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Research Article

ETHNOBOTANICAL STUDY OF THE PLANTS USED IN THE TREATMENT OF THE DIGESTIVE DISEASES BY THE RIVERINE POPULATION OF THE FOREST OF IZARÈNE

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ABSTRACT

For a safeguard and a valorization of ancestral knowledge on the medicinal plants most used in traditional pharmacopoeia in the treatment of the diseases of the digestive system, an ethnobotanic study was carried out near the riverine population of the forest of Izarène, (North-East of the town of Ouezzane). By using 520 questionnaires, and during three programs of terrain (2007-2010). This study enabled us to count 62 exploited species, divided into 31 families and 59 genres. The families best represented are Lamiaceae, Apiaceae, and Fabaceae. The gotten results showed also that the aerial part is the most used. The infusion is the mode of preparation dominating and the administration is done mainly by oral way. Among the 62 medicinal species used by the riverine population, 20 spontaneous species are collected from the forest of Izarène. The overexploitation threatens some species little abundant like *Mentha rotundifolia*, *Origanum compactum*, *Centaurium Erythraea*, and *Solanum nigrum* of disappearance from the forest of Izarène. Hence the interest to adopt a sustainable approach of management to ensure the conservation and the preservation of these species. In addition, among the noted species, some are recognized by their toxic capacity such as *Nigella sativa, Zygophyllum gaetulum* and *Artemisia herba-alba.*
The results obtained could constitute a data base from the point of view of the phytochimical and pharmacological experiments and of the implementation of the innovating initiatives being able to lead to the manufacture of the traditional drugs used in the treatment of the diseases of the digestive system.

INTRODUCTION

Objectives

The diseases of the digestive system form a set of acute and chronic affections highly varied in terms of natural history, risk factors and forecast. They can affect the digestive tract (From the oral cavity to the rectum), the peritoneum, as well as the liver, the bile ducts and the pancreas. These affections are often benign: it is the case of gastro-enteritis, a diarrhoea, constipation or heartburns. Nevertheless, these problems can be more serious: hepatitises, ulcer of the stomach, cancer of the liver…. (Fnors, 2015).

In the face of the expansion of these diseases the coverage of which is high,WHO, encouraged ethnobotanic studies and pharmaceutical research to improve medicine with medicinal plants to promote their optimal uses in the systems of service of health care (Ghourri *et al.*, 2013; Trabi *et al.*, 2008).

In Morocco, as everywhere in the world, the medicinal plants still find their therapeutic indications in the treatment of several diseases, including the diseases of the digestive system in spite of the increasing influence of the modern medical system.

Morocco occupies a privileged place among the Mediterranean countries which have a long medical tradition and a traditional know-how containing medicinal plants (Scherrer *et al.*, 2005). The richness of its traditional medicine was demonstrated by all the studies carried out on ground, which is a heritage of the Arabo-berber civilisation and benefited largely from Muslim and Jewish tradition which reigned in this country (Jouad *et al.*, 2003). Indeed, some of these plants were described in the older Moroccan pharmacopoeia (Bellakhdar, 1978; Bellakhdar *et al.*, 1982; Boulos, 1983), and in several recent but partial and fragmentary ethnobotanic studies (Bellakhdar *et al.*, 1991; Claisse, 1990; Sijelmassi, 1993; Hmamouchi, 1999; Ziyyat *et al.*, 1997; ……..).

In the field of pharmacology, traditional knowledge containing plants became a tool recognized in the search for new sources of drugs and pharmaceutical products (Ghosh, 2003; Sharma *et al.*, 2003). The drugs containing plants are regarded as not very

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toxic and soft compared to the pharmaceutical drugs (Dibong *et al*., 2011; Tahri *et al*., 2012).

The rural communities are considered as the sector most neglected in terms of ethnobotanic studies (Prance, 1991) and several studies proved that up to 70% of this population always depends on traditional medicine as a primary source of medical care while only 30% are based on the conventional system of medical care (Jeruto, 2008). However, the intensive exploitation of the vegetable species for medicinal needs can become harmful if it exceeds the bearable threshold of regeneration by the used resources (Mehdioui & Kahouadji, 2007).

To document and thus perpetuate the traditional knowledge acquired by the local population, our laboratory tries to undertake floristic, ecological and ethnobotanic research of the medicinal plants on various parts of Morocco. Thus, diverse works were published on the Moroccan ethnobotanic knowledge among which we will quote: Benkhnigue *et al*.,(2014); Ghourri *et al*.,(2014); El Hilah *et al*., (2014); Orch *et al*.,(2015); Bouayyadi *et al*.,(2015) …etc.

From this perspective, we have led an ethnobotanic study, whose principal objective is to identify, and to count the medicinal plants used in the treatment of pathologies of the digestive system by the bordering population of the forest of Izarène which presents a floristic and ecological diversity and offers to the local population a knowledge rather rich in traditional phytotherapy.

MATERIAL AND METHODS

Study Area

According to the territorial cutting of 2015, the forest massif of Izarène is part of the Tangier-Tétouan-Al Hoceïma area.

It is located in the North-western zone of the Kingdom 12 km to the North-East of the town of Ouezzane and covers an approximate forest surface of 14600 ha between the parallels 34° 45' and 34° 58' N and the meridian lines 5° 25 ' and 5° 32' W. Limited to the southern part by marls of the tablecloth of the cretaceous pre-rifaine, this forest massif is characterized by a broken relief where altitudes vary approximately between 350 and 680m (HCEFLCD, 2005).

The zone of study, the Circle of Mokrisset, is a part of the province of Ouezzane and group 3 Caïdats (Zoumi, Mokrisset and Brikcha), and 3 rural districts (Zoumi, Ain Baïda and Brikcha) (Figure 1); it contains a population estimated at 25 000 inhabitants (SPEF, 2004).

The geological formation of the forest massif is characterized by a tormented mountainous area due to the presence of several hills forming the beginning of the mountains of the Rifaine chain of the south side. These hills are characterized by a deep argilo-slaty or argilo-marly ground which can reach in some places more than 3 meters of depth. The climate of the zone is subhumid at moderate winter, the annual average precipitation would be about 1000mm. These precipitations are distributed over approximately 70 days during all the year (November until April). One winter soft practically without cold and very rainy succeeds a dry season and hot of a duration from 3 to 4 months (Askarn, 1982).

Vegetable cover is characterized by a rich and diversified forest formation, constituted mainly a vegetation which testifies to a degradation of the climatic formation of the oak cork (Borgniet *et al*., 2009). The fires of the forest constitute for the area, one of the principal factors of degradation and destruction. The forest of Izarène has a vital economic, ecological and social importance for the bordering population.

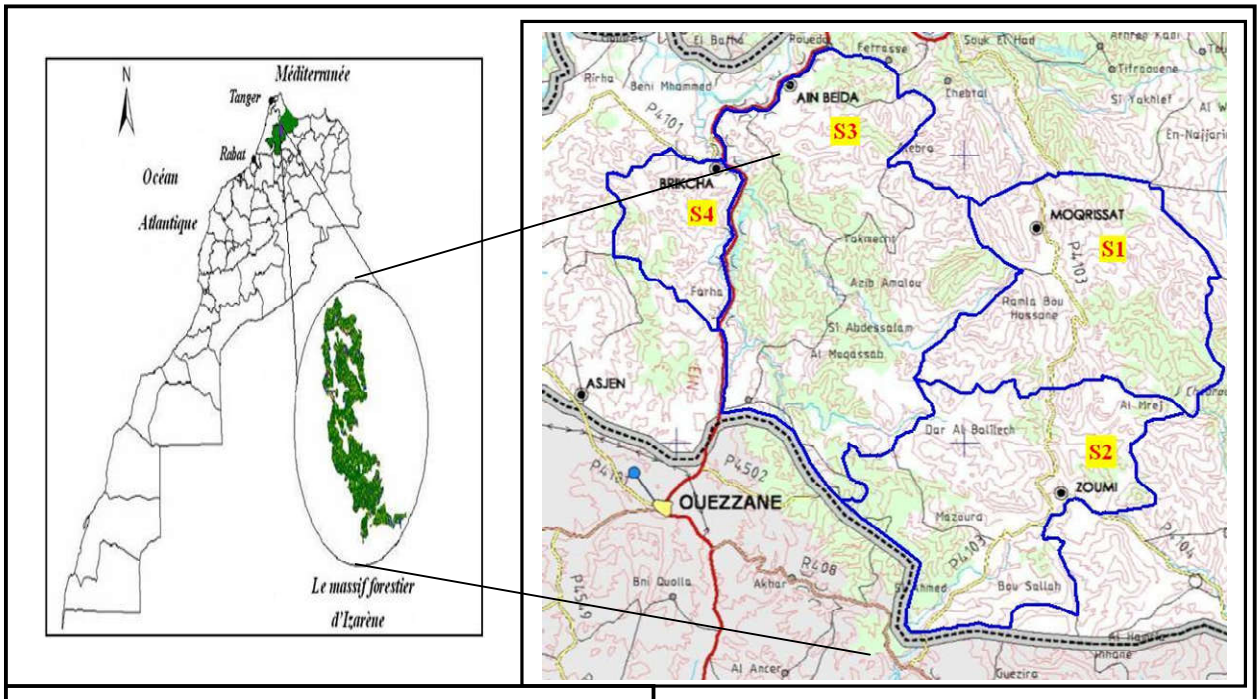

Figure 1 : Map of the Study area.

It assures the needs of the population for the firewood and for work, and constitutes the principal source of fodder for the cattle (Borgniet *et al.*, 2009). Beyond its paramount functions, it plays also a role in traditional medicine thanks to the use of the medicinal plants which belong to the means of subsistence of the bordering population.

METHODOLOGY

The exploratory study was carried out between February 2007 and May 2010 through ethnobotanic inquiries in various localities, villages and douars, bordering the forest of Izarène. The determination of the various mediums of inquiries was achieved thanks to the techniques of probabilistic stratified sampling (Kahouadji, 1986). In this study, the sample is divided into 4 homogeneous strata (S1, S2, S3 and S4), of which 3 correspond to the numbers of the rural communes of the Circle of Mokrisset (Table 1).

The investigation was carried out on 480 people inhabitants of villages and douars of the studied zone. By adopting a random stratified sampling, samples of 120 people are then formed for each of the 4 strata and they are put together to constitute the total sample (480 people).

The studies on the ground required us to deal with two groups: those which knew and/or employed plants for medicinal goals and those which employed plants and products of the plants for commercial goals (Collecting of the plants, herbalists, tradipraticians...). A pre-established questionnaire was designed to collect all information on surveyed and the maximum concerning the use of the medicinal plants by the local population, the vernacular name of each species, the methods of harvest, the bodies or the parts of the plant used, the mode of preparation, the mode of administration, the side effects, etc

The time devoted to each interview was about two hours and all the questioned people were informed on the objective of this study. The complete floral list was established after determination and checking of the samples, collected on the ground, thanks to the following documents:

- Petite flore des régions arides du Maroc occidental of Nègre (1961, 1962), tomes I et II.
- Nouvelle flore d'Algérie et des régions désertiques méridionales of Quézel & Santana (1962, 1963), tomes I et II.
- Les plantes médicinales du Maroc of Sijelmassi (1993).
- La pharmacopée marocaine traditionnelle of Bellakhder (1997).
- Flore pratique du Maroc of Fennane *et al*. (1999).
- Les plantes médicinales et aromatiques marocaines of Hmamouchi (2001), 2nd edition.
- Catalogues des plantes vasculaires du Nord du Maroc, incluant des clés d'identification, of Valdés *et al*. (2002), volumes I et II.
- Flore vasculaire du Maroc : inventaire et chorologie of Fennane & Ibn Tattou (2005).

In the end, the results obtained were registered in a data base then treated and analyzed statistically using the software Microsoft Office "Excel ".

Table 1 Distribution (Répartition) of the inquiries (investigations) according to strata (the layers)

Strata	Names of strata	number of inquiries
Strata 1	Mokrisset	120
Strata 2	Zoumi	120
Strata 3	Ain Baïda	120
Strata 4	Brikcha	120
	Echantillon	
	480	

RESULTS AND DISCUSSION

Profile of Surveyed of Study Area

Use of Plants According to Age

The use of the medicinal plants touches all the age brackets (Figure 2) on the scale of the bordering population of the forest massif of Izarène. The people of age higher than 61 years have a frequency of use of the medicinal plants of 33 %. Then comes the age brackets [50-60], [40-50[, [30-40[, [18-30[with a percentage respectively of 20 %, 18 %, 15 % and 14 %. The results obtained show indeed that the subjects of at least sixty (60) years have more knowledge in medicinal plants compared to the other age groups. Indeed, the old people are judicious to provide more reliable information, owing to the fact that they hold a good part of the ancestral knowledge which is transmitted orally. The transmission of this knowledge is in danger currently because it is not always assured (Weniger, 1991; Anyinam 1995). One also notes a loss of information on the medicinal plants, which is explained by the mistrust of certain people, particularly the young people, who tend not to believe too much in this traditional medicine.

Use of Medicinal Plants According to Sex

The data processing shows that among the surveyed individuals, 75% of female sex against 25% of male sex (figure 3), which explains that in this region women possess much more knowledge on plants and their modes of use and preparation. This can be justified by the fact that women are concerned with the treatment not only of themselves but also of their families and with the preparation of the receipts for the care. These results confirm the results of the other ethnobotanic works realized on a national scale (Ziyyat *et al.*, 1997; Hmamouchi, 2001; Jouad *et al*., 2001; Eddouks *et al*., 2002; Tahraoui *et al*., 2007; Mehdioui & Kahouadji, 2007; Salhi *et al.*, 2010; Benkhnigue *et al.*, 2010).

Use of Plants According to the Level of Study

Concerning the level of schooling of the users of the medicinal plants in the zone of study, the results obtained show that the majority of the users are illiterate with a percentage of 49 % (Figure 4). This relatively high percentage is in direct correlation with the level of studies of the local population. Nevertheless, the people having the primary and secondary level of studies have a considerable percentage of use of the medicinal herbs (27% and 17% respectively), whereas those having a level of higher education, use the medicinal plants very little (8 %).

According to the Family Situation

The local residents investigated in this region are mainly married with a percentage of 85% against 15% for the

unmarried people (Figure 5). That is probably explained by the concern of minimizing the material loads required by the doctor and the pharmacist.

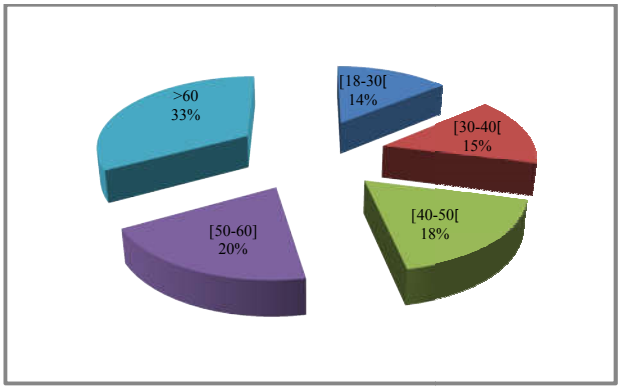

Figure 2 Distribution of the frequency of use of the medicinal plants according to age

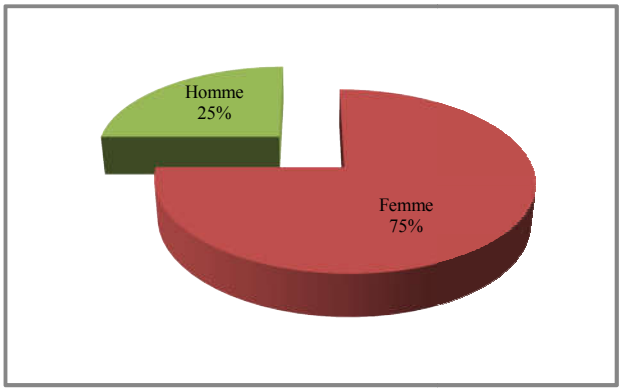

Figure 3 Distribution of the frequency use of plants according to sex

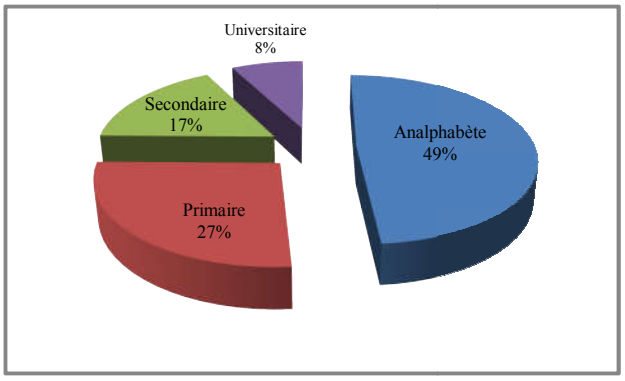

Figure 4 Distribution of the frequency use of plants according to the level of study

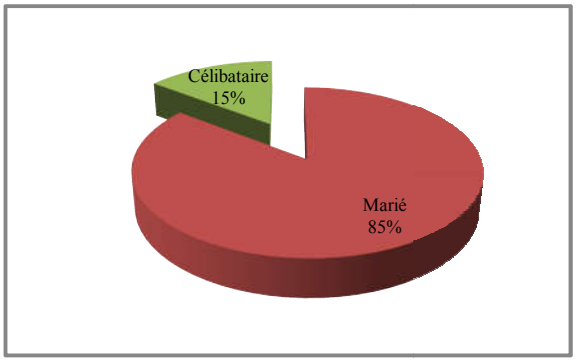

Figure 5 Distribution of the frequency use of plants according to the family situation

Ethnobotanic Analysis

Plant Parts Used

To prepare traditional recipes in the treatment of the digestive system, various parts of the listed vegetable plants are exploited by the local population (leaves, roots, bark, fruits …).

In the zone of study, the use of the aerial part is dominant with a percentage of 24.24% (Figure 6). Then comes the leaves and the fruits with the same percentage (19.69%), then the seeds (13.63 %). the whole of the parts used remaining with knowing roots, flowers, bark, rhizomes, bulbs, stigma of flowers, is represented by a cumulative rate of 22.7 %.

The high use of the aerial part can be explained by the ease and the speed of harvest (Bistindou, 1986). In addition, harvest is done in an arbitrary way by the local users. They tend to tear off the whole plant instead of being interested only in the desired part. This mode of picking compromises the durability of the medicinal species seriously, while leading to the reduction in the productivity and the reduction and/or the loss of the biodiversity.

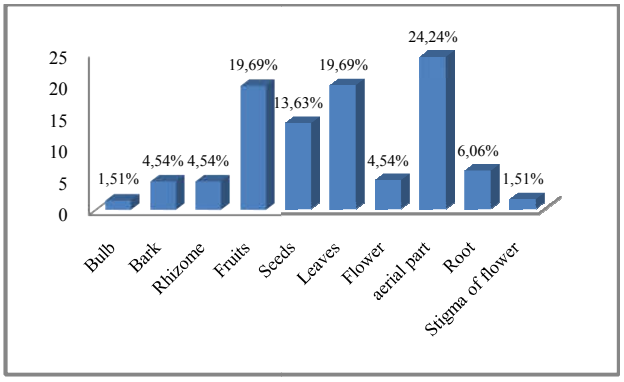

Figure 6 Percentages of Different parts used for the treatment of digestive diseases in the zone of study.

Mode of Preparation and Administration

To administer the active ingredients which contain the medicinal plants, various modes of preparation are used for the treatment of the digestive system (decoction, infusion, maceration, raw, or powder preparation).

The recourse to infusion, in water, tea or milk, is the mode of administration more used with a percentage of 37.97% (Figure7), followed by the decoction with a percentage of 22.78% and the powder preparation with a percentage of 21.51% .

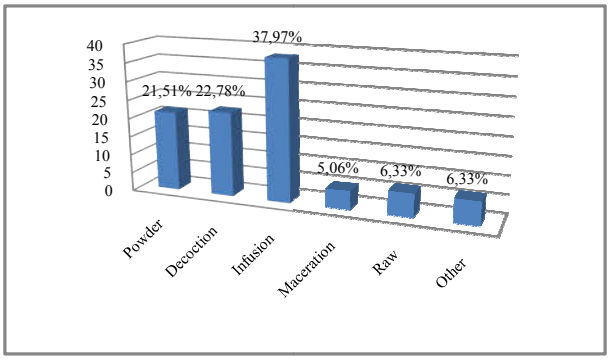

Figure 7 Percentages of different modes of remedies preparation used in the zone of study.

Table2 List of medicinal plants used for the treatment of digestive diseases in the zone of study

Families	Scientific name	Common name	Part used	Preparation mode	Frequency
Amaryllidaceae	*Allium sativum* L.	Toum	Bulb	Raw	18
Anacardiaceae	*Pistacia lentiscus* L.	Adrô	Leaves	Decoction	37
Apiaceae	*Ammodaucus leucotrichus* Coss. et Dur	Kamoun sooufi	Seeds	Powder, infusion	15
	Apium graveolens L.	Krafèss	Aerial parts	Decoction, infusion	3
	Carum carvi L.	L'kerwiya	Seeds	Infusion	40
	Coriandrum sativum L.	Qezbor	Seeds, leaves	Powder, infusion	12
	Cuminum cyminum L.	Kamoun	Seeds	Powder, infusion	25
	Petroselinum sativum Hoffm.	Maâdanous	Seeds, aerial parts	Powder, infusion	21
Arecaceae	*Phoenix dactylifera* L.	Tmer	Fruits	Raw	4
Aristolochiaceae	*Aristolochia baetica* L.	Bereztam	Roots	Infusion	19
Asteraceae (Composées)	*Artemisia herba alba* Assac.	Chih	Leaves	Decoction, infusion	36
	Inula viscosa L. Ait.	Terrahlâ	Leaves	Decoction	38
	Matricaria chamomilla L.	Mansaniya	Leaves	Decoction, infusion	30
Brassicaceae (Cruciferae)	*Anastatica hierochuntica* L.	âkarbâ	Aerial parts	Maceration	11
	Lepidium sativum L.	Hab Rchad	Seeds	Decoction	20
Chenopodiaceae	*Chenopodium ambrosioides* L.	Mkhinza	Leaves	Decoction	19
Cucurbitaceae	*Citrullus colocynthis*(L.) Schard.	Lhdej	Seeds	Powder	6
Ericaceae	*Arbutus unedo* L.	Sasnou	Fruits	Raw	4
Euphorbiaceae	*Mercurialis annua* L.	L-hurriga l-melsâ	Roots	Mastication	9
Fabaceae	*Ceratonia siliqua* L.	L-kharrôbe	Fruits	Powder	38
	Glycyrrhiza glabra L.	ârq sûss	Racines	Decoction	3
	Senna alexandrina Mill.	Sannâ haram	Leaves	Infusion	1
	Trigonella foenum-graecum L.	Al'Houlba	Seeds	Decoction, powder, and maceration	32
Fagaceae	*Quercus suber* L.	D'bbagh	Bark	Powder	17
Gentianaceae	*Centaurium Erythraea* Rafn	Gossat Al'Hayya	Aerial parts	Decoction, infusion	29
Lamiaceae	*Ajuga iva* (L.) Schreb.	Chendgûra	Aerial parts	Infusion	10
	Calamintha officinalis Moench	Manta	Aerial parts	Infusion	19
	Lavandula stoechas L.	Al'Halhal	Aerial parts	Infusion	48
	Marrubium vulgare L.	Merriwta	Aerial parts	Infusion	23
	Mentha pulegium L.	Fliyou	Aerial parts	Infusion	28
	Mentha rotundifolia L.	Mchichtrô	Aerial parts	Infusion	44
	Mentha viridis L.	Naanaâ	Aerial parts	Infusion	13
	Origanum compactum Bentham.	Zaâtar	Aerial parts	Infusion	52
	Origanum majorana L.	Merdedouch	Aerial parts	Infusion	27
	Satureja granatensis (Boiss. & Reut.)	Z'îtra	Aerial parts	Infusion	28
	Thymus ssp (vulgaris)	Zaîtra	Aerial parts	Infusion	30
Lauraceae	*Laurus nobilis* L.	werkat sîdna mousâ	Leaves	Infusion	7
Lythraceae	*Lawsonia inermis* L.	L'hennâ	Leaves	Infusion	19
Moraceae	*Punica granatum* L.	Rummân	Bark of fruits	Powder, decoction	32
Myrtaceae	*Ficus carica* L.	L'kermôs	Fruits	Raw	33
	Eugenia caryophyllata Thunb	Qronfel	Nails of flowers	Decoction, powder, and maceration	19
	Myrtus communis L.	Arraihan	Leaves, Fruits	Decoction, infusion	29
Oleaceae	*Olea europaea var. sativa*	Zitoun, Zabbouj	Leaves, Fruits	Decoction, infusion	49
Polygonaceae	*Emex spinosa* (L.) Campd	L'hummayda	Aerial parts	Other	4
Poaceae	*Hordeum vulgare* L.	Zraâ	Fruits	Powder	2
	Triticum aestivum L.	Farina	Fruits	Powder	5
	Zee mays L.	Lahyat Adra	Stigma of flower	Infusion	10
Ranunculaceae	*Nigella sativa* L.	Assânûj	Seeds	Powder	35
Rhamnaceae	*Rhamnus alaternus* L.	Âmlîles	Fruits, bark	Decoction	5
Rosaceae	*Eriobotrya japonica (Thunb.) Lindl.*	L'mzah	Leaves	Decoction	11
	Prunus domestica L.	Barkok	Fruits	Other	9
	Rosa damascena Mill.	L'werd L'beldi	Flowers	Infusion	40
Rubiaceae	*Coffea arabica* L.	Al'qahwa	Fruits	Powder	13
	Rubia tinctorium L.	Al'Fouwa	Roots	Decoction	23
Rutaceae	*Citrus limon* (L.) Brum.	Lhâmmed	Fruits	Other	27
Solanaceae	*Capsicm frutescens* L.	Felfel Hârr	Seeds	Raw	24
	Solanum nigrum L.	Buqnîna	Leaves	Other	3
Verbenaceae	*Aloysia citriodora* Links	Alwîza	Leaves	Infusion	18
Zingiberaceae	*Alpinia officinarum* Han.	khdenjâl	Rhizome	Powder	15
	Curcuma longa L.	harqûm	Rhizome	Powder	8
	Zingiber officinal Rosc.	Sekinjbîr	Rhizome	Decoction, powder, and maceration	12
Zygophyllaceae	*Zygophyllum gaetulum Emb. & Maire*	Al'âggaya	Leaves	Infusion	25

The other modes of preparation such as the use of the plant raw, the maceration, and others represent 17.72%.

At the level of the studied zone, the oral route is employed for most plants. However, the majority of surveyed ignore the weights, the dose, and precise measurements to prescribe in the preparation and the posology of the phytomedicines.

Floristic Analysis

Medicinal Plants Used

The ethnobotanic investigations carried out into the study area made it possible to count and identify 62 species belonging to 31families and divided into 59 genera. The most represented families are Lamiaceae (11 species), Apiaceae (6 species) and Fabaceae (4 species).Then comes Asteraceae, Poaceae, Rosaceae and Zingiberaceae (3 species). The other remaining families count only one or two species (29 species) (Figure 8). The various listed species are represented in a table (table 2), in which each species will be characterized by a certain number of characters in particular: the scientific name, the common name, the part used in the preparation of the recipes, the mode of preparation, and frequencies of use.

Among these plants, eleven species belonging to eight botanical families are frequently used by the bordering population in the treatment of the digestive system. It is about: *Pistacia lentiscus*, *Origanum compactum*, *Lavandula stoechas*, *Artemisia herba alba*, *Inula viscosa*, *Ceratonia siliqua*, *Mentha rotundifolia*, *Carum carvi*, *Olea europea*, *Nigella sativa*, and *Rosa damascena*. This representativeness was also observed, except for some differences, during a similar ethnomédicinal investigation realized in the central plate by El hilah & Zidane (2014).

In addition, among the listed plants, some are recognized by their toxic capacity such as: *Nigella sativa* (Zaoui *et al*., 2000; Bnouham *et al*., 2002), *Zygophyllum gaetulum* and *Artemisia herba-alba* (Eddouks *et al*., 2002; Tahraoui *et al*., 2007). Indeed, the majority of the herbalists are unaware of the toxicity of the plants used as well as the methods of their use, in particular the modes of preparation and the recommended doses.

The use of the medicinal plants must be rationalized and the benefit/ risks determined. Studies relating to these objectives are thus necessary.

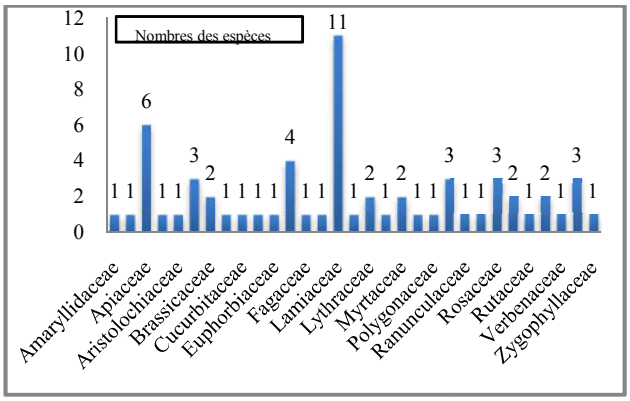

Figure 8 Distribution of the families by the percentage of the species in the zone of study.

Frequency of Use of the Medicinal Plants According to their Origin

The results of our investigation showed that 25 species among the 65 inventoried medicinal species are imported from other areas of the country, whereas 17 species are cultivated, and 20 species collected of the forest of Izarène.

Among these last species, four medicinal plants, *Mentha rotundifolia*, *Origanum compactum*, *Centaurium Erythraea*, and *Solanum nigrum* are not very abundant in the area and are likely to disappear from the forest of Izarène if no protection measure is taken by the services concerned, because of the intensive collection of these species.

CONCLUSION

The diseases of the digestive system constitute an authentic problem of public health. The recourse to medicinal plants for therapeutic ends knew a renewal of attention and interest in all Morocco and the countries in the process of development in general.

The level of poverty and the expensive cost of the treatments proposed by modern medicine, in addition to awkward side effects, constitute the principal factors which push the bordering population of the forest of Izarène to use the medicinal plants of the traditional pharmacopoeia in the treatment of the digestive infections.

The study carried out in the region of Izarène, allowed to show the potential wealth of the medicinal flora used in the treatment of the diseases of the digestive system. Indeed, 62 medicinal species were listed by the actors of traditional medicine in the area of study; they belong to 31 families and divide into 59 genera. The most represented families are Lamiaceae, Apiaceae then Fabaceae.

The infusion is the most used mode for remedy preparation, whereas the aerial part is used the most in the phytotherapeutic treatment. In addition, the study highlighted threatened species. This work constitutes a source of information which contributes to a knowledge of the medicinal flora and a safeguard of the popular local knowledge. It can also constitute a database for the phytochemists and pharmacologists for the valorization of the medicinal plants used in the diseases of the digestive system in order to discover new active ingredients usable in pharmacology.

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