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Catalog of Medicinal Plants of the Argan Grove of the Beni-Snassen Range in Eastern Morocco

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Abstract: The argan tree is part of the red list including 36 taxa considered as vulnerable in the catalog of rare, endangered or endemic vascular plants of Morocco. As such, its conservation constitutes a real challenge. Intimately linked to the sub-Mediterranean vegetation layer, the argan tree organizes populations of capital importance for south-west as well as eastern Morocco, despite their great degree of openness. The present work focused on the study of the floristic series of this formation by insisting on the medicinal plants of the argan grove of West Beni-Snassen. In this project, the flora of the Béni- Snassèn argan grove has been approached in several of its aspects (phytosociology, biodiversity, bioclimatology), with special focus on the possible candidates for medicinal purposes. Thus, several surveys of the vegetation and the environment were carried out and led to the census of 60 species. This low number can be explained first, by the degree of dispersion of these tree populations, but also by the harshness of the ecological conditions. Several medicinal species have been recorded within these groves including *Argania spinosa, Ajuga iva, Peganum harmala*. A botanical and ecological description of each taxon has also been carried out, in addition to its therapeutic properties while focusing on the bioactive molecules that it contains.

Keywords: *Argania spinosa*, Béni-Snassèn, medicinal plants, therapeutic properties.

Introduction

Currently, the human pharmacopoeia uses more than 20,000 plants for the treatment of various diseases and the recognition of the clinical and pharmaceutical value of herbal medicines continues to grow despite the continued development of the pharmaceutical industry and especially the diversification of synthetic and biological medical products. Taxa are increasingly endangered in the world [1], which justifies a multidisciplinary approach to the study of flora (phytosociology, biodiversity, bioclimatology) [2, 3]. Traditional remedies are the main medical treatment for two thirds of the world's population, due to the limited availability and affordability of standard pharmaceutical drugs used in developed countries [4]. It should be noted that 75% of the medicines have a plant origin and 25% contain at least one active molecule of plant origin [5]. Demographic growth in the developing world and the growing interest in industrialized countries have considerably increased the demand for Medicinal and Aromatic Plants (MAP) and their by-products. Indeed, the reputed efficacy of medicinal plants in the treatment of various human diseases has been attributed to the presence of several active compounds, mainly phenolic derivatives such as flavonoids and phenylpropanoids [6]. These compounds have undeniable antioxidant properties. They play a very important role in the prevention of human disorders with inflammatory background [7]. In addition to this, initiatives and actions have been taken to give added value to these plants and integrate them into a sustainable and harmonious development. The virtues of MAPs are multiple and no longer to be demonstrated [8].

Numerous ethnobotanical studies have been carried out to identify the medicinal applications of several plant species.

The identification of the MAPs that grow in the Beni Snassen argan grove is intended to:

• uncover the therapeutic virtues of the MAPs of the argan grove in order to promote their traditional and industrial use;

• shed light on the potential of this unit so as to better integrate it into a sustainable, global, and

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integrated development of Moroccan forests and pre-forestry.

Materials and methods

Physical setting: The Beni Snassen range

The Beni-Snassen range is a WSW-ENE mountainous group in eastern Morocco. It begins in the west with plateaus bordering the Moulouya and continues eastwards through higher mountains, up to Orania [9]. It is subdivided into two parts by a faulty elevation at Taforalt; including Western Béni-Snassèn that is characterized by a clear homogeneity in its stratigraphy and where the Jurassic stretches are largely dominant [10], and Oriental Beni-Snassen.
The main climatic factors identified on this range are as follows [11]:

• Average precipitation: from 251 to 553 mm / year;
• Number of rainy days: 45 to 50 per year;
• Seasonal Rainfall: HPAE;
• Minimum average temperatures of the coldest month: -0.2 to 4.6 ° C;
• Maximum average temperatures of the hottest month: from 26.7 to 30.8 ° C;
• Bioclimates: A, SA, SH.

Vegetation: Argan grove.

The argan tree is of tropical origin but also currently mainly produced in the Mediterranean region [12]. Indeed, apart from its small stations in the Western Béni-Snassèns and in the Grou Wadi valley, the argan tree also grows in the arid and semi-arid zones of the Moroccan South-West [13]. It covers an area of about 800,000 hectares [14]. The argan tree has suffered greatly from human action and the long and abusive exploitation of its plantation suggests that the isolated stations of the Beni Snassens and Upper Grou valley are only indicative of a possible extension of the species [15].

The argan tree mainly developed in southwestern Morocco is a xerophilic and thermophilic tree. It can only survive under very strict conditions of temperature and humidity [16]. Within the argan area, the average annual rainfall can vary between 116 and 519 mm while its optimum rainfall appears to be between 200 and 250 mm on average [17]. The maximum temperature it can bear is 50.2 ° C [18]. The argan tree can also withstand low temperatures around 0 ° C provided that they are short-lived [17]. On the edaphic domain, the argan tree can accommodate all types of substrates, except mobile sands. It grows on an altitudinal level ranging from sea level up to 1600 m. Throughout Morocco, argan tree populations develop in a semi-arid and arid bioclimatic environment where they play an important role in the fight against desertification [19]. These groves extend into the inframediterranean vegetation layer. On the phytosociological level, most of the climatic tree groups that develop there are integrated in the category of the *Acacio-Arganietalia* [20].

Methodology

Several vegetation and environmental surveys were carried out. For each station, in addition to the floristic inventory, the survey provides accurate information on the following characteristics: altitude, exposure, slope, substrate and overall vegetation cover.

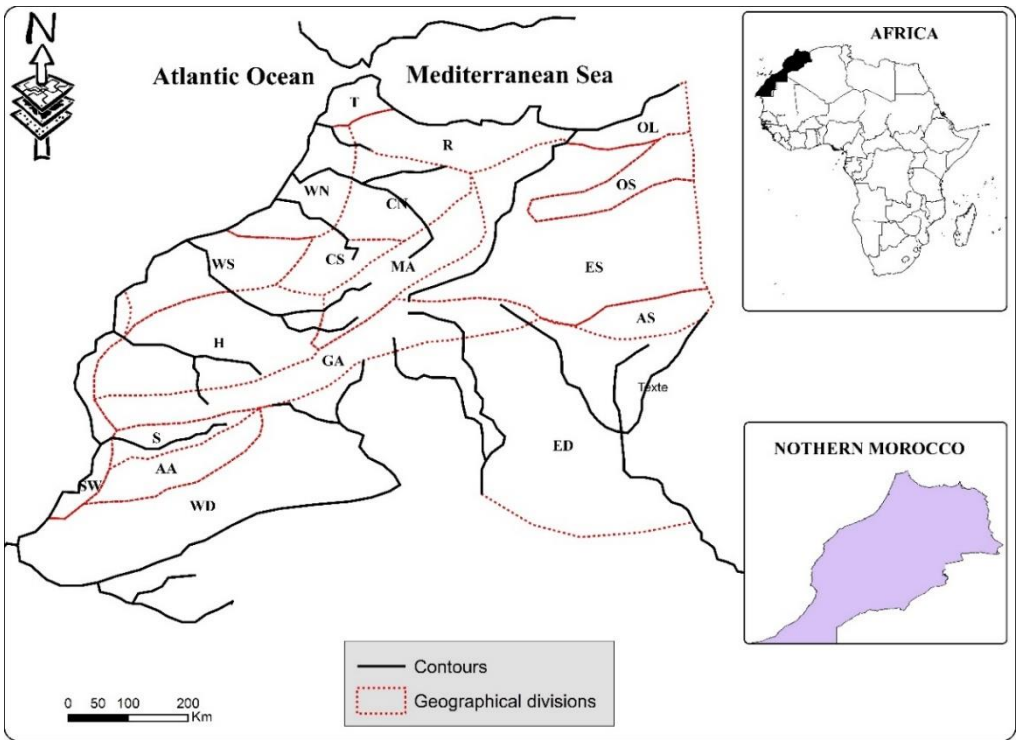
Within the surveys, each species is assigned two indices indicating not only its presence but also its density. These are indices of abundance, dominance, and sociability designed according to a scale established by Braun-Blanquet.

In the elaborated catalog, the species are presented by families listed in alphabetical order. Each of them is described by 7 descriptors that are:

- Biological type: The abbreviations used to indicate the various known biological types are: Th (therophyte), G (geophyte), Hem (hemicryptophyte), Ch (chaméphyte), Nph (nanophanérophyte), Ph (phanérophyte).
- Flowering date: known flowering period for each species
- Altitudinal range: altitudinal range in which the species was encountered in the study area as well as the maximum altitude reached by the species in Morocco.
- Distribution in the different provinces of Morocco: area where the various taxa grow within the Moroccan territory taking into account the subdivisions retained by [21] in the Moroccan plant catalog. These authors have subdivided Morocco into 19 phytogeographical regions. Since its appearance, the catalog of plants of Morocco has constituted a basic document for all studies of regional floras. The subdivisions included in this work are:

- AA: Anti-Atlas
- AS: Saharan Atlas (Figuig Mountains)
- CN: Central Morocco, the northern part
- CS: Central Morocco, the southern part
- ED: Eastern desert Morocco (from Algeria to the upper Drâa)
- ES: Eastern steppe Morocco (Moulouya basin)
- GA: Grand Atlas
- H: Southern Morocco steppe (Haouz and Tadla)
- MA: Middle Atlas (including Mount Tazzeka)
- OL: Littoral Oranian Sector (Beni-Snassen)
- OS: Mountainous oranian sector (mountains from Debdou to Ghar Rouban)
- R: Eastern and Western Rif, from Moulouya to Oued Laou, including the Atlas Rif
- S: Souss Plain
- SW: Moroccan Macaronesian sector (littoral and coastal hills of Cantin Cap in Ifni)
- T: Tingitane or Djebala Peninsula

(southern limit: Larache-Oued Laou)
- WD: Western Desert Morocco (at the W of the High Drâa)
- WN: North-Western Morocco (from Larache to Casablanca)
- WS: South-Western Morocco (from Casablanca to Cap Cantin)
- Z: Zaïan Mountains



Map: Geographical divisions of Northern Morocco [22Source: Jahandiez and Maire, 1931]

- Distribution in the world: the various localities known for housing the species, throughout the world.
- Ecology: the habitats where the species was frequently seen.
- Bioclimate: the different bioclimatic environments where the species grows. The bioclimatic atmospheres selected are those defined by Emberger, Saharan (S), Arid (A), Semi-arid (SA), Subhumid (SH), Humid (H), and (HM) High Mountain. Within the semi-arid bioclimatic environment, two variants were distinguished: one is soft (SA d), and the other cold (SA f).

Results and Discussion: Presentation of the catalog

CUPRESSACEAE

Tetraclinis articulata (Vahl) Mast., *J. Roy. Hort. Soc.* 14: 250 (1892).

Description

1. Ph.
2. March-May.
3. 100-1420 m (2000 m.)
4. OL, OS, R, T, CN, CS, WN, SW, ES, MA, GA, AA.
5. Southern Spain, Malta, Algeria, Tunisia, Libya, Cyprus.
6. Shape of forests and scrubs in the plains and low mountains.
7. SA d, SH.

Therapeutic Properties

In Morocco, local people use this forest essence in traditional medicine. The different parts of the tree, particularly the leaves and twigs, are used in the treatment of intestinal and respiratory infections [22]. A first study on the bioactivity of the essential oil extracted from the wood of Tetraclinis articulata originating in Essaouira has proved its antimicrobial power [23]. The different parts of the tree, particularly the leaves and twigs, are known for their sudorific, diuretic and antirheumatic properties. They are also recommended in the treatment of intestinal infections, respiratory diseases, diabetes and high blood pressure [24]. Leaves alone are often used as packs in the treatment of children's fevers, in drinking with whey against acute diarrhea and applied as dressings on the wounds as a healing agent.

The essential oil of the leaves of Tetraclinis articulata exhibits, in vitro, an interesting bacteriostatic activity with respect to Escherichia coli, Bacillus subtilis, Staphylococcus aureus and Micrococcus luteus and a notable fungistatic activity against Penicillium parasiticus and Aspergillus niger [25].

Several authors [26, 27, 28, 23] worked on the antimicrobial activity of the majority compounds of the essential oils that they have classified in the following descending order: phenols> alcohols> aldehydes> ketones> ethers> hydrocarbons [29]. The same authors have also reported that phenols and alcohols have microbicidal rather than microbiostatic activity. This does not exclude a synergistic effect between the different molecules that can also be responsible for the significant efficacy of the oxygenated fractions in inhibiting pathogenic microorganisms. These molecules are also believed to be responsible for the antioxidant and anti-inflammatory action of the Essential oil of the leaves of *Tetraclinis articulata*.

EPHEDRACEAE
Ephedra fragilis Desf., *Fl. Atlant.* 2: 273 (1799).

Description

1. Ph (Ch).
2. April-May.
3. 150-910 m (2000 m).
4. OL, R, CN, OS, SW, GA, AA, AS.
5. Portugal, Southern Spain, Balearic Islands, Sicily, Malta, Tunisia, Algeria, Canary Islands, Madeira.
6. Arid rocks, perilous places of the plain.
7. S, A, SA d, SA f.

Therapeutic Properties

Used for at least 5000 years by the Chinese, Ephedra is considered as one of the oldest known drugs [30]. It is commonly used in herbal medicine for asthma and nasal congestion. The therapeutic properties of this plant are mainly due to the presence of ephedrine and pseudoephedrine (Roberts and Wink., 1998). The levels of phenols, flavonoids and alkaloids of Ephedra vary according to species [31]. Ephedrine stimulates heart rate, increases blood pressure, promotes bronchodilation and has strong effects on the central nervous system (CNS) by binding to adrenergic receptors. Pseudoephedrine acts in a similar way, but with fewer effects on the CNS [32].

CARYOPHYLLACEAE
Paronychia argentea Lam., *Fl.* 3: 230 (1779).
Description

1. Hém.
2. February-July.
3. 150-1150 m (2300 m).
4. R, T, OL, CN, WN, Z, H, SW, S, OS, ES, WD, MA, GA, AA.
5. Southern Europe, Western Asia, Northern Africa, Canary Islands, Madeira.
6. Dry uncultivated places, pastures of the plain and the mountains.
7. A, SA d, SA f, SH, H.

Therapeutic Properties

This species is used in the Maghreb as a beverage and a popular remedy for preventive measures against the formation of kidney and vesicular stones with hypoglycaemic activity [33, 34], diuretic and antimicrobial activity [35]. This species is widely known for its ability to help dissolve and expel stones from the urinary tract after a few days of treatment [36]. Paronychia argentea is also used as an analgesic to treat gastric ulcer, anorexia and flatulence [37]. However, pharmacological tests or toxicity studies for this species remain rare [38].

SAPOTACEAE
Argania spinosa (L.) Skeels, U.S.D.A. Bur. Pl. Bull. 227, invent. 25: 28 (1911).

Description

1. Ph.
2. April-June.
3. 150 m (1450 m).
4. SW, S, WN (grooves of the Wadi Grou), OL, GA, AA.
5. Endemic of Morocco.
6. Plain and low limestone and siliceous mountains.
7. S, A, SA d.

Therapeutic Properties

Several studies have demonstrated the hypolipidemic, hypocholesterolemic and antioxidant effects of argan oil [39, 40, 41, 42]. A clinical study by [40] showed that the daily intake of argan oil at 15 g / day decreased plasma LDL cholesterol, and the susceptibility of LDL to peroxidation. Indeed, the rich composition of argan oil in mono and polyunsaturated fatty acids, in sterols as well as in antioxidants (1%) such as polyphenols and tocopherols [43] gives it aneffect of cardiovascular disease prevention [44]. Argan oil also has revitalizing properties due to its high content of linoleic acid. Indeed, unsaturated fatty acids enter the membrane phospholipids, moisturize the skin and nourish it [45].

Argan oil has a special composition characterized by high levels of linoleic and oleic acids. In addition, it is rich in polyphenols and tocopherols, with antioxidant activity. Argan oil also contains other minor compounds such as carotenoids, squalenes, sterols and xanthophylls. These compounds could contribute to the nutritional value of argan oil, its properties beneficial for health, as well as its organoleptic and dietary characteristics and its preservation [46, 43, 47].

FABACEAE
Bituminaria bituminosa (L.) C.H. Sirt, Bothalia 13: 318 (1981).

Description

1. Hém.
2. April-July.
3. 150-630 m (2100 m).
4. R, T, OS, OL, CN, SW, H, WD, MA, GA, AA, AS.
5. Southern Europe, Western Asia, Cyrenaica, Tripolitania, Tunisia, Algeria, Canary Islands, Madeira.
6. Forest clearing, bush and rocks, plains and mountains.
7. A, SA d, SA f, SH, H.

Therapeutic Properties

The Bituminaria species is firmly anchored in phytochemistry as a source of furanocoumarins, whose compound (furo [3, 2-g] [1] benzopyran-7-one) has been named psoralen [48]. On the Madeira island, it is commonly used in popular medicine as a decoction for the external restoration of hair [49]. The infusion of fresh leaves is also used for the treatment of fever and urinary infections [50, 51]. Antioxidant and antibacterial activities have also been described as effect of B. bituminosa extracts [48, 52, 53, 54]. [55] have shown that the aqueous extract of Bituminaria has antidiabetic effects.

Phytochemical analysis of the aqueous extract of Bituminaria revealed the presence of tannins, alkaloids, flavonoids, anthocyanins, terpenes and sterols in the extract [55].
Calicotome intermedia C. Presl., *Abh. Konigl. Böhm. Ges. Wiss.*, Ser. 5, 3: 481 (1845)

Description

1. Nph.
2. March-May.
3. 190-950 m (1000 m).
4. R, T, OL, OS, CN, MA.
5. Spain, Libya, Tunisia, Algeria.
6. Clear forests, bushes of low limestone mountains, more rarely clayey.
7. SA d, SH.

Therapeutic Properties

According to this secondary species has anti-inflammatory, anti-atherosclerotic, antitumor, antimutagenic, anticancer, antibacterial and antiviral properties [56, 57].

This species is rich in non-terpene compounds and fatty acids with tricosan, pentacosane, pentadecanoic acid, helicanosan, pentadecan-2-one and tridecane-2-one as major components. Hexadecanoic acid is the main compound that can prevent cardiovascular disease and has antibacterial and antifungal activities. Dodecanoic acid and octadecanoic acid have antibacterial and antifungal activities [58, 59, 60, 61].

Genista tricuspidata Desf., *Fl. Atlant.* 2: 138 (1798).

Description

1. Nph.
2. January-June.
3. 260-1030 m.
4. R, OL, CN, Z, SW, GA.
5. Tunisia, Algeria.
6. Clear forests, bushwood of low mountains.
7. A, SA d, SH.

Therapeutic Properties

Phytochemical studies on the Genista species have essentially led to the isolation of alkaloids [62] and flavonoids, especially isoflavonoids [63], known for their diverse biological activities and antispasmodic, laxative, diuretic, and anti-inflammatory effects. [64] demonstrated an intermediate inhibitory activity of Genista essential oils on three strains of bacteria, namely *Pseudomonas aeruginosa*, *Escherichia coli*, and *Staphylococcus aureus.*

RHAMNACEAE
Rhamnus lycodes subsp. Oleoides (L.) Jahand. & Mayor, *Cat. Pl. Morocco* 2: 476 (1932).

Description

1. Nph.
2. March-June.
3. 100-1420 m (3000 m).
4. O, R, T, CN, WN, WS, SW, Z, H, OS, ES, ED, S, MA, AS.
5. Portugal, Spain, Baleares, France, Sardinia, Malta, Sicily, Greece, Crete and Karpathos, Eastern Aegean islands, Anatolia, Egypt, Libya, Tunisia, and Algeria.
6. Forests, bush, rocks and rockeries, plains and mountains.
7. A, SA d, SH, H.

Therapeutic Properties

In Morocco, this species is used as a laxative [65] and against liver diseases [66]. Rhamnus species are known for their pharmacological activities, including hypostentive activity [67], antiproliferative and antioxidant activity [68].

Ziziphus lotus (L.) Lam., Encycl. 3: 317 (1789)

Description

1. Nph.
2. May-July.
3. 260-680 m.
4. R, CN, OL, WN, T, WS, Z, SW, H, ES, ED, MA, AA, AS.
5. Western Mediterranean.
6. Clayey plains, barren stony slopes, steppes, desert dayas in the plain and the low mountains.
7. S, A, SA, SH.

Therapeutic Properties.

The different types of the Zizyphus species are widely used in the treatment of digestive disorders, liver diseases, obesity, urinary disorders, diabetes, skin infections, fever, diarrhea and insomnia [69, 70, 71]. Z. lotus is also used to treat sore throat, relieve stress and common colds [72]. Its reported antimicrobial activities are specially attributed to its most active ingredients; the polyphenols and the alkaloids [73].

ANACARDIACEAE
Pistacia lentiscus L., Sp. Pl. 1026 (1753).

Description

1. Nph (Ph).
2. March-May.
3. 80-1420 m (1600 m).
4. R, T, OL, CN, WN, Z, H, WS, SW, S, OS, MA, GA, AA, AS.
5. Southern Europe, Western Asia, Northern Africa, Canary Islands.
6. Forests and scrublands of the plain and low mountains.
7. SA d, SH, H.

Therapeutic properties

The aerial parts have been used in the treatment of high blood pressure and have stimulating and diuretic properties [74]. According to [75], leaves are widely used in traditional medicine for the treatment of eczema, diarrhea and throat infections, and as a potent antiulcer. The essential oil extracted from the aerial parts has antioxidant, anti-inflammatory, antimicrobial properties [76], and antifungal agents [77, 78]. Mastic gum was used for the management of abdominal discomfort, stomach pain, dyspepsia and peptic ulcer [79]. It was reported by [80] that at 50%, the ethanolic extract of the P. lentiscus gum inhibited proliferation and induced apoptosis in human colon cancer cells in vitro. Other medicinal properties of this plant were related to the fixed oil extracted from the dark berries of P. lentiscus [81].

Rhus pentaphylla Desf., *Fl. Atlant*. 1: 267 (1798).

Description

1. Nph (Ph).
2. March-May.
3. 100-440 m (1000 m).
4. R, OL, CN, WN, Z, H, WS, SW, S, OS, WD, MA, GA, AA.
5. Algeria, Tunisia, Sicily.
6. Clear forests, bushes of the plain and low mountains.
7. S, A, SA d.

Therapeutic Properties

The leaves, roots, and barks in decoction, are used to combat gastrointestinal disorders. Either fresh or dried fruit are used in the treatment of diarrhea [65].

ZYGOPHYLLACEAE
Fagonia cretica L., *Sp. Pl*. 386 (1753).

Description

1. Ch.
2. May-June.
3. 100-540 m.
4. OL, ES, R, T, CN, CS, WN, WS, SW, H, S, WD,
5. GA, AA.
6. Southern Spain, Balearic Islands, Sicily, Malta, Crete, Cyclades, Cyprus, Arabia, Socatra, Northern Africa, Canaries.
7. Clear forests, bush, rocks, rocky pastures of the plain and low mountains.
8. A, SA d, SH.

Therapeutic Properties

Fagonia is a species whose representatives are confined to warm regions of almost every continent. It has many phytochemical constituents, that have an important role in preventing different types of diseases [82]. *Fagonia cretica* is known to have important therapeutic effects against various hematological, hepatic, neurological and inflammatory problems [83]. The *Fagonia* type is anti-asthmatic, stimulant, antiseptic, antidote, antidysenteric, antihepatotoxic, antipyretic, diuretic and analgesic [84]

Peganum harmala L., *Sp. Pl.* 444 (1753).

Description

1. G.
2. May-July.
3. 160 m (1100 m).
4. WD, ED, ES, R, CN, CS, WS, SW, H, S, OL, OS, MA, GA, AA, AS.
5. Spain, Sardinia, Southern Italy, Greece, Western and Central Asia, Northern Africa.

6. Arid slopes, dry uncultivated fields, rubble, earthy steppes, nitrophilous.
7. S, A, SA d, SA f.

Therapeutic Properties

In Algeria, P. harmala is used to treat gastrointestinal problems, infertility and urinary tract infections [85]. P. harmala contains alkaloids and flavonoid derivatives that provide its pharmacological activities [86]. The phytochemical study of P. harmala extracts showed that the seeds of this plant contain alkaloids, saponins, tannins, quinones, anthraquinones, terpenoids and steroids [85]. Thanks to this composition, P. harmala is known for analgesic [87, 88], antibacterial and antifungal effects [89]. Extracts of P. harmala have also shown an important therapeutic effect in the treatment of depression [90].

APIACEAE
Eryngium maritimum L

Description

1. Hem
2. June-August
3. 280 m
4. Europe; West Asia; Northern Africa.
5. Maritime sands of western Morocco, the Rif and Béni-Snassèn and the Macaroonian-Moroccan sector.
6. SA

Therapeutic Properties

Several medicinal properties have been attributed to *E. maritimum* including important antioxidant, antibacterial and antifungal activities of leaf and root extracts [91]. *E. maritimum* is an important expectorant, diuretic, antiscorbutic, cytotonic, aphrodisiac, and anthelmintic. It is also used in the treatment of cystitis and urethritis as an antinociceptive and anti-inflammatory. This type is also used to treat snake bites, fevers or reproductive disorders in women [92].

ASCLEPIADACEAE
Caralluma europaea (Dec.) N.E.Br., *Gard. Chron., S*.3, 12: 370 (1892).

Description

1. Ch.
2. September-November.
3. 220-520 m (900 m).
4. R, ES.
5. Southern Spain, Algeria.
6. Limestone rocks of the lower mountains.
7. SA d.

Therapeutic Properties

This type is used in traditional medicine as a cure for diabetes and cancer [93]. It is also known for its lipolytic activities [94], hypoglycaemic [95, 96], an anti-inflammatory analgesic [97] and its attenuating effect on arterial high blood pressure [98].

Periploca laevigata Labill., *Inco. Pl. Syr* 2:13 (1791).

Description

1. Nph.
2. March-May.
3. 260 m.
4. R, OL, WD, AS, AA, GA.
5. Southern Spain, Sicily, Syria, Northern Africa, Canary Islands.
6. Forests, bush, rocks of the dry regions.
7. S, A, SA d.

Therapeutic Properties

Periploca is involved in the preparation of tea in some countries of North Africa. Because of its reputed medicinal properties, it is used in the treatment of headache and diabetes [99]. *Periploca sepium*, *Periploca graeca* and *Periploca nigrescens* have been reported to exhibit various biological activities, mainly including hypotensive effects [100].

SOLANACEAE
Withania frutescens (L.) Pauquy, *Belladonna* 15 (1825).

Description

1. Nph.
2. February-June.
3. 100-710 m (1400 m).
4. OL, SO, ES, R, T, CN, WN, Z, CS, WS, SW, H, S, MA, GA, AA.
5. Southern Spain, Ibiza, Western Algeria.
6. Clear forests, bushes of the plains, and low mountains.
7. A, SA d, SH.

Therapeutic Properties

This type is used against poisoning and skin diseases. It also has hepatoprotective properties [101] and anti-inflammatories [102].

LAMIACEAE
Ajuga iva (L.) Schreb., *Pl. Verticill. Unilab. Gen. Sp*. 25 (1774).

Description

1. Hem (Th).
2. February-July.
3. 100-950 m (2700 m)
4. T, R, OL, CN, WN, Z, CS, H, WS, SW, S, WD, ES, OS, MA, GA, AA.
5. Southern Europe, Palestine, Northern Africa,

Macaronesia, Cape Verde Islands.
6- Forest clearings, pastures, uncultivated fields, limestone and siliceous rockeries, plains and mountains.
7- A, SA d, SA f, SH, H.

Therapeutic properties

Antidiabetics, antihypertensives, leishmanicides, digestive disorders, eczema [103], thyroid problems [104], and nervous disorders [105]. Cardiovascular diseases, respiratory tract diseases [106], injury, and contusion [107].

Ballota hirsuta Benth., *Labiat. Gen. Spec*. 595 (1834)

Description

1. Nph.
2. March-July.
3. 100-1100 m (1200 m).
4. T, R, OL, CN, WN, Z, CS, H, WS, SW, S, ES, OS, MA, GA, AA, AS.
5. Iberian Peninsula, Balearic Islands, NW of Algeria.
6. Clear forests, rocks, bushes, plains, and low and medium mountains.
7. A, SA d, SA f, SH, H.

Therapeutic Properties

According to reference [108], the preliminary biological evaluation of hispanolone and diterpene prehispanolone [109], compounds detected in B. *hispanica*, revealed anti-inflammatory activity [110] and identified prehispanolone as a platelet-activating factor-specific antagonist [111]. Labdanes, which belong to the bicyclic diterpenoid group, exhibit a broad spectrum of biological activities (antibacterial, antiviral, anti-inflammatory, cytotoxic, anti-tumor ...) [108]. A decoction of leafy stems is indicated as antidiabetic [112].

Lavandula dentata L., *Sp. Pl.* 572 (1753).

Description

1. Ch.
2. February-June.
3. 80-950 m (1800 m).
4. R, T, OL, WN, WS, SW, S, OS, MA, GA, AA.
5. Iberian Peninsula, NW of Africa, Ethiopia, Saudi Arabia, Yemen.
6. Forests and undergrowth of the limestone and siliceous soils of the littoral and low mountains.
7. SA d, SH.

Therapeutic Properties

Algieri F et al. [113] who studied both *Lavandula dentata* and *Lavandula stoechas*, have noted that both species are frequently used in traditional medicine, especially for the treatment of digestive disorders including liver and intestinal inflammations [114], but also for other inflammatory disorders such as arthritis [114], rheumatism [115]. The medical importance of these species is well established. In fact, different pharmacopoeias include medicines prepared with them, mainly in the form of infusions [116].

Lavandula multifida L., *Sp. Pl.* 572 (1753).

Description

1. Ch.
2. February-June.
3. 80-500 m (1200 m).
4. T, R, OL, CN, WN, H, WS, SW, S, WT, WD, ES, OS, MA, GA, AA.
5. Portugal, Spain, Southern Italy, Sicily, Egypt, Tripolitania, Algeria, Tunisia.
6. Clear forests, bush, arid pastures, plains and low limestone and siliceous mountains.
7. A, SA d, SH.

Therapeutic Properties

Lavender and thyme are widely used in traditional Moroccan medicine [117]. In fact, *Lavandula multifida* is traditionally used to treat headaches, depression, diabetes and also has sedative properties [118, 119]. Lavender essential oil is rich in monoterpenes and used for its antimicrobial and carminative properties, to treat burns and for cosmetic purposes [120]. Its leaves and stems are used in Moroccan popular medicine to prepare decoctions against rheumatism, cold and to treat problems of the digestive system [121]. Additionally, an inflammatory activity has been identified for this lavender [122].

Prasium majus L. L., *Sp. Pl*. 601 (1753).

Description

1. Nph.
2. March-June.
3. 300 m.
4. R, T, OL, CN, WN, Z, CS, WS, SW, S, ES, MA, GA, AA,
5. Southern Europe, Western Asia, Northern Africa, Canary Islands, Madeira.
   Forests and bushes, rocks, plains and low mountains.
6. A, SA d, SH, H

Therapeutic Properties

In infusion, the leaves act against the evils of the gall bladder. In decoction, they are known as digestive and calming [123]

OLEACEAE

Olea europaea var. Sylvestris (Mill.) Lehr, *Diss. Bot. -Med.* 20 (1779).

Description

1. Ph (Nph).
2. May-June.
3. 80-1420 m (2000 m).
4. All Morocco except the Sahara.
5. Mediterranean region, SW Asia.
6. Forests and scrublands of the plains and mountains.
7. A, SA, SH, H.

Therapeutic properties

Olive leaves are used in folk medicine and phytotherapy to treat and prevent hypertension. They are known for their hypoglycemic, antiseptic and diuretic properties [124]. They were used to alleviate arrhythmia and prevent intestinal muscle spasms [125]. Olive leaves are an important source of several antioxidants [125, 126].

CAPRIFOLIACEAE

Scabiosa stellata L., *Sp. Pl.* 100 (1753).

Description

1. Th.
2. May-June.
3. 220-1160 m (1500 m).
4. All of Morocco.
5. From Portugal to Liguria, Sardinia, Algeria, Tunisia.
6. Forest clearing, stony and clayey pastures, plains and mountains.
7. A, SA d, SA f, SH, H.

Therapeutic properties

Leaves and flowers act against heel cracks [123].

ASTERACAE

Artemisia herba-alba Asso., *Syn. Stirp. Arag*. 117 (1779).

Description

1. Ch.
2. August-September.
3. 150-950 m (1100 m).
4. OS, ES, ED, R, T, H, SW, S, OL, WD, MA, GA, AA, AS.
5. Spain, from the Canaries to Egypt, Western Asia.
6. Clay steppes, rocky pastures of the plain and mountains in the dry regions.
7. S, A, SA f.

Therapeutic Properties

Artemisia herba-alba has extensive use in traditional medicine for the treatment of gastric disorders, such as diarrhea and abdominal cramps and external wound healing [127]. Uses for the treatment of diabetes and other conditions such as jaundice are also reported [128]. This species is recommended for neurological disorders [129].

ARECACEAE

Chamaerops humilis L., *Sp*. Pl. 1187 (1753) [*Gen. Pl., Ed.* 5: 494, 1754].

Description

1. Ch (Ph).
2. April-June.
3. 100-1070 m (2300 m).
4. ES, OL, R, T, CN, WN, WS, SW, H, Z, MA, GA, AA.
5. Western Mediterranean Region.
6. Forests, bush, clayey, sandy and stony pastures of the plains and the mountains.
7. A, SA d, SH.

Therapeutic Properties

Hasnaoui O et al. [130] showed the positive effect of this species for the treatment of digestive problems. These indications are confirmed by the presence of groups of chemical compounds (tannins, flavonoids, saponins, steroids, unsaturated sterols and terpenoids) responsible for the therapeutic properties of this taxon.

ARACEAE

Arisarum vulgare Targ-Tozz., *Ann. Mus. Imp. Fis. Firense* 2 (2): 67 (1810).

Description

1. G.
2. October-April.
3. 100-860 m.
4. R, T, CN, Z, WN, WS, SW, H, S, MA, GA, AA.
5. Mediterranean region.
6. Shady places, embankments, old walls, rocky pastures of the plains and low mountains.
7. A, SA d, SH, H.

Therapeutic Properties

The roots in cataplasm, associated with *Aristolochia longa* are used against skin cancer and as vulnerary [123]. Tubers are used as emetocathartic and purgative [131]. They are also used to heal bruises [132].

POACEAE

Ampelodesmos mauritanica (Poir.) T. Durand & Schinz

Description

1. Hem (G)

2. April-June.
3. 100-930 m (2000 m).
4. OL, R, CN, MA.
5. Mediterranean region.
6. Forests and bushes, stony pastures of the plain and low mountains.
7. SA d, SH, H.

Therapeutic Properties

Djilani A et al [133] noted that in some areas of Algeria Ampelodesma mauritanica has been used to reduce blood glucose in diabetics. This value has been conferred on it because of its richness in compounds such as flavonoids, saponins, cardenolides and tannins [134, 135].

ASPARAGACEAE
Asparagus altissimus mumby, Bull. Soc. Bot. France 2: 2287 (1855).

Description

1. Nph (G).
2. July / September.
3. 780 m.
4. OL, R, CN, SW, WS, H, S, GA, AA, ES, WD.
5. NW of Africa (Algeria), Mediterranean littoral.
6. Brushwood, maquis, rocks of the plain and low mountains.
7. S, A, SA d.

Therapeutic Properties

The berries, stems and roots are known as stomachic and aperitive. In frying with eggs and camel grease, asparagus is considered a powerful spermatogen and aphrodisiac [131].

HYACINTHACEAE
Urginea maritima (L.) Baker, *J. Linn. Soc. Bot.* 13: 221 (1873).

Description
1. G.
2. June-November.
3. 80-1060 m (1400 m).
4. OL, ES, R, T, CN, WN, WS, SW, S, GA, AA, WD, MA.
5. Southern Europe, Western Asia, Northern Africa, Canary Islands.
6. Steppes, bush and stony or sandy pastures, rocks and sandstone or limestone rocks of the plain and low mountains.
7. A, SA d, SA f, SH, H.

Therapeutic properties

At low doses, *Urginea* mixed with meals is used against chills. It is an aphrodisiac, diuretic and abortive plant (especially in fumigations). In decoction, bulbs are used to treat sterility and as a mouthwash against toothache [123]. It is also used for cough, bronchitis, and in the treatment of jaundice [65].

Conclusion

Despite the state of the advanced opening of the Béni-Snassèn argan grove, the surveys carried out within it allowed the census of 60 species. A large proportion of them have an indisputable medicinal interest, and a wide range of therapeutic effects of these species was noted. Indeed, the species cited in this catalog have very diversified effects and allow predicting or fighting more diseases. Their use in the region, in Morocco or around the world is very old and their effectiveness is approved. This interest is another strong argument that adds to the ecological, biogeographic interests ... to start initiatives to protect the argan grove of eastern Morocco. The action plans for the preservation and conservation of the argan grove set up by the National Agency for the Development of the Oasian Zones and the argan grove initially concerned only the *Argania* blocks of South West of Morocco. Thus, in addition to the urgent needs of extending this preservation and conservation to all the Moroccan argan tree that is at the base of this important potential, these interesting results deserve valorization and popularization in both traditional and modern medicine. This component must now be taken nowadays into the all project development concerning the argan tree.

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