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Plants with topical uses in the Ripollès district (Pyrenees, Catalonia, Iberian Peninsula): Ethnobotanical survey and pharmacological validation in the literature

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ABSTRACT

Ethnopharmacological relevance: The skin is the main structure that protects the human body from environmental factors and has, in addition, a relevant relationship to people's appearance and beauty. Official medicine and cosmetics have shown interest on elaborating products to protect the dermal system, yet the role of folk medicine is highly unknown in this field. Taking this into account, we performed an ethnobotanical study in a Catalan district of the eastern Pyrenees (northeast Iberian Peninsula), with the purpose of assessing popular plant knowledge and use. In this paper, we present exclusively the results on topically-used plants. Additionally, we have performed a thorough literature search in order to validate the uses of plants recorded in well-established pharmacological works.
Methodology: A number of 163 informants (57.7% women and 42.3% men, born between 1915 and 1988, with an average age of 71.6 years) were interviewed by means of 104 semi-structured interviews. Voucher specimens were collected, prepared and deposited in the BCN herbarium.
Results: We collected information on the popular uses implying topical application of 115 plant taxa (three determined at generic level and 112 at specific level), belonging to 92 genera and 51 families. Taxa with use reports higher than 5% included *Arnica montana* subsp. *montana*, *Hypericum perforatum*, *Thymus vulgaris*, *Lilium candidum* and *Tussilago farfara*. The degree of reliability of the results is very high, as indicated by a big number of report uses (1676) and a very high informant consensus factor (0.93 of a maximum of 1). Topical uses of 21 plant taxa with more than 1% of use reports have been validated consulting pharmacological literature.
Conclusions: Data indicate a high degree of plant knowledge in the studied region regarding dermal conditions, cosmetics and additional affections (such as snake bite). The present study constitutes a good basis for further phytochemical and pharmacological research, which could be of interest in the design of new drugs. Furthermore, the evidence of these folk uses could be the key information in simplified procedures established by the European Union for the registration of herbal medicinal products based on traditionally used plants, reinforcing the already recognized role of ethnobotany in the mentioned applied research and development field.

1. Introduction

Skin is the main structure that protects human body from the environmental factors and has, in addition, a relevant relationship to personal aspect and beauty (Lall and Kishore, 2014). This is why applications for the skin are amongst the most important objectives of pharmaceutical industries, both with regard to dermatological pathologies as well as to cosmetics. At present, millions of people are affected annually with dermatological ailments (Tripathi and Srivastava, 2010), accounting for around 34% of all the disease cases recorded in the World (Abbasi et al., 2010). Skin problems can range from simple to major, including burns caused by contact with hot objects, fire or excessive exposure to sunlight as well as large infections caused by various pathogens, amongst others; even contact dermatitis caused by plants has a big incidence in rural areas (Modi et al., 2009). In addition, topical use of plants may also refer to the need for cleaning, moisturizing and taking care of the skin, as a barrier that protects the body from external aggressions.

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This interface between medicine and cosmetics is undoubtedly of pharmacological interest, as it indicates the fact that the term cosmeceuticals was coined (Elsner and Maibach, 2000), in analogy to nutraceuticals, to denote this double focus of some remedies.

Every year, a great number of drugs are developed for the treatment of the skin, yet people are more and more in favour of developing drugs that ensure safety, efficacy and quality for patients and users (Shojania et al., 2002). Herbal remedies constitute a relevant part of the therapeutic arsenal used to fight against dermatological illnesses (Behl and Srivastava, 2002; Shen efelt, 2011). For this reason, research on ethnopharmacological use related to this subject can provide new approaches and novel solutions, giving to pharmaceutical companies supplementary knowledge about plants that can lead to innovative drugs, as well as benefiting local communities, able to share such knowledge, experiment with it, and promote its use. Traditional remedies, especially for minor illnesses, have gained importance and popularity in industrialized countries due, in part, to their perceived lower toxicity compared to synthetic compounds; during most part of the late 20th century, naturopathic medicine has become the mainstream worldwide (Marini-Bettolo, 1980; Elvin-Lewis, 2001; Panthi and Singh, 2013). Many skin troubles are not severe, but some are serious, what is consistent with the idea that phytotherapy (either folk or industrial), like most so-called complementary and alternative medicines, mostly deals with mild or chronic affections, although they can also be useful in stronger cases (Barnes, 2003).

Cox (1994) reported that dermatological ailments are related to 15% of folk plant uses detected by ethnobotanical surveys, 11% of drugs in the US pharmacopoeia and 4% of western societies diseases treated with drugs derived from ethnobotanical information. Based on these data, this author predicted a success for ethnodirected bioprospection focused on such plant uses. This statement has been confirmed by rather abundant ethnopharmacological studies on plant topical use, which have been carried out, especially in African and Asian territories (Messele, 2004; Ajose, 2007; Abbasi et al., 2010; Martínez and Barboza, 2010; Jatav and Mehta, 2013; Kumar et al., 2013; Mabona et al. 2013; Panthi and Singh, 2013), but these kinds of studies are very scarce in Europe, especially outside Spain (Pieroni et al., 2004; Cavero et al., 2013, for works specifically targeting skin alterations; Camejo-Rodrigues et al., 2003; Akerreta et al., 2010; González et al., 2010; Calvo et al. 2011; Cavero et al. 2011a, b; Menendez-Baceta et al., 2014, for more general works containing some information on dermatological plant uses). These references often focus on a few species of plants (Tripathi and Srivastava, 2010), on pharmaceutical prospecting and validation (Cavero et al., 2013) or on the interactions between various plants (Al Aboud, 2011). Prior general ethnobotanical research in Catalonia (northeastern Iberian Peninsula) has already shown the relevance of topical uses of plants (Agelet and Vallès, 2001, 2003; Bonet and Vallès, 2003; Rigat et al., 2007; Parada et al., 2009). The main aims of the present study were: i) to collect information about plant species used topically in the Ripollès district; ii) to analyse these ethnopharmacological data; iii) to look for coincidences of the reported uses in the literature in order to validate them from a pharmacological viewpoint (for species with more than 1% of use reports); and, iv) to propose new plant species for pharmacological validation of certain uses.

2. Material and methods

2.1. Study area

Ripollès is a Catalan district (*comarca* in Catalan language) located in the eastern Pyrenees, having a high mountain climate with Mediterranean influence (Fig. 1). The associated vegetation is characterized by alpine meadows occupying higher altitudes, followed, descending, by communities with *Pinus mugo* subsp. *uncinata* and *Abies alba* and forests with deciduous *Quercus* spp. and *Fagus sylvatica* as most predominant trees. Meadows, riverside woodlands, and crops constitute the remaining elements of the landscape (Vigo, 2008). Geographically, two different areas can be distinguished. The first one (Alt Ripollès), in the north, characterized by a high-mountainous area constituted by both Ter and Freser river valleys, and the second one (Baix Ripollès), in the south, is a middle-mountainous area constituted of a plane in the confluence of both aforementioned rivers.

Ripollès occupies an area of 956.6 km^2 and, in 2013, had a population of 25,995 inhabitants (IDESCAT, 2013) distributed in 19 municipalities, with a high percentage of the population inhabiting small villages and isolated houses. Agriculture is not a relevant source of income for most households—mostly due to climatic and orographic conditions—but many farms and houses have their own home garden for private consumption. In the past, conventional medicine was difficult to access for these communities, promoting the use of plants or other natural resources as they were necessary to survive extreme conditions. Nowadays, official healthcare services reach virtually everybody in the region, but traditional practices seem to remain present, at least to a certain extent.

2.2. Methodology

We used semi-structured interviews (Pujadas et al., 2004) as a technique for data collection from informants. Interviews were practiced from August 2004 to October 2013 after informing participants on the research purpose and receiving their consent. Native people, mostly the elderly (over 70 years of age), were selected on a snowball basis (Goodman, 1961), and were interviewed in Catalan, the common language both to interviewees and interviewers.

Information was obtained from 163 informants (born between 1915 and 1988 and an average age of 71.6 years; 57.7% women and 42.3% men) along 104 semi-structured ethnobotanical interviews (60 individual and 44 collective) covering the whole Ripollès area (all 19 municipalities). All interviews were recorded, transcribed and entered to a private database. All plants reported by the informants were collected and identified according to *Flora dels Països Catalans* (Bolòs et al., 2005). For botanical families, APG groupings were used (APG III, 2009). A voucher for each taxon was deposited at the *Centre de Documentació de Biodiversitat Vegetal*, University of Barcelona, herbarium (BCN).

Scientific name, vernacular name/s, botanical family, number of herbarium voucher, part of plant used, popular uses, pharmaceutical form and number of reports were recorded for each taxon. Some plant mixtures and preparation modes were also described.

In the present study, we included all plants with topical application independently if they were used for topical ailments, or related to other conditions. Hence, in addition to considering plants with dermatological uses (e.g. vulnerary or antiecchymotic), we also embraced plants with topical application not strictly indicated for skin disorders (e.g., antiophidian or antialopecic).

2.3. Quantitative ethnobotany, statistical analyses and pharmacological validation in the literature

Several ethnobotanical quantitative indices were calculated from the obtained dataset. The informant consensus factor (F_{IC}; Trotter and Logan, 1986) was calculated as the ratio of the number of topical use reports (UR) minus the number of used taxa to the number of topical use reports minus one. This index is more

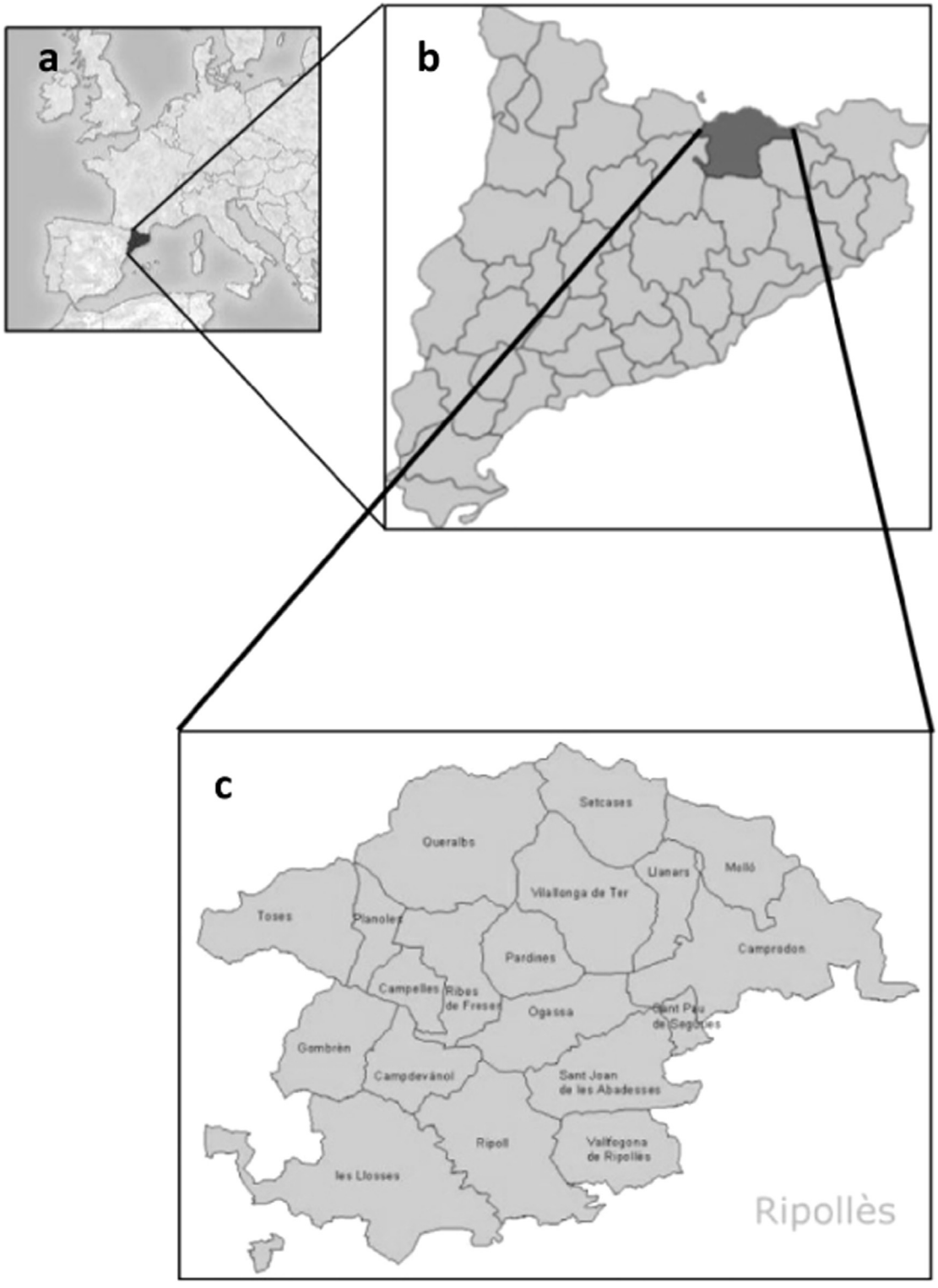

Fig. 1. Map of the study area. a) Catalonia within Europe, b) Ripollès within Catalonia and, c) Ripollès district, with its municipalities (taken from www.municat.gencat.cat).

reliable when closer to 1. The index of medicinal importance (MI), recently proposed by Carrió and Vallès (2012), was also calculated, dividing the total use reports for a specific use-category by the number of taxa possessing this use. Descriptive statistical analyses and graphics were carried out with Excel software (Microsoft Office 2003).

To confirm the reported specific uses by participants in the study, we additionally reviewed the literature to carry out a pharmac ological validation on most reported plants, using monographs (sometimes linked to databases) from official sources (Blumenthal, 1998; WHO, 1999, 2004, 2007, 2009, 2010; ESCOP, 2003; EDQM, 2010; EMA, 2010), along with encyclopaedic bibliography on phytotherapy (Blumenthal, 2003; Duke, 2003; Vanaclocha and Cañig ueral, 2003). Additionally, we tested the used claimed by our informants in a general database on useful plants (PFAF, Plants for a future, http://www.pfaf.org), which is not a strictly pharmacological source, but contains a large and detailed information on medicinal plant uses.

Table 1
List of collected plant species and related ethnopharmacological information.

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
Abies alba Mill. (Pinaceae) BCN24699	Avet, avet de Setcases, oli d'avet (product)	Resin	Antineoplastic	Without pharmaceutical form (direct use)	1
Achillea millefolium L. (Asteraceae) BCN24700	Herba de tall, herba de les cent fulles, herba de les mil fulles, herba dels conills	Inflorescence	External antiseptic	Bath	1
		Inflorescence	Cicatrization	Poultice	2
		Inflorescence	Vulnerary	Poultice	4
Achillea ptarmica L. subsp. *pyrenaica* (Sibth. ex Godr. in Gren. et Godr.) Rouy (Asteraceae) BCN24701	Camamilla, camamilla de muntanya	Inflorescence	Antiecchymotic	Liniment	2
		Inflorescence	Cosmetic (hair)	Not reported	1
Alkanna tinctoria Tausch (Boraginaceae) BCN24706	Pota de colom	Root	Antipyrotic	Ointment	2
		Root	Antitoxic	Liniment	3
		Root	Cosmetic	Without pharmaceutical form (direct use)	2
		Root	Resolvent	Ointment	2
Allium cepa L. (Amaryllidaceae) BCN27279	Ceba	Bulb	External antiseptic	Bath	3
		Bulb	Antitoxic	Poultice	2
		Bulb	Cosmetic	Without pharmaceutical form (direct use)	2
		Bulb	Resolvent	Ointment	2
		Bulb	For whitlow	Poultice	1
		Bulb	Vulnerary	Embrocation	1
		Bulb	Vulnerary	Poultice	1
Allium sativum L. (Amaryllidaceae) BCN24708	All	Bulb	Antieczematous	Without pharmaceutical form (direct use)	1
		Bulb	Antifungal	Without pharmaceutical form (direct use)	2
		Bulb	Antiophidian	Emulsion	3
		Bulb	Antiophidian	Fumigation	3
		Bulb	External antiseptic	Embrocation	5
		Bulb	Antitoxic	Without pharmaceutical form (direct use)	3
		Bulb	For pernio (chilblain)	Without pharmaceutical form (direct use)	3
		Bulb	For whitlow	Poultice	1
		Bulb	Resolvent	Embrocation	2
		Bulb	Vulnerary	Embrocation	3
Aloe vera (L.) Burm.f. (Xanthorrhoeaceae) BCN 27242	Àloe vera, aloe, cactus	Leaf juice	Antipyrotic	Without pharmaceutical form (direct use)	3
Althaea officinalis L. (Malvaceae) BCN 24709	Arrel de malví, malvesí, malví	Root	External antiseptic	Embrocation	1
		Root	Resolvent	Embrocation	1
		Root	Vulnerary	Embrocation	1
Anemone hepatica L. (Ranunculaceae) BCN 27247	Herba fetgera, viola de llop	Leaf	Cicatrization	Without pharmaceutical form (direct use)	2
		Leaf	Vulnerary	Without pharmaceutical form (direct use)	3
Anthyllis vulneraria L. subsp. *forondae* (Senn.) Cullen (Fabaceae) BCN 24713	Vulnerària	Aerial parts	External antiseptic	Bath	1
Arnica montana L. subsp. *montana* (Asteraceae) BCN 24716	Àrnica, flor de tabac	Inflorescence	Antieczematous	Embrocation	2
		Inflorescence	Antiecchymotic	Essence	9
		Inflorescence	Antiecchymotic	Liniment	67
		Inflorescence	Antiecchymotic	Lotion	115
		Inflorescence	Antiecchymotic	Not reported	7
		Inflorescence	Antiecchymotic	Cream	3
		Inflorescence	Antiecchymotic	Medicinal vinegar	3
		Inflorescence	Antipyrotic	Embrocation	6
		Inflorescence	Antitoxic	Liniment	3
		Inflorescence	Antitoxic	Medicinal vinegar	2
		Inflorescence	Vulnerary	Embrocation	4
		Inflorescence	Vulnerary	Essence	3
		Inflorescence	Vulnerary	Lotion	4

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
Arum italicum Mill. (Araceae) BCN 32358	Fulles de cremat	Leaf	Antierythematous	Without pharmaceutical form (direct use)	2
Bellis perennis L. (Asteraceae) BCN 31264	Margarideta	Inflorescence	Antipyrotic	Embrocation	1
Betula pendula Roth. (Betulaceae) BCN 27263	Beç, bedoll	Leaf	Cosmetic (hair)	Lotion	2
		Sap	Cosmetic (skin)	Not reported	2
Brassica oleracea L. (Brassicaceae) BCN 24728	Col	Leaf	External antiseptic	Without pharmaceutical form (direct use)	3
Bryonia cretica L. (Cucurbitaceae) BCN 24730	Carabassí, carabassina	Root	External antiseptic	Embrocation	2
		Root	External antiseptic	Fumigation	4
		Root	For rotten fingers	Cream	2
		Root	Resolvent	Embrocation	2
		Root	Vulnerary	Embrocation	2
Buxus sempervirens L. (Buxaceae) BCN 24731	Boix	Root	For pernio (chilblain)	Bath	3
		Leaf	Antiverrucose	Magico-religious beliefs	3
		Leaf	Antiverrucose	Lotion	2
Calendula arvensis L. (Asteraceae) BCN 29637	Gujats, lligamans	Inflorescence	Antiecchymotic	Liniment	2
Calendula officinalis L. (Asteraceae) BCN 24732	Calèndula, bojacs, jaumets, lligamans	Inflorescence	Antipsoriatic	Liniment	1
		Inflorescence	Antitoxic	Essence	1
		Inflorescence	To treat clavus (callus)	Cream	1
		Inflorescence	For irritation	Liniment	1
Carduncellus monspelliensium All. (Asteraceae) BCN 21473	Herba dels erístols	Not reported	For whitlow	Bath	3
Castanea sativa Mill. (Fagaceae) BCN 24740	Castanyer	Fruit	For pernio (chilblain)	Bath	3
Centaurea calcitrapa L. (Asteraceae) BCN 24742	Floravia, herba espitllera	Inflorescence	External antiseptic	Bath	6
		Not reported	For whitlow	Bath	5
		Aerial parts	For whitlow	Embrocation	3
Chelidonium majus L. (Papaveraceae) BCN 24750	Celidonis, herba berruguera, herba dels fics, llet de Santa Teresa	Latex	Antiverrucose	Without pharmaceutical form (direct use)	19
		Aerial parts	Antiverrucose	Lotion	2
Citrus limon (L.) Burm. (Rutaceae) BCN 27241	Llimoner	Fruit juice	Antiverrucose	Without pharmaceutical form (direct use)	3
Citrus sinensis (L.) Osbeck (Rutaceae) BCN 24752	Taronger	Fruit juice	Antiverrucose	Without pharmaceutical form (direct use)	2
Conium maculatum L. (Apiaceae) BCF 49407	Cicuta, julivertassa	Root	Resolvent	Embrocation	3
		Leaf	Antiecchymotic	Poultice	4
		Leaf	Antiecchymotic	Liniment	2
		Leaf	Antiophidian	Embrocation	2
		Leaf	Resolvent	Poultice	3
		Leaf	Resolvent	Liniment	3
Crataegus monogyna Jacq. subsp. *monogyna* (Rosaceae) BCN 24756	Arç blanc	Thorns	Antiophidian	Without pharmaceutical form (direct use)	3
Cucurbita pepo L. (Cucurbitaceae) BCN 24757	Carbassa	Flower	Antiacneic	Cream	3
		Flower	Antidermatitic	Cream	3
		Flower	Antiecchymotic	Cream	1
		Flower	Antiophidian	Cream	1
		Flower	Antipyrotic	Cream	3
		Flower	Antipyrotic	Ointment	2
		Flower	Antitoxic	Cream	3
		Flower	Cosmetic	Liniment	1
		Flower	Resolvent	Ointment	2
		Flower	Vulnerary	Cream	3
		Flower	Vulnerary	Ointment	2
		Fruit	External antiseptic	Ointment	1
Daphne laureola L. (Thymelaeaceae) BCN 24762	Senet, senet bord	Leaf	Antifungal	Embrocation	1
Dracunculus vulgaris Schott (Araceae) BCN 24765	Herba escurçonera	Bulb	Antiecchymotic	Ointment	2
		Bulb	Antiophidian	Liniment	3
		Bulb	Antiophidian	Not reported	2
		Bulb	Antiophidian	Ointment	3
		Bulb	Antitoxic	Liniment	2
		Flower	Antiophidian	Without pharmaceutical form (direct use)	1
Echium vulgare L. (Boraginaceae) BCN 24766	Cua de porc	Aerial parts	Antiophidian	Not reported	1
Eryngium bourgatii L. (Apiaceae) BCN 24881	Espinacals, espinacals blaus	Root	Antiophidian	Liniment	1
		Aerial parts	Antiecchymotic	Liniment	2
		Aerial parts	Antiophidian		10

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
				Without pharmaceutical form (direct use)	
		Aerial parts	Antiophidian	Liniment	2
Eryngium campestre L. (Apiaceae) BCN 24882	Espinacals	Root	Antierythematous	Without pharmaceutical form (direct use)	2
		Root	Antiophidian	Liniment	6
		Root	Antitoxic	Embrocation	4
		Root	Vulnerary	Embrocation	3
		Aerial parts	Antierythematous	Without pharmaceutical form (direct use)	2
		Aerial parts	Antiophidian	Without pharmaceutical form (direct use)	15
Euphorbia sp. (Euphorbiaceae)	Lleteresa, lletones	Latex	Antiverrucose	Without pharmaceutical form (direct use)	1
Ficus carica L. (Moraceae) BCN 24887	Figuera	Latex	Antiverrucose	Without pharmaceutical form (direct use)	3
Fraxinus excelsior L. (Oleaceae) BCN 24890	Freixe	Leaf	External antiseptic	Bath	6
		Cortical parenchyma	External antiseptic	Bath	8
		Cortical parenchyma	External antiseptic	Embrocation	1
		Cortical parenchyma	Resolvent	Embrocation	1
		Cortical parenchyma	Vulnerary	Bath	4
		Cortical parenchyma	Vulnerary	Embrocation	1
Geranium robertianum L. (Geraniaceae) BCN 24894	Cicuta, herba de Sant Robert	Aerial parts	Antiecchymotic	Poultice	6
		Aerial parts	Antiecchymotic	Liniment	6
		Aerial parts	Antiherpetic	Liniment	1
		Aerial parts	Antineoplastic	Poultice	1
		Aerial parts	To treat lipoma	Ointment	1
		Aerial parts	Vulnerary	Embrocation	1
Hedera helix L. (Araliaceae) BCN 27262	Heura	Leaf	External antiseptic	Bath	3
Hypericum androsaemum L. (Hypericaceae) BCN 24904	Fulles de la mare de Déu	Leaf	Cicatrization	Without pharmaceutical form (direct use)	3
		Leaf	Vulnerary	Without pharmaceutical form (direct use)	10
		Leaf	Vulnerary	Embrocation	1
Hypericum perforatum L. (Hypericaceae) BCN 24905	Herba de cop, herba de Sant Joan, pericó, trescamp	Flowering aerial parts	Antiecchymotic	Liniment	135
		Flowering aerial parts	Antiecchymotic	Lotion	14
		Flowering aerial parts	Antiecchymotic	Ointment	2
		Flowering aerial parts	Antiecchymotic	Medicinal vinegar	2
		Flowering aerial parts	Antipyrotic	Embrocation	9
		Flowering aerial parts	Antitoxic	Embrocation	3
		Flowering aerial parts	Antitoxic	Liniment	3
		Flowering aerial parts	For irritation	Liniment	1
		Flowering aerial parts	Vulnerary	Embrocation	3
Iris germanica L. (Iridaceae) BCN 31278	Lliris blaus	Flower	Vulnerary	Embrocation	2
		Flower	Vulnerary	Lotion	2
Jasonia tuberosa (L.) DC. (Asteraceae) BCN 24907	Herba del mal estrany	Flowering aerial parts	External antiseptic	Fumigation	1
		Flowering aerial parts	Antipyrotic	Ointment	1
Juglans regia L. (Juglandaceae) BCN 24908	Noguer	Leaf	Antiacneic	Bath	1
		Leaf	Antiherpetic	Bath	1

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
		Leaf	Antiherpetic	Lotion	1
		Leaf	Antipyrotic	Without pharmaceutical form (direct use)	1
		Leaf	External antiseptic	Bath	7
		Leaf	For pernio (chilblain)	Bath	1
		Fruit juice	Antiverrucose	Without pharmaceutical form (direct use)	2
Juniperus communis L. (Cupressaceae) BCN 24910	Ginebre, ginebró,oli de ginebre (product)	Stem	Antifungal	Without pharmaceutical form (direct use)	3
		Stem	Resolvent	Without pharmaceutical form (direct use)	1
		Stem	Vulnerary	Without pharmaceutical form (direct use)	1
Lactuca sativa L. (Asteraceae) BCF 38305	Enciam	Leaf	Antiherpetic	Ointment	1
Laurus nobilis L. (Lauraceae) BCN 24912	Llor, llorer	Leaf	Antiecchymotic	Liniment	1
		Leaf	Antiecchymotic	Lotion	1
Lavandula angustifolia Mill. subsp. *angustifolia* (Lamiaceae) BCN 24913	Barballó, barmelló, espígol, esprígol, lavanda	Flowering aerial parts	Antiecchymotic	Lotion	7
		Flowering aerial parts	External antiseptic	Fumigation	3
Lilium candidum L. (Liliaceae) BCN 24916	Lliri blanc, lliri de Sant Josep	Bulb	For skin or subcutaneous cell tissue conditions. For clavus (callus)	Embrocation	2
		Bulb	Resolvent	Poultice	3
		Bulb	Resolvent	Cream	2
		Bulb	Vulnerary	Poultice	2
		Flower	Antiecchymotic	Lotion	7
		Flower	Antipyrotic	Embrocation	2
		Flower	Antipyrotic	Poultice	1
		Flower	Antipyrotic	Lotion	3
		Flower	Cicatrization	Embrocation	1
		Flower	Cicatrization	Lotion	1
		Flower	For skin or subcutaneous cell tissue conditions. For spots in the skin	Liniment	2
		Flower	Resolvent	Embrocation	5
		Flower	Resolvent	Poultice	2
		Flower	Resolvent	Lotion	4
		Flower	Vulnerary	Embrocation	21
		Flower	Vulnerary	Poultice	2
		Flower	Vulnerary	Lotion	50
Lilium martagon L. (Liliaceae) BCN 24917	Consolta, consolta vermella, consolva, marcòlic vermell	Bulb	Resolvent	Ointment	2
Lilium pyrenaicum Gouan (Liliaceae) BCN24918	Consolta, consolta groga, consolva, marcòlic groc	Root	External antiseptic	Embrocation	1
		Root	Resolvent	Embrocation	1
		Root	Vulnerary	Embrocation	1
		Bulb	For whitlow	Ointment	1
		Bulb	Resolvent	Poultice	4
		Bulb	Resolvent	Ointment	1
Linum usitatissimum L. subsp. *angustifolium* (Huds.) Thell. (Linaceae) BCN 24920	Lli, llinet	Seed	Resolvent	Poultice	8
Malva sylvestris L. (Malvaceae) BCN 24924	Malva	Flower	Antipruritic	Without pharmaceutical form (direct use)	3
		Leaf	Antitoxic	Without pharmaceutical form (direct use)	3
		Leaf	For whitlow	Poultice	2
		Aerial parts	Antipruritic	Without pharmaceutical form (direct use)	8
		Flowering aerial parts	External antiseptic	Bath	3
		Flowering aerial parts	Resolvent	Bath	1
		Flowering aerial parts	Resolvent	Poultice	1
Medicago sativa L. subsp. *sativa* (Fabaceae) BCN 24927	Ufals, userda	Flower	Antiecchymotic	Poultice	1

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
		Aerial parts	Antialopecic	Bath	2
		Aerial parts	Antiecchymotic	Poultice	19
		Aerial parts	Antiecchymotic	Ointment	8
		Aerial parts	Antitoxic	Poultice	1
		Aerial parts	Resolvent	Poultice	3
Nicotiana tabacum L. (Solanaceae) BCN 27239	Tabaco	Leaf	Resolvent	Poultice	2
Olea europaea L. var. *europaea* (Oleaceae) BCN 24937	Olivera	Fruit oil	Antieczematous	Without pharmaceutical form (direct use)	1
		Fruit oil	Antifungal	Without pharmaceutical form (direct use)	3
		Fruit oil	Antifungal	Embrocation	1
		Fruit oil	Antiophidian	Emulsion	3
		Fruit oil	Antipyrotic	Ointment	1
		Fruit oil	External antiseptic	Fumigation	2
		Fruit oil	Antibacterial. For impetigo	Embrocation	2
		Fruit oil	For punctures	Embrocation	2
		Fruit oil	For punctures	Fumigation	5
		Fruit oil	For skin or subcutaneous cell tissue conditions. For spots in the skin	Emulsion	2
		Fruit oil	Vulnerary	Poultice	2
		Fruit oil	Vulnerary	Fumigation	3
Origanum vulgare L. (Lamiaceae) BCN 24939	Orenga	Flower	Vulnerary	Embrocation	2
Papaver rhoeas L. (Papaveraceae) BCN 24940	Gall, gallarets, roselles	Flower	Vulnerary	Embrocation	2
		Not reported	Antiecchymotic	Liniment	3
Parietaria officinalis L. (Urticaceae) BCN 24942	Blet, Blet de paret, mollera roquera, morella, parietaria	Aerial parts	Antipyrotic	Embrocation	1
		Aerial parts	Antipruritic	Without pharmaceutical form (direct use)	3
Petroselinum crispum (Mill.) Hill (Apiaceae) BCN 24943	Julivert	Root	Antiecchymotic	Liniment	4
		Root	Antiecchymotic	Ointment	1
		Root	Antierythematous	Liniment	3
		Root	External antiseptic	Embrocation	2
		Root	To treat lipoma	Ointment	1
		Root	For whitlow	Poultice	1
		Root	For irritation	Liniment	1
		Root	Resolvent	Embrocation	2
		Root	Vulnerary	Embrocation	3
		Aerial parts	Antiecchymotic	Poultice	7
		Aerial parts	Antiecchymotic	Ointment	8
		Aerial parts	Cosmetic (hair)	Bath	2
Phaseolus vulgaris L. (Fabaceae) BCN 27265	Fesol, mongetera	Leaf	Antiverrucose	Bath	3
		Leaf	Antiverrucose	Without pharmaceutical form (direct use)	3
		Seed	Antiecchymotic	Liniment	2
		Seed	Antifungal	Ointment	3
		Seed	Antiverrucose	Without pharmaceutical form (direct use)	1
Pinus sylvestris L. (Pinaceae) BCN 27259	Pi, pi rajolet, pi roig, pega negra (product), trementina (product)	Not reported	Antiecchymotic	Lotion	1
		Not reported	To remove thorns/spines	Not reported	1
		Resin	Resolvent	Poultice	2
Piper nigrum L. (Piperaceae) BCN 28392	Pebre	Seed	For whitlow	Poultice	1
Plantago lanceolata L. (Plantaginaceae) BCN 24949	Plantatge, plantatge estret, plantatge llarg	Leaf	Antiverrucose	Without pharmaceutical form (direct use)	1
Plantago major L. (Plantaginaceae) BCN 24950	Plantatge, plantatge ample, plantatge rodó	Leaf	Antiverrucose	Without pharmaceutical form (direct use)	1
		Leaf	Antitoxic	Without pharmaceutical form (direct use)	2
Plantago sp. (Plantaginaceae)	Plantatge	Aerial parts	Antipruritic	Without pharmaceutical form (direct use)	3
Polygala calcarea F.W. Schulz (Polygalaceae) BCN 24951	Angelets, herba de bac, herba blava, herba de les inflamacions, flor de maig	Flowering aerial parts	External antiseptic	Bath	4
Prunella grandiflora L. (Lamiaceae) BCN 24956	Herba del traïdor, xuclabelles	Flowering aerial parts	External antiseptic	Bath	18

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
		Flowering aerial parts	For whitlow	Bath	2
Prunella vulgaris L. (Lamiaceae) BCN 29759	Herba de la inflamació, herba de la cangrena	Flowering aerial parts	External antiseptic	Bath	8
		Flowering aerial parts	Vulnerary	Bath	1
Quercus ilex L. (Fagaceae) BCN 24963	Alzina, aulina	Bark	Antiherpetic	Bath	1
		Bark	Antiherpetic	Lotion	1
		Bark	External antiseptic	Bath	2
		Bark	Cicatrization	Bath	4
		Bark	Resolvent	Bath	1
		Bark	Vulnerary	Bath	2
		Aerial parts	External antiseptic	Bath	1
Quercus petraea (Matt.) Liebl. (Fagaceae) BCN 24964	Roure	Bark	External antiseptic	Bath	3
		Bark	Cicatrization	Bath	5
Ramonda myconi (L.) Reichenb. (Gesneriaceae) BCN 24965	Borraina de roca, orella d'ós	Aerial parts	Antitoxic	Liniment	3
Ranunculus parnassifolius L. (Ranunculaceae) BCN 24967	Herba del mal gra	Root	Resolvent	Embrocation	1
		Aerial parts	Antineoplastic	Embrocation	9
		Aerial parts	Antineoplastic	Poultice	4
		Aerial parts	Antineoplastic	Ointment	2
		Aerial parts	External antiseptic	Embrocation	5
		Aerial parts	Resolvent	Bath	1
		Aerial parts	Vulnerary	Embrocation	5
Ribes petraeum Wulfen in Jacq. (Grossulariaceae) BCN 24970	Groselles	Fruit	Antipyrotic	Without pharmaceutical form (direct use)	1
Rosa canina L.(Rosaceae) BCN 29772	Roser bord, roser de pastor	Flower	Antipyrotic	Bath	2
Rosmarinus officinalis L. (Lamiaceae) BCN 24974	Romaní	Flowering aerial parts	Antiecchymotic	Lotion	3
		Flowering aerial parts	External antiseptic	Bath	1
		Flowering aerial parts	External antiseptic	Fumigation	1
Rubus caesius L. (Rosaceae) BCN 24976	Romegueró	Root	Resolvent	Poultice	1
Rubus ulmifolius Schott (Rosaceae) BCN 24978	Romeguera	Leaf	Antiherpetic	Without pharmaceutical form (direct use)	3
		Leaf	Antipyrotic	Without pharmaceutical form (direct use)	1
		Leaf	Vulnerary	Without pharmaceutical form (direct use)	6
		Leaf	Vulnerary	Embrocation	2
Rumex scutatus L. (Polygonaceae) BCN 24979	Badoles, madoles	Leaf	Antipruritic	Without pharmaceutical form (direct use)	1
Rumex sp. (Polygonaceae)	Llengua bovina, llengua de bou	Leaf	Resolvent	Poultice	2
Ruta chalepensis L. (Rutaceae) BCN 24980	Ruda	Aerial parts	Antiecchymotic	Poultice	1
		Aerial parts	Antiecchymotic	Liniment	2
		Aerial parts	Antiecchymotic	Lotion	1
		Aerial parts	External antiseptic	Embrocation	2
		Aerial parts	Antitoxic	Liniment	3
		Aerial parts	Resolvent	Embrocation	2
		Aerial parts	Vulnerary	Embrocation	2
		Aerial parts	Vulnerary	Liniment	2
		Aerial parts	Vulnerary	Cream	1
Salvia officinalis L. (Lamiaceae) BCN 24981	Sàlvia	Aerial parts	Resolvent	Without pharmaceutical form (direct use)	1
Salvia verbenaca L. (Lamiaceae) BCN 29942	Tàrrec	Leaf	Antipyrotic	Ointment	2
		Leaf	Resolvent	Ointment	2
Sambucus nigra L. (Adoxaceae) BCN 24984	Sabuquer, sabuc, saüc	Flower	Antiacneic	Bath	2
		Flower	Antibacterial. For erysipelas	Fumigation	1
		Flower	Antiecchymotic	Bath	2
		Flower	Antiecchymotic	Fumigation	2
		Flower	Antiophidian	Fumigation	4
		Flower	External antiseptic	Bath	3
		Flower	External antiseptic	Fumigation	23
		Flower	For punctures	Fumigation	14
		Flower	Vulnerary	Fumigation	11

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
		Cortical parenchyma	Antipyrotic	Ointment	1
Saxifraga longifolia Lap. (Saxifragaceae) BCF 38212	Corona de rei	Flowering aerial parts	External antiseptic	Bath	3
Scrophularia nodosa L. (Scrophulariaceae) BCF 44719	Setge	Not reported	Vulnerary	Without pharmaceutical form (direct use)	2
Sedum album L. (Crassulaceae) BCF 47249	Arròs de paret	Aerial parts	Antipyrotic	Without pharmaceutical form (direct use)	2
		Aerial parts	Antipruritic	Without pharmaceutical form (direct use)	4
Sedum dasyphyllum L. (Crassulaceae) BCN 24994	Arròs de bruixes, arròs de paret	Aerial parts	Antipyrotic	Embrocation	1
		Aerial parts	Antipruritic	Without pharmaceutical form (direct use)	10
		Aerial parts	External antiseptic	Embrocation	1
		Aerial parts	Antitoxic	Without pharmaceutical form (direct use)	2
		Aerial parts	Resolvent	Embrocation	1
		Aerial parts	Vulnerary	Embrocation	1
Sedum telephium L. subsp. *maximum* (L.) Krock. (Crassulaceae) BCN 24995	Arròs de paret, bàlsam, herba grassa, matafocs	Leaf	Antifungal	Poultice	2
		Leaf	Antifungal	Liniment	1
		Leaf	Antifungal	Ointment	2
		Leaf	Antipyrotic	Not reported	2
		Aerial parts	Antiecchymotic	Liniment	2
Sempervivum tectorum L. (Crassulaceae) BCN 24997	Sempreviva, té de roca	Aerial parts	Antipyrotic	Without pharmaceutical form (direct use)	2
		Aerial parts	Antipyrotic	Poultice	3
		Aerial parts	Antipyrotic	Ointment	2
		Aerial parts	Resolvent	Ointment	2
		Leaf juice	External antiseptic	Without pharmaceutical form (direct use)	1
Senecio leucophyllus DC. (Asteraceae) BCN 24998	Herba blanca	Flowering aerial parts	Antineoplastic	Poultice	2
Senecio vulgaris L. (Asteraceae) BCN 24999	Xenixell	Aerial parts	For whitlow	Poultice	2
Solanum dulcamara L. (Solanaceae) BCN 25003	Dolçamara, dulcamara	Aerial parts	Antipsoriatic	Bath	1
Solanum lycopersicum L. (Solanaceae) BCN 27289	Tomàquet, tomata	Fruit	For whitlow	Without pharmaceutical form (direct use)	3
Solanum tuberosum L. (Solanaceae) BCN 25006	Patata	Tuber	Antipyrotic	Without pharmaceutical form (direct use)	3
Sonchus oleraceus L. (Asteraceae) BCN 25008	Lletissó	Aerial parts	External antiseptic	Liniment	2
		Aerial parts	Vulnerary	Liniment	3
Stachys byzantina C.Koch (Lamiaceae) BCN 25010	Orella de xai	Leaf	Vulnerary	Without pharmaceutical form (direct use)	1
Stachys officinalis L. (Lamiaceae) BCN 25011	Betònica	Aerial parts	Vulnerary	Bath	1
Symphytum officinale L. (Boraginaceae) BCN 25012	Consolda major	Root	Vulnerary	Bath	1
Taraxacum officinale Weber in Wiggers (Asteraceae) BCN 25015	Xicoina, xicoina de prat, xicoina d'horta, pixacans, pixallits	Latex	Antiverrucose	Without pharmaceutical form (direct use)	2
		Flower	Cosmetic (face)	Cream	1
Taxus baccata L. (Taxaceae) BCN 25017	Arbre quiné, quina, teix	Cortical parenchyma	Antipyrotic	Ointment	2
		Cortical parenchyma	External antiseptic	Bath	8
		Cortical parenchyma	Cosmetic (hair)	Bath	2
		Cortical parenchyma	Resolvent	Ointment	2
Thymus serpyllum L. (Lamiaceae) BCN 25020	Farigola de muntanya, farigola de pastor, farigoleta, xerpoll	Flowering aerial parts	External antiseptic	Bath	13
Thymus vulgaris L. (Lamiaceae) BCN 25023	Farigola, timó	Flowering aerial parts	Antiophidian	Fumigation	1
		Flowering aerial parts	External antiseptic	Bath	114

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
		Flowering aerial parts	For whitlow	Bath	2
		Flowering aerial parts	Resolvent	Bath	1
		Flowering aerial parts	Vulnerary	Bath	12
Tilia platyphyllos Scop. (Malvaceae) BCN 25024	Tell, til·la	Flower with bract	External antiseptic	Bath	7
		Cortical parenchyma	Antiecchymotic	Poultice	1
		Cortical parenchyma	Antipyrotic	Poultice	1
		Cortical parenchyma	Antipyrotic	Ointment	1
		Cortical parenchyma	External antiseptic	Bath	3
		Cortical parenchyma	Vulnerary	Bath	4
		Cortical parenchyma	Vulnerary	Poultice	5
Trifolium pratense L. (Fabaceae) BCN 25027	Trèbol, trebolet, trèfola	Leaf	Vulnerary	Embrocation	1
Triticum aestivum L. (Poaceae) BCN 27284	Blat, mestall, segon	Seed	Antiecchymotic	Poultice	3
		Bran	Antiherpetic	Ointment	1
		Bran	For pernio (chilblain)	Without pharmaceutical form (direct use)	3
Tussilago farfara L. (Asteraceae)BCN 25028	Fulla de vellut, pota de cavall	Leaf	Vulnerary	Without pharmaceutical form (direct use)	49
		Leaf	Cicatrization	Without pharmaceutical form (direct use)	49
Typha latifolia L. (Typhaceae) BCN 31314	Boga	Aerial parts	Antiherpetic	Ointment	1
Umbilicus rupestris (Salisb.) Dandy (Crassulaceae) BCN 25029	Barrets de paret	Aerial parts	Antipyrotic	Embrocation	1
		Aerial parts	Antipyrotic	Liniment	1
		Aerial parts	Antipyrotic	Cream	1
		Aerial parts	External antiseptic	Embrocation	1
		Aerial parts	Resolvent	Embrocation	1
		Aerial parts	Vulnerary	Without pharmaceutical form (direct use)	3
		Aerial parts	Vulnerary	Embrocation	1
		Aerial parts	Antipyrotic	Without pharmaceutical form (direct use)	2
Urtica dioica L. (Urticaceae) BCN 25030	Ortriga, ortiga, ortiga blanca	Aerial parts	Antialopecic	Bath	2
		Aerial parts	Antitoxic	Poultice	1
Urtica urens L. (Urticaceae) BCN 25031	Ortigó, ortiga barragana	Aerial parts	Antiecchymotic	Poultice	2
Valeriana officinalis L. (Caprifoliaceae) BCN 25033	Valedriana, valeriana	Root	Vulnerary	Embrocation	1
Verbascum pulverulentum Vill. (Scrophulariaceae) BCN 25035	Blenera, borrassa, cua de guilla, flor de torpa, herba ploranera	Root	For pernio (chilblain)	Bath	3
		Leaf	Antieczematous	Bath	2
		Leaf	Vulnerary. For fistulae	Not reported	2
Verbena officinalis L. (Verbenaceae) BCN 25036	Berbena	Aerial parts	Antiecchymotic	Poultice	30
		Aerial parts	Antiecchymotic	Ointment	4
		Aerial parts	Antineoplastic	Poultice	3
		Aerial parts	Resolvent	Poultice	4
Vincetoxicum hirundinaria Medic. (Apocynaceae) BCN 25040	Pebroteres bordes	Aerial parts	External antiseptic	Fumigation	1
Vitis vinifera L. (Vitaceae) BCN 25043	Vinya, vinagre (product)	Fruit juice	Antiecchymotic	Without pharmaceutical form (direct use)	6
		Fruit juice	Antiecchymotic	Poultice	4
		Fruit juice	Antierythematous	Bath	5
		Fruit juice	Antiherpetic	Without pharmaceutical form (direct use)	3
		Fruit juice	Antiherpetic	Ointment	4
		Fruit juice	Antipruritic	Without pharmaceutical form (direct use)	1
		Fruit juice	Antitoxic		3

Table 1 (*continued*)

Species Herbarium voucher	Vernacular name/s (Catalan)	Used part	Use	Pharmaceutical form	Reports
				Without pharmaceutical form (direct use)	
		Fruit juice	For whitlow	Poultice	1

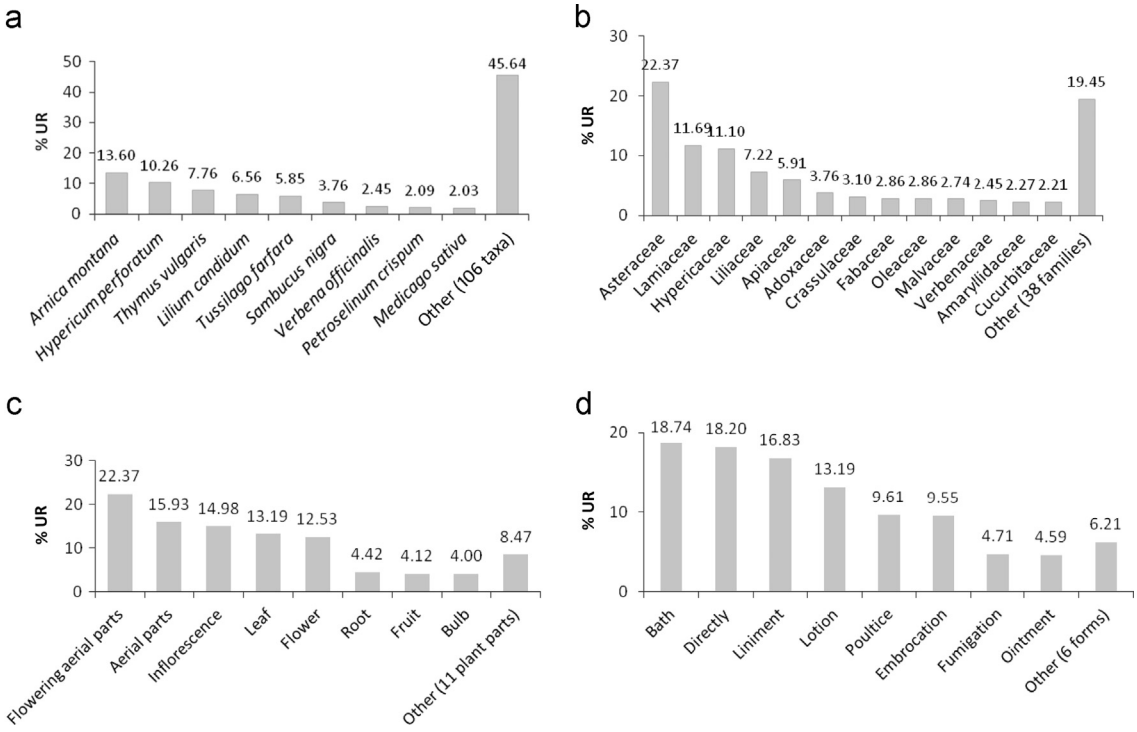

Fig. 2. Topical use reports according to: a) plant species; b) botanical family; c) plant part used, and; d) pharmaceutical form.

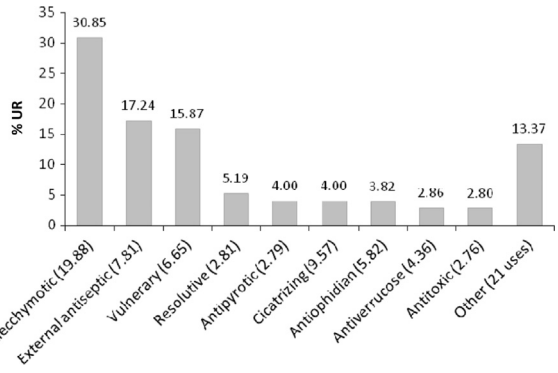

Fig. 3. Percentage of use reports with topical application. Percentages below 2% are not given a number and considered within the 'other' category. The indices of medicinal importance (MI, Carrió and Vallès, 2012: total use reports for a specific use-category divided by the number of taxa possessing this use) for the different activities are indicated within parentheses.

3. Results and discussion

The list of collected plant species and related information is shown in Table 1, and summarized in Figs. 2 and 3. Informants reported a total of 115 taxa (112 species and three additional taxa identified at generic level), with a total of 1676 reports for topical uses (average of 10.28 use reports per informant). The 112 species included eight subspecies and one variety. Comparing the results with previous research with the same focus in and outside Europe is illustrative. In a study with a similar approach in a central-eastern Italian area, Pieroni et al. (2004) recorded 135 cosmetic, cosmeceutical or skin-healing preparations based on 70 plant species. One work with the same focus performed, as the current one, in an Iberian region (Navarra, Spain) recorded 982 uses for 91 plant species (Cavero et al., 2013). A relatively high amount of taxa is shared by the present research and the Italian (44 coincidental taxa) and Spanish (21, but only one third of the plants are explicitly mentioned in this work) studies, accounting for a common natural and cultural Mediterranean substratum. Conversely, only two of the species here reported (the cultivated *Allium cepa* and *Linum usitatissimum*) are coincidental with the 90 recorded for skin healing purposes in Uttarakhand, India (Sharma et al., 2014). Even if the coincidence at generic level is slightly higher (10), this example of comparison with a remote territory clearly shows the differences in floristic and cultural bases.

These 115 taxa belong to 92 genera (those most reported include *Lilium* and *Solanum* with only three taxa each), and 51 botanical families, the Asteraceae (13.04% of total taxa), Lamiaceae (9.57%) and Crassulaceae (4.35%) being the three most represented families in number of species, and the Asteraceae (22.37% of total UR), Lamiaceae (11.69%) and Hypericaceae (11.1%) being the three most cited families in number of use reports (Fig. 2).

3.1. Use reports

Nine taxa were mentioned above 2% of UR (Table 2), including *Arnica montana* subsp. *montana* (228 use reports; 13.6% of total use reports), *Hypericum perforatum* (172 UR; 10.26%), *Thymus*

Table 2
Ethnopharmacological characteristics of most cited species (above 1% of total use reports), including percentage of total use reports, plant parts used, ethnopharmacological use with relative percentages, bibliographic validation of reported use, and pharmaceutical form with relative percentages. Uses validated in the literature are indicated with an asterisk (*).

Taxon	Use	%UR	Validation	Form	%UR
Arnica montana subsp. *montana*	Antiecchymotic*	89.47	a,d,f,g	Lotion	52.19
(13.60% UR; 100% inflorescence)	Vulnerary*	4.82	a,f	Liniment	30.70
	Antipyrotic	2.63	NR	Embrocation	5.26
	Antitoxic*	2.19	a,b,f	Essence	5.26
	Antieczematous	0.88	NR	Not reported	3.07
				Medicinal vinegar	2.19
				Cream	1.32
Hypericum perforatum	Antiecchymotic*	87.43	a	Liniment	80.81
(10.26% UR; 100% flowering aerial parts)	Antipyrotic*	5.14	a,b,c,e,f,g	Embrocation	8.72
	Antitoxic*	5.14	a	Lotion	8.14
	Vulnerary*	1.71	a,c,e,f,g	Medicinal vinegar	1.16
	For irritation*	0.57	a,e	Ointment	1.16
Thymus vulgaris	External antiseptic*	87.69	a,e,f		
(7.76% UR; 100% flowering aerial parts)	Vulnerary*	9.23	a,f	Bath	99.23
	For whitlow	1.54	NR	Fumigation	0.77
	Antiophidian*	0.77	a		
	Resolvent	0.77	NR		
Lilium candidum	Vulnerary*	68.18	a	Lotion	59.09
(6.56% UR; 91.8% flower, 8.2% bulb)	Resolvent	14.55	NR	Embrocation	28.18
	Antiecchymotic	6.36	NR	Poultice	9.09
	Antipyrotic*	5.45	a	Cream	1.82
	For skin or subcutaneous cell tissue conditions (skin spots)	3.64	NR	Liniment	1.82
	Cicatrization	1.82	NR		
Tussilago farfara	Vulnerary*	50.00	a	Without pharmaceutical form (direct use)	100.00
(5.85% UR; 100% leaf)					
	Cicatrization	50.00	NR		
Sambucus nigra	External antiseptic	41.27	NR		
(3.76% UR; 98.4% flower, 1.6% cortical parenchyma)	For punctures	22.22	NR		
	Vulnerary	17.46	NR	Fumigation	87.30
	Antiecchymotic*	6.35	a	Bath	11.11
	Antiophidian	6.35	NR	Ointment	1.59
	Antiacneic	3.17	NR		
	Antibacterial	1.59	NR		
	Antipyrotic*	1.59	a		
Verbena officinalis	Antiecchymotic*	82.93	a	Poultice	90.24
(2.45% UR; 100% aerial parts)	Resolvent	9.76	NR	Ointment	9.76
	Antineoplastic*	7.32	a		
Petroselinum crispum	Antiecchymotic*	57.14	a		
(2.09% UR; 51.4% root, 48.6% aerial parts)	Antierythematous	8.57	NR		
	Vulnerary*	8.57	a	Ointment	28.57
	Cosmetic (hair)*	5.71	a	Liniment	22.86
	External antiseptic*	5.71	a	Poultice	22.86
	Resolvent	5.71	NR	Embrocation	20.00
	For irritation*	2.86	a	Bath	5.71
	For whitlow*	2.86	a		
	To treat lipoma	2.86	NR		
Medicago sativa subsp. *sativa*	Antiecchymotic	82.35	NR	Poultice	70.59
(2.03% UR; 97.1% aerial parts, 2.9% flower)	Resolvent*	8.82	a	Ointment	23.53
	Antialopecic	5.88	NR	Bath	5.88
	Antitoxic	2.94	NR		
Eryngium campestre	Antiophidian	65.63	NR	Without pharmaceutical form (direct use)	59.38
(1.91% UR; 53.13% aerial parts, 33.13% root)					
	Antitoxic	12.50	NR	Embrocation	21.88
	Antierythemnatous	12.50	NR	Liniment	18.75
	Vulnerary	9.38	NR		
Olea europaea var. *europaea*	For punctures	25.93	NR	Fumigation	37.04
(1.61% UR; 100% fruit)	Vulnerary*	18.52	a, b	Embrocation	18.52
	Antifungal	14.81	NR	Emulsion	18.52
	Antiophidian	11.11	NR	Without pharmaceutical form (direct use)	14.81
	Antibacterial. For impetigo	7.41	NR	Poultice	7.41
	External antiseptic	7.41	NR	Ointment	3.70
	For skin or subcutaneous cell tissue conditions. For spots in the skin	7.41	NR		
	Antieczematous*	3.70	e		
	Antipyrotic*	3.70	a,b,e		
Ranunculus parnassifolius	Antineoplastic	55.56	NR	Embrocation	74.07
(1.61% UR; 96.30% aerial parts, 3.70% root)	External antiseptic	18.52	NR	Poultice	14.81
	Vulnerary	18.52	NR	Ointment	7.41
	Resolvent	7.41	NR	Bath	3.70

Table 2 (*continued*)

Taxon	Use	%UR	Validation	Form	%UR
Vitis vinifera (1.61% UR; 100% fruit)	Antiecchymotic	37.04	NR	Without pharmaceutical form (direct use)	48.15
	Antiherpetic	25.93	NR		
	Antierythematous*	18.52	a	Poultice	18.52
	Antitoxic	11.11	NR	Bath	18.52
	Antipruritic	3.70	NR	Ointment	14.81
	For whitlow	3.70	NR		
Allium sativum	Antiophidian*	23.08	a	Embrocation	38.46
(1.55% UR; 100% bulb)	External antiseptic*	19.23	a,b,c,e,f	Without pharmaceutical form (direct use)	34.62
	Antitoxic*	11.54	a	Emulsion	11.54
	For pernio (chilblain)	11.54	NR	Fumigation	11.54
	Vulnerary*	11.54	a	Poultice	3.85
	Antifungal*	7.69	a,b,c,e,f		
	Resolvent	7.69	NR		
	Antieczematous	3.85	NR		
	For whitlow*	3.85	a		
Cucurbita pepo	Antipyrotic*	20.00	a,f		
(1.49% UR; 96% flower, 4% fruit)	Vulnerary*	20.00	a		
	Antiacneic	12.00	NR		
	Antidermatitic*	12.00	a	Cream	68.00
	Antitoxic	12.00	NR	Ointment	28.00
	Resolvent	8.00	NR	Liniment	4.00
	Antiecchymotic	4.00	NR		
	Antiophidian	4.00	NR		
	Cosmetic	4.00	NR		
	External antiseptic	4.00	NR		
Tilia platyphyllos	External antiseptic*	45.45	a	Bath	63.64
(1.31% UR; 68.18% cortical parenchyma, 31.82% flower with bract)	Vulnerary*	40.91	e	Poultice	31.82
	Antipyrotic	9.09	NR	Ointment	4.55
	Antiecchymotic	4.55	NR		
Chelidonium majus	Antiverrucose*	100.00	a,e	Without pharmaceutical form (direct use)	90.48
(1.25% UR; 90.5% latex, 9.5% aerial parts)				Lotion	9.52
Fraxinus excelsior	External antiseptic*	71.43	a	Bath	85.71
(1.25% UR; 71.4% cortical parenchyma, 28.6% leaf)	Vulnerary*	23.81	e	Embrocation	14.29
	Resolvent	4.76	NR		
Malva sylvestris	Antipruritic	52.38	NR	Without pharmaceutical form (direct use)	66.67
(1.25% UR; 38.1% aerial parts, 23.8% flowering aerial parts, 23.8% leaf, 14.3% flower)					
	Antitoxic*	14.29	a,e	Bath	19.05
	External antiseptic	14.29	NR	Poultice	14.29
	For whitlow	9.52	NR		
	Resolvent*	9.52	e		
Prunella grandiflora	External antiseptic	90.00	NR	Bath	100.00
(1.19% UR; 100% flowering aerial parts)	For whitlow	10.00	NR		
Conium maculatum	Resolvent	52.94	NR	Poultice	41.18
(1.01% UR; 82.4% leaf, 17.6% root)	Antiecchymotic	35.29	NR	Embrocation	29.41
	Antiophidian	11.76	NR	Liniment	29.41

Bibliographic validation of reported uses: a) Duke (2003); b) Blumenthal (1998); c) Blumenthal (2003); d) European Scientific Cooperative on Phytotherapy (2003); e) Vanaclocha and Cañigueral (2003); f) World Health Organization (1999, 2004, 2007, 2009, 2010); g) European Medicines Agency (2010).

vulgaris (130 UR; 7.76%), *Lilium candidum* (110 UR; 6.56%), *Tussilago farfara* (98 UR; 5.85%), *Sambucus nigra* (63 UR; 3.76%), *Verbena officinalis* (41 UR; 2.45%), *Petroselinum crispum* (35 UR; 2.09%) and *Medicago sativa* subsp. *sativa* (34 UR; 2.03%). Within these species, which accounted for 54.36% of total use reports, *Arnica montana* subsp. *montana*, *Hypericum perforatum*, *Verbena officinalis*, *Petroselinum crispum* and *Medicago sativa* subsp. *sativa* were for the most part used as antiecchymotic and mostly administered in lotion, liniment, poultice, multiple forms and poultice respectively; *Thymus vulgaris* was for the most part used as an external antiseptic almost exclusively in bath form; and *Lilium candidum* was mostly used as a vulnerary in lotion form. *Tussilago farfara* was used equally as a vulnerary and in cicatrization and always directly applied, and *Sambucus nigra* was employed for a great variety of topical conditions, as an external antiseptic being the most reported, and for the most part administered by fumigation. Certain specific uses of some plants are quoted by a very large number of informants. The one placed in the first position is the antiecchymotic use of *Arnica montana* (204 reports) and *Hypericum perforatum* (153 reports). These two taxa are components of several phytomedicines used for the purpose mentioned; this confirms the consistency between folk knowledge and possible industrial applications. Apart from other antiecchymotic plants (*Medicago sativa* and *Verbena officinalis*, 27 and 34 reports, respectively), other uses with a high number of reports are vulnerary (*Lilium candidum*, 53 reports), antiophidian (*Eryngium bourgatii* and *Eryngium campestre*, 12 and 21 reports, respectively; these two species are in some cases used

indistinctly by the informants), and external antiseptic (*Prunella grandiflora*, *Sambucus nigra* and *Thymus vulgaris*, 25 and 15 and 114 reports, respectively). These high amounts of quotations of some uses should be used as a complement to the reliability criteria that are addressed below in order to detect candidate plants to further pharmacological studies.

Plants claimed to be used as antiophidian are abundant (11 taxa) and have, overall, a high number of reports (64). It is worth mentioning that eight out of these 11 taxa are not recorded in the classical work on plants used against snake bite by Houghton and Osibogun (1993), including a list of ca. 900 taxa. These species are *Conium maculatum*, *Crataegus monogyna*, *Cucurbita pepo*, *Dracunculus vulgaris*, *Eryngium bourgatii*, *Eryngium campestre*, and *Olea europaea*; at generic level, only *Eryngium* (with *Eryngium foetidum* L.) is included in the mentioned compilation. In previous papers on Iberian ethnobotany (Agelet and Vallès, 2003; Camejo-Rodrigues et al., 2003) we have added novelties to this list, not comprising any of the taxa here reported now. Therefore, the present work contributes new possibilities for experimental tests aiming to develop antivenins to fight against an important source of mortal accidents (Houghton and Osibogun, 1993).

A particular case is constituted by *Ranunculus parnassifolius*, whose aerial parts received 15 reports as antineoplastic for skin cancer, applied in various forms, especially embrocation. This taxon is claimed to be used against 'mals dolents' (textually 'bad illnesses', an expression commonly used in Catalan language to refer to cancer without mentioning this name), particularly in this case against skin troubles. No pharmacological validation was found for this use in the literature, as *Ranunculus parnassifolius* corresponds to a species not included in any of the official sources consulted. No references of this use were found doing a broader literature search. Further laboratory or clinical study of the potentialities of this reported activity would be of interest to validate any antitumor properties of the aerial parts of this plant species. Additionally, the use of this taxon could generate a conservation issue. Several informants reported that that in some occasions, large amounts of the plant (full big bags) were collected. Furthermore, they stated that they have the impression that the populations of this Pyrenean endemic species are decreasing. This could be partly due to massive collections for medicinal purposes, but at least also partly to the diminution of the snow presence in the high mountain areas occupied by this taxon. Sáez et al. (2010) include this plant in the red book of endemic and endangered Catalan vascular flora, with the status of least concern. Population biology research would be suitable to confirm or negate an impoverishment of the populations of this taxon, and to regulate its collection if necessary.

3.2. Parts of plants used and pharmaceutical forms

According to informants, different plants parts were used to prepare remedies with a topical application (Fig. 2). Most reported parts consisted of flowering aerial parts (22.37%), aerial parts (15.93%), inflorescences (14.98%), leaves (13.19%) and flowers (12.53%). These were the most cited, but there were parts such as thorns (*Crataegus monogyna*), resin (*Abies alba* and *Pinus sylvestris*), tubers (*Solanum tuberosum*) or sap (*Betula pendula*) with only two or three use reports (less than 0.2% of total UR). While the same plant can have various uses and distinct pharmaceutical forms, the part of the plant employed did not vary, in most cases, amongst informants. Only in a few cases, two or up to three different plant parts were used.

We found a wide range of pharmaceutical forms (up to 15) while the form of administration was always external (topical). Regarding pharmaceutical form (Fig. 2), the most reported was bathing the affected area, normally with a decoction of the plant (18.74%), followed by liniments (16.83%), direct application (16.59%), lotions (13.19%), poultices (9.61%) and embrocations (9.55%). Nine additional forms accounted for the remaining 15.51%.

In total, 30 uses were reported (Fig. 3). Amongst these, to treat ecchymosis was the most reported (30.85%), followed by far by external antiseptic (17.24%), vulnerary (15.87%), resolvent (5.19%), in cicatrization (4%) and antipyrotic (4%). Other uses, including antiophidian (3.82%), antiverrucose (2.86%), antitoxic (2.8%), and 21 more uses (13.37%), complemented the list. Results also indicated that one plant species could be used for different purposes or in different preparation ways, alone or combined with other plant species, varying from species to species.

3.3. Plant mixtures

As pointed out by participants, several species have been traditionally used in combination with other plant species to treat topical conditions (Table 3), enhancing the effects of remedies through synergy (Rigat et al., in preparation). Thirty-five mixtures made with combinations of a total pool of 60 plant taxa (i.e. more than half of the total reported) are given in Table 3. These include combinations from two to up to eight different species, and account for 4.41% of total UR. *Arnica montana* subsp. *montana* combined with *Hypericum perforatum* corresponds to the most reported mixture (6 UR), followed by the combination of *Alkanna tinctoria*, *Salvia verbenaca*, *Sempervivum tectorum* and *Taxus baccata* (4 UR), along with *Arnica montana* subsp. *montana* combined with *Lilium candidum* (4 UR). In terms of individual species, *Hypericum perforatum* is the plant most reported amongst mixtures (17 UR in six combinations), followed equally with 14 use reports by three species: *Petroselinum crispum* (found in eight mixtures), *Ruta chalepensis* (in seven mixtures) and *Allium sativum* (in six mixtures). Next comes *Arnica montana* subsp. *montana* with 13 UR and present in three mixtures.

Within mixtures and similar to what happened for all plants, antiecchymotic uses were the most significant (28.38% of total), followed by external antiseptic which represents 12.16% of total UR for mixtures. Nonetheless for pharmaceutical forms, different figures arose when compared to all plants recorded. For combinations of different plants, baths were not the most preferred form, while embrocations (16.22%) and poultices (16.22%) gained significance. Both, liniments and lotions remained significant. In our analysis of synergy, we ascertained the importance of vegetal oils and animal fats (either from chicken, usually an old hen, or from pig), that in the preparation of topical remedies act as a vehicle for active compounds.

3.4. Pharmacological validation from a literature survey

As reported by Cavero et al. (2013), topical use was validated for those 21 plants showing use reports higher than 1% (totalling over 70% of total use reports), using specialized literature on phytotherapy including monographs and general reference works (Blumenthal, 1998, 2003; WHO, 1999, 2004, 2007, 2009, 2010; Duke, 2003; ESCOP, 2003; Vanaclocha and Cañigueral, 2003; EDQM, 2010). Not all plants were found in all literature sources used, indicating a lack of coverage in the literature. By far, Duke's CRC handbook of medicinal herbs (Duke, 2003) was the most inclusive, systematic and detailed work analysed, including all plants consulted.

Validation of ethnopharmacological uses in the literature (Table 2 fourth column) indicates that certain species, such as *Chelidonium majus*, *Hypericum perforatum*, *Thymus vulgaris*, *Arnica montana*, *Fraxinus excelsior*, *Verbena officinalis*, *Tilia platyphyllos*, *Petroselinum crispum*, *Allium sativum* and *Lilium candidum*, have a high degree of validation in the literature, while *Eryngium campestre*, *Ranunculus parnassifolius*, *Prunella grandiflora* and *Conium maculatum* have no validation for any of their topical uses

Table 3
Mixtures of plants with topical application.

Mixture	Use	Pharmaceutical form	Reports
Medicago sativa and *Ruta chalepensis*	Antiecchymotic	Poultice	1
Geranium robertianum and *Petroselinum crispum*	Antiecchymotic	Poultice	1
Arnica montana subsp. *montana*, *Hypericum perforatum*, *Lavandula angustifolia* and *Rosmarinus officinalis*	Antiecchymotic	Lotion	3
Arnica montana subsp. *montana* and *Lilium candidum*	Antiecchymotic	Lotion	4
Lavandula angustifolia subsp. *angustifolia*, *Laurus nobilis* and *Ruta chalepensis*	Antiecchymotic	Lotion	1
Hypericum perforatum and *Papaver rhoeas*	Antiecchymotic	Liniment	3
Hypericum perforatum and *Verbena officinalis*	Antiecchymotic	Ointment	2
Medicago sativa subsp. *sativa* and *Verbena officinalis*	Antiecchymotic	Poultice	3
Medicago sativa subsp. *sativa* and *Petroselinum crispum*	Antiecchymotic	Ointment	1
Achillea ptarmica subsp. *pyrenaica*, *Eryngium bourgatii*, *Hypericum perforatum*, *Petroselinum crispum*, *Phaseolus vulgaris*, *Ruta chalepensis* and *Sedum telephium* subsp. *maximum*	Antiecchymotic	Liniment	2
Lactuca sativa, *Triticum aestivum*, *Typha latifolia* and *Vitis vinifera*	Antiherpetic	Ointment	1
Ranunculus parnassifolius and *Senecio leucophyllus*	Antineoplastic	Poultice	2
Allium sativum and *Olea europaea* var. *europaea*	Antiophidian	Emulsion	3
Allium sativum and *Sambucus nigra*	Antiophidian	Fumigation	3
Malva sylvestris, *Parietaria officinalis* and *Plantago* sp.	Antipruritic	Without pharmaceutical form (direct use)	3
Jasonia tuberosa, *Sambucus nigra* and *Tilia platyphyllos*	Antipyrotic	Ointment	1
Arnica montana subsp. *montana* and *Hypericum perforatum*	Antipyrotic	Embrocation	3
Alkanna tinctoria, *Salvia verbenaca*, *Sempervirum tectorum* and *Taxus baccata*	Antipyrotic	Ointment	2
Bellis perennis, *Parietaria officinalis*, *Sedum dasyphyllum* and *Umbilicus rupestris*	Antipyrotic	Embrocation	1
Arnica montana subsp. *montana* and *Hypericum perforatum*	Antitoxic	Liniment	3
Medicago sativa subsp. *sativa* and *Urtica dioica*	Antitoxic	Poultice	1
Alkanna tinctoria, *Ramonda myconi* and *Ruta chalepensis*	Antitoxic	Liniment	3
Citrus limon and *Citrus sinensis*	Antiverrucose	Without pharmaceutical form (direct use)	1
Buxus sempervirens and *Chelidonium majus*	Antiverrucose	Lotion	2
Allium sativum, *Althaea officinalis*, *Bryonia cretica*, *Lilium pyrenaicum*, *Petroselinum crispum*, *Ruta chalepensis*, *Sedum dasyphyllum* and *Umbilicus rupestris*	External antiseptic	Embrocation	1
Allium sativum, *Bryonia cretica*, *Fraxinus excelsior*, *Petroselinum crispum* and *Ruta chalepensis*	External antiseptic	Embrocation	1
Fraxinus excelsior, *Prunella vulgaris* and *Thymus vulgaris*	External antiseptic	Bath	3
Rosmarinus officinalis and *Thymus vulgaris*	External antiseptic	Bath	1
Allium cepa, *Centaurea calcitrapa*, *Malva sylvestris* and *Saxifraga longifolia*	External antiseptic	Bath	3
Calendula officinalis, *Hypericum perforatum* and *Petroselinum crispum*	For irritation	Liniment	1
Allium sativum, *Petroselinum crispum*, *Piper nigrum*, *Senecio vulgaris* and *Vitis vinifera*	For whitlow	Poultice	1
Allium sativum, *Althaea officinalis*, *Bryonia cretica*, *Lilium pyrenaicum*, *Petroselinum crispum*, *Ruta chalepensis*, *Sedum dasyphyllum* and *Umbilicus rupestris*	Resolvent	Embrocation	1
Allium sativum, *Bryonia cretica*, *Fraxinus excelsior*, *Petroselinum crispum* and *Ruta chalepensis*	Resolvent	Embrocation	1
Nicotiana tabacum and *Verbena officinalis*	Resolvent	Poultice	2
Linum usitatissimum subsp. *angustifolium* and *Rubus caesius*	Resolvent	Poultice	1
Alkanna tinctoria, *Salvia verbenaca*, *Sempervirum tectorum* and *Taxus baccata*	Resolvent	Ointment	2
Geranium robertianum and *Petroselinum crispum*	To treat lipoma	Ointment	1
Cucurbita pepo and *Ruta chalepensis*	Vulnerary	Cream	1
Allium sativum, *Althaea officinalis*, *Bryonia cretica*, *Lilium pyrenaicum*, *Petroselinum crispum*, *Ruta chalepensis*, *Sedum dasyphyllum* and *Umbilicus rupestris*	Vulnerary	Embrocation	1
Allium sativum, *Bryonia cretica*, *Fraxinus excelsior*, *Petroselinum crispum* and *Ruta chalepensis*	Vulnerary	Embrocation	1
Allium sativum, *Geranium robertianum* and *Valeriana officinalis*	Vulnerary	Embrocation	1
Allium cepa and *Petroselinum crispum*	Vulnerary. For geriatric skin ulcers	Embrocation	1

recorded in the Ripollès region. These four species do not appear also in the previous ethnopharmacological European works on plants used to treat skin diseases (Pieroni et al., 2004; Cavero et al., 2013). In between are the cases of *Cucurbita pepo*, *Tussilago farfara*, *Malva sylvestris*, *Vitis vinifera*, *Medicago sativa*, *Sambucus nigra* and *Olea europaea*, with certain relevant uses validated, while others lack references in the literature. Amongst the latter species, experimental pharmacological validation of non-reported uses could be relevant in the search for new medicines and treatments with topical application, especially for those species showing high percentages of use reports (e.g., *Tussilago farfara* and *Sambucus nigra*).

Apart from the strict literature pharmacological validation, we tested the presence of the plant uses quoted by our informants in a general, large and comprehensive database on useful plants (PFAF, see methodology). Twenty three out of the 112 species reported in the present work have at least one use recorded in this database (Table 4), which contains information on around 1500 plant species in 14 sections dealing with topical applications.

3.5. Use reliability

The overall data collected show a high consistency. On one hand, 25 out of 30 uses have been quoted by three or more informants, representing 83.33% of all reported uses. This means that a great part of folk plant remedies in the studied area meets the reliability criterion of Le Grand and Wondergem (1987) and Johns et al. (1990). On the other hand, the informant consensus factor (F_{IC}) is very high (0.93 of a maximum of 1, as defined by Trotter and Logan, 1986), indicating a high degree of agreement in the treatment of topical conditions in the area of study. This value is similar to the previous ones obtained in the upper river Ter valley for total medicinal uses (0.87; Rigat et al., 2007) and higher than the values for this factor found in Mallorca (0.71; Carrió and Vallès, 2012) and those reported from Mexican areas (0.75 and 0.79; Heinrich et al., 1998 and Leonti et al., 2001 respectively). In a neighbouring territory, Alt Empordà, the general consensus factor was very similar (0.91). Additionally, the obtained medicinal importance indices (MI, summarized in Fig. 3) for all the topical ailments are high. This shows a positive social perception of these uses and clearly

Table 4
Plant species with at least one topical use coincidental with those recorded in a general and comprehensive database (PFAF, Plants for a future, http://www.pfaf.org).

Species	Topical use
Achillea millefolium	Antiseptic
Allium cepa	Antiseptic, for animal bites
Allium sativum	Antiseptic, for animal bites
Arnica montana	Antiecchymotic, vulnerary
Geranium robertianum	Vulnerary
Hedera helix	Antiseptic
Hypericum perforatum	Vulnerary
Lavandula angustifolia	Antiseptic
Lilium candidum	Emollient
Lilium martagon	Emollient
Linum usitatissimum	Tumour resolvent
Malva sylvestris	Emollient
Olea europaea	Antiseptic
Plantago major	Antitoxic
Prunella vulgaris	Antiseptic, vulnerary
Rosmarinus officinalis	Antiseptic
Sedum album	Antipyrotic
Solanum tuberosum	Antipyrotic
Symphytum officinale	Vulnerary
Thymus serpyllum	Antiseptic
Thymus vulgaris	Antiseptic
Umbilicus rupestris	Antipyrotic
Urtica dioica	For animal bites

accounts for a high consistency of the data recorded. The antiecchymotic (MI=19.88), for punctures (MI=10.5) and in cicatrization (MI=9.57) show the highest values for this index.

Overall, these high consensus results, which suggest high reliability of uses claimed by the informants, encourage deeper pharmacological studies on this subject in the sampled area. For species with more than 1% of UR, topical uses validated in the literature also indicate a high reliability of data, except for a few taxa that would require further pharmacological research.

3.6. Perspectives in drug development

The plants used topically in the area prospected have shown themselves reliable in terms of consistency of their uses among population. Additionally, many of their applications are in agreement with data on relevant phytopharmacological literature. Either these plants or those with uses not reported in these sources could be considered in programs of drug development. First, as stated above, skin disorders and other troubles associated with topical uses are among the more frequent worldwide. Second, the European Union established a directive (2004/24/EC) on traditional herbal products establishing a simplified registration procedure for herbal medicinal products with evidence of use in the Community for at least 15 years. The present work (and others with similar approaches) can provide people dealing with drug design with the necessary evidences for this traditional use, reinforcing the already recognized role of ethnobotany in this applied field (Heinrich and Gibbons, 2001; Lewis, 2003).

4. Concluding remarks

The present study is the first one in the Catalan territories to focus on plants for topical use, and one of the very few within the European continent. The data collected show a high degree of consistency and indicate a remarkable persistence of folk knowledge on plant uses for topical conditions, especially in a selection of plants. This is the first step in pharmaceutical bioprospection, which has contributed sufficient data of a reliable nature. These data may be the starting point for further research aimed at obtaining products that may generalize the alternative medical uses here considered at a local level. Phytochemical and pharmacological studies on some of the plants quoted here—of which we could provide material to potentially interested researchers—would be useful first steps in this process.

The amount and reliability of plant traditional uses shown in the present and many other ethnobotany-based papers, and the perspectives of such information in drug development make us believe that, if a past period of golden days of ethnopharmacology could be over, as stated by Gertsch (2009), a new similar age may perfectly occur nowadays, since, according to large and various current research evidence—to which this paper aims to contribute—, the challenges described by Heywood (2011)—in particular the cooperation with health sector—may most likely be addressed with success.

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