics and pensioners' clubs; (c) pharmacists in rural areas; (d) family, friends and contacts; and (e) spontaneous meetings.

In the field work we noted for each species the local name, place and collection method, drying and preservation system, parts or organs used and method of preparation, dosage and administration. The questionnaire was previously reported (Calvo et al., 2013). Voucher samples were kept in the PAMP Herbarium at the Faculty of Science (University of Navarra).

3. Results and discussion

All the information is compiled in Table 1, which includes, the plant nomenclature and voucher specimen, the main local name, part used, administration form, common popular use as claimed by the informants, preparation, total uses and ethnobotanical references in other Mediterranean areas.

A total of 57 pharmaceutical uses were reported, belonging to 19 plants (74% native and 26% introduced species from other continents, or other European regions).

The 19 medicinal plants belong to 13 families, mainly represented by *Asteraceae* (37%). The most frequently used parts were inflorescences (67%), flowers (8%), aerial parts (5%), and leaves and flowered aerial parts (3%, each one). Plants were used dry (61%), fresh (28%), or either (11%) and were administered in different forms, clean with infusion (62%), decoction (21%), direct application and maceration in olive oil (7%, each one), and ointment (3%). The percentage of external uses was 98%. The only cited plant for internal administration was *Allium sativum*.

The treated affections fell into eleven categories: bloodshot eyes, watery eyes and wounds (2%, each one), improve vision, irritated eyelids, rheums and styes (3.5%, each one), tired eyes (5%),

conjunctivitis (19%), eyewash (26%), ocular problems in general (30%).

The most widely cited plants for ophthalmological problems were: *Chamaemelum nobile* and *Santolina chamaecyparissus* L. ssp. *squarrosa* (14 uses, 23%, each one), *Sambucus nigra* ssp. *nigra* (6 uses, 10%), *Rosa agrestis* (5 uses, 8%) and *Calendula officinalis* (4 uses, 7%).

Two mixtures were cited for conjunctivitis, decoction of *Ch. nobile*, *R. agrestis* and *S. nigra* to clean eyes (mixture 1) and oil macerated of *H. perforatum*, *U. rupestris* and *V. sinuatum* as drops (mixture 2).

Five medicinal plants (26%) are cited for the first time for ophthalmological problems, *Cichorium intybus* and *Populus alba* for conjunctivitis, *Heliotropium europaeum* for eyewash, *Salvia officinalis* for irritated eyelids and *Veronica* ssp. for conjunctivitis and tired eyes. To the best of our knowledge, pharmacological references have not been found for these affections in the scientific literature.

Nine medicinal plants (47%) showed some ethnobotanical reference in another Mediterranean area: *Calendula officinalis*, *Hypericum perforatum*, *Olea europaea*, *Tanacetum parthenium* and *Umbilicus rupestris* in Catalonia, *Rosa agrestis* in Basque Country, *Helichrysum stoechas* in Catalonia and Valencian Community, *Verbascum sinuatum* in the Kingdom of Morocco, and *Allium sativum* in the Portuguese Republic and the Kingdom of Morocco.

Finally, ethnobotanical review showed five plants (26%) with numerous ethnobotanical studies in different Mediterranean areas: *Chamaemelum nobile*, *Chamomilla recutita*, *Foeniculum vulgare*, *Sambucus nigra* ssp. *nigra* and *Santolina chamaecyparissus* ssp. *squarrosa*.

From the therapeutic point of view, *A. sativum*, *C. officinalis*, *F. vulgare* and *S. chamaecyparissus* ssp. *squarrosa* deserve special attention, because published pharmacological studies could confirm some of these ophthalmological uses.

Allium sativum, commonly known as ajo or galic, is a species in the onion genus, *Allium*. It is native of central Asia and has long been a staple in the Mediterranean region, as well as a frequent seasoning in Asia, Africa and Europe. According to the results obtained in different clinical trials, garlic can be used as an adjunct in the prophylaxis of atherosclerosis and hyperlipidemia. It is also used to improve circulation in peripheral arterial vascular disorders: hypertension, arterial disease, intermittent claudication, prevention of thromboembolism (ESCOP, 2003–2009). For its antimicrobial action it is useful to combat colds and other respiratory tract infections (ESCOP, 2003–2009).

In the last few years, five pharmacological studies have been published in relation to the beneficial effect of garlic on certain ophthalmological affections, two of them for the treatment of keratoconjunctivitis (Polat et al., 2008; Bandyopadhyay et al., 2010), two anticataract (Javadzadeh et al., 2009; Raju et al., 2008), and the last one for the treatment of ocular infections against *Aspergillus flavus* (Ahmed et al., 2012). These studies confirm the ethnobotanical data for this species.

Calendula officinalis, commonly known as calendula, is widely distributed throughout the world as an ornamental plant. It has long history of usage by the folk systems because of its rich ethnomedicinal values. The European Medicines Agency (EMA-HMPC, 2008) has approved the traditional use of topical preparations for the symptomatic treatment of minor inflammations of the skin and as an aid in healing of minor wounds, and for the symptomatic treatment of minor inflammations in the mouth or the throat.

Although there are only two ethnobotanical references, in Navarra and Catalonia, two pharmacological studies have recently appeared related to ophthalmology. In the first one, Varzaru et al., (2015) determined by HPLC the content of several bioactive compounds (lutein and zeaxanthin, vitamin E and zinc) in *C. officinalis*,

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