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## INVENTORY AND SOCIAL INTEREST OF MEDICINAL, AROMATIC AND HONEY-PLANTS FROM MOKRISSET REGION (NW OF MOROCCO)

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ABSTRACT: Many peoples of developing countries use medicinal plants as main source in health cares. Most of these plants are considered as honey- and/or aromatic plants. In the beginning of summer 1997, 295 inquires have been led in 29 Locations (fields, markets or villages) of Mokrisset region (Chefchaouen, NW of Morocco), and 76 medicinal, toxic and aromatic wild species belonging to 46 families have been inventoried. *Origanum vulgare* and *O. compactum*, and *Centaureum erythraea* are the most commercialised (24.2 and 4.3 dirhams kg-1 of dry and wet matter respectively). Concerning honey-plants, we have listed 78 species including the cultivated and the introduced ones, belonging to 35 families. Therefore, 34.6% of identified honey-species are used in traditional medicine or in essential oil extraction. Locally, apiculture is sedentary and interests 13.4% of households of the inquired villages. Honey and wax are sold at 179 and 4 dirhams kg-1 respectively. Other characteristics of apiculture have been underlined. The inventoried species have been classified following their social importance in the region. Marketing paths of the essential products have been commented, and some economic parameters such financial product and income have been estimated.

*Keywords:* Ethnobotany, natural resources, social importance, Morocco.

## INTRODUCTION

In the world 80% of population resorts mainly to traditional remedies. Medicines having an origin linked to the vegetable reign represent 60% (FLEURENTIN & PELT, 1990). In developing countries, several hundred of million peoples use medicinal plants as main source in health cares (HEYWOOD, 1992). In Morocco, 20% of population lives at least partially from the forest products (EL HATTAB, 1989) and more of 500 medicinal plants are economically important (BELLAKHDAR, 1986/89; 1997).

Unfortunately, knowledge related to traditional plant uses are losing in terms of generations because of the acculturation and the westernization of primitive societies (SCHULTES, 1992). Many species are threatened because of an excessive exploitation by human population and loss of their habitats (HEYWOOD, *l.c.*). Studies of conservation state and marketing of medicinal plants are necessary for countries which are dependent on these natural resources. A collaboration between actors interfering with this sector namely botanists, ecologists, chemists, economists, etc. is necessary to preserve and develop the use of medicinal plants (HEYWOOD, *l.c.*).

In addition to social and moral aspects of apiculture as well as its economic fallen (honey, wax, pollen, royal frost, propolis, venom), it contributes indirectly to the vegetable resources durability via the pollination process. Thereby, MOREAU underlines that the disappearance of the bee could have entail the extinction of more of 100 thousand plant species (in VANHEE, 1991; in VIN, 1991a, b). Moreover, 80% of plants are pollinated by insects and the contribution of bees is estimated at 80% (VIN, 1991a).

In the study area (Circle of Mokrisset, Chefchaouen, NW of Morocco), economy of subsistence dominates and depends largely on natural resources namely pastoral activity and arboriculture (carob tree, oliver, vineyard, fig tree, etc.). Marketing of other natural resources, eg. medicinal and aromatic plants, play a secondary role in the local economy (ENNABILI *et al.*, 1997).

This study aims to inventory medicinal, aromatic and honey-plants and to show its social importance in this region.

## MATERIALS AND METHODS

The Circle of Mokrisset displays 1.166 km<sup>2</sup> and is situated between Chefchaouen and Ouezzane in NW of Morocco (figure 1). With an average density of 74.2±21.9 inhab. km<sup>2</sup> (vs. 60 inhab. km<sup>2</sup> in the country), this zone is relatively populated. The average size of household equals 5.59±0.11 persons (LAD, 1998; ADL, 1997). Administratively, this Circle is subdivided on 3 Caïdats or Subcircles, 6 rural Communes and 213 douars or rural agglomerations (ADL, 1997).

After having established the questionnaire form (annex), 295 interviews have been retained from 29 sites. Inquires have been led in the souks (weekly markets) as well as by visiting douars and Communes the most important.

The botanical nomenclature we have updated according to TUTIN *et al.*, (1990/93) follows MAIRE (1952/80). For cultivated and introduced species, we have used other flora: METRO & SAVAGE (1955), QUEZEL & SANTA (1962/63) and FOURNIER (1977). Concerning the vernacular nomenclature, we have done a transcription of all retained words in Latin characters. A sample of identified species is filed in the Department of Biology of Faculty of Sciences of Abdelmalek Essaâdi University.

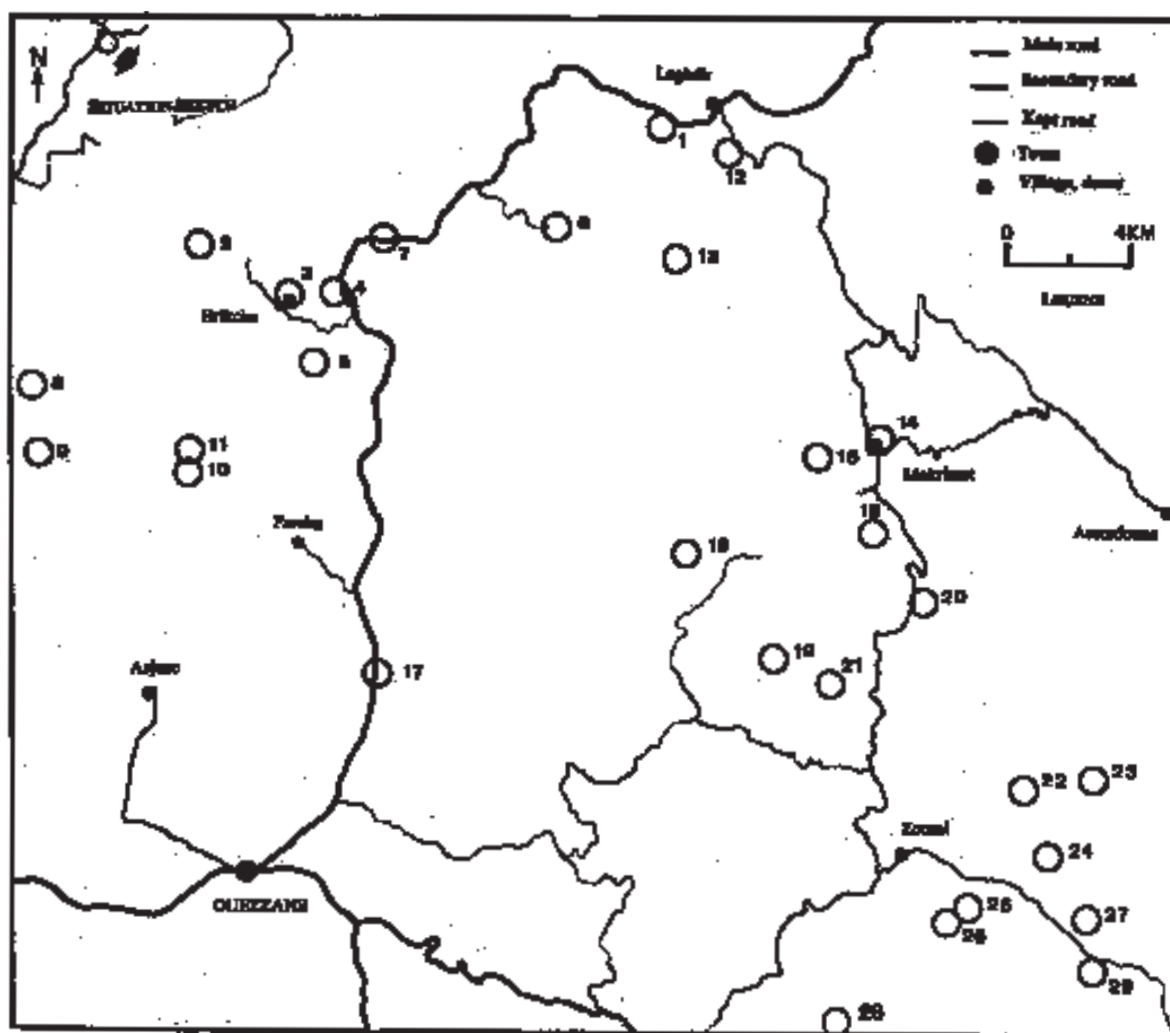


FIG. 1. Study area. 1. El Koub; 2. Beni Mhammed; 3. Brikcha; 4. Essebt; 5. Bellouta; 6. Kalâa; 7. Aïn Baïda; 8. Dchar Elkheir; 9. Zeïtouna; 10. Tala; 11. El Gharra; 12. Tizirane; 13. Alma-Tizgane; 14. Mokrisset centre; 15. Anngoucht; 16. El Meska; 17. El Jabriyine; 18. Aïn Bouhassane; 19. Mhijer; 20. Nefzi; 21. Harrakine; 22. Kechachda; 23. Lemraj; 24. Afra; 25. El Horech; 26. Guerrajine; 27. Younane; 28. El Aonsar; 29. Azarif.

## RESULTS AND DISCUSSION

The average of questionnaire forms frequency attains 10.2 per Location. Medicinal, aromatic and toxic plants are exploited directly by fellahs or farmers and merchants which represent 91.4% of the inquired persons. For the honey-plants, apiarists represent 84.6%.

The identified species and their traditional utilisation are inventoried in the table 1. The 125 identified species belong to 68 botanical families. *Labiatae*, *Compositae*, *Leguminosae*, *Rosaceae*, *Graminae*, *Cistaceae* and *Umbelliferae* represent 45.6% of these species.

Seen the modest area of the studied region, we have not noted an intra-zonal variation of the vernacular nomenclature such that a name can designate two or several genera. This fact has been noted by ENNABILI *et al.* (1996) in macrophytes from NW of Morocco. Nevertheless, many species have several vernacular synonyms. This phenomenon is very current especially in medicinal species (DELON & PUJOS, 1969; BERTRAND, 1991; FLEURENTIN & PELT, 1990). For this study, we report more of 50 new vernacular names corresponding to 45 species. Six of them are attributed to the allied species (BERTRAND, 1991; SIJELMASSI, 1993; BELLAKHDAR, 1997). Omissions have been noted for some used species such *Salvia verbenaca* and *Trifolium* sp. Five other vernacular names “*âonk edjrou*, *el gharra*, *kaf limam*, *mchicht el âttara* and *chefrada*” corresponding to medicinal or toxic plants have not been identified in this study, because of samples unavailability. At least seven species (5.6%) are designated by Berber names (BERTRAND, 1991) although residents do not speak it, owing to the migratory movements or the past of the study area.

### 1. Medicinal, aromatic and toxic plants

#### 1.1. Cultural considerations

As morphological characters, medicinal and aromatic virtues could serve to appoint plants. *Salvia* emanates from the Latin word “*salvare*” meaning to heal; *Thymus* correspond to an Egyptian term “*tham*” which means to embalm, etc. (FOURNIER, 1977). Locally, many vernacular names of plants include their function in traditional medicine. “*Messaça*” (*Plantago major*) and “*Yebbassa*” (*Cuscuta monogyna*) correspond to suction and drying functions respectively, for external application (Location 13; figure 1). An herbalist from Chefchaouen confirms that “*Hrihra*” (*Trachelium caeruleum*) coincides with its use against constipation.

Several proverbs, sayings or popular accounts outline the medicinal, toxic or ecological traits of some plants. For example, we admit that (i) Satan has told that

if the man knew what *Origanum compactum*, *O. vulgare*, *Calamintha sylvatica*, *Centaureum erythraea*, *Triticum monococcum* and *Allium sativum* comprise, he would have exterminated us “*Ibales kalou law el insan âraf ma fibim -sabtâr, manta, kors elhaya, chentil we touma - law ketlouna bibim*”; (ii) *Atractylis gummifera* has killed a woman and its children “*dada ketlet el mra we oulada*”; (iii) *Marrubium vulgare* grows in bad sites although it is a medicinal plants “*eddoua fya wel kbhra fya*”, etc. (Location 13). Sometimes, historical ruins could inform on the ancient utilisation of some species. In the Location 14, a ceramic remains abound with dense groupings of *Thymus capitatus*, species having medicinal and aromatic virtues.

The number of questionnaire forms by specie reveals that medicinal species are little used (table 1). Residents ignore how to administer medication from 36.8% of identified medicinal species, usually collected by foreigners (herbalists and merchants).

## 1.2. Exploitation

The medicinal, toxic and aromatic species indicated in the table 1 comprise 76 wild species belonging to 46 families. Cultivated species constitute 23.7% of the identified ones. Nevertheless, *Anabasis aretioides*, *Euphorbia falcata* and *Linum usitatissimum* are only marketable. *Labiatae*, *Compositae* and *Graminae* total 38.2% of the identified species. Several of these latter have been underlined by anterior works (BELLAKHDAR, 1986/89, 1997; SIJELMASSI, 1993; ENNABILI et al., 1996). Other species such *Teucrium webbianum*, *Clematis cirrhosa*, *Centaurea calcitrapa*, *Cynara humilis*, *Orchis papilionacea*, *Sedum sediforme*, *Anabasis aretioides*, *Gladiolus communis*, *Triticum monococcum*, *T. aestivum* and *Chara vulgaris* are newly quoted at least in the study area.

Roots, tubers or leaves of 15.8% of medicinal species are toxic or harmful for the man and/or animals. Their toxicity could be reduced by drying as in *Arisarum vulgare*, *Clematis flammula* and *C. cirrhosa* (Location 13). Residents underline toxicity of *Ceratonia siliqua*, *Clematis cirrhosa*, *Orchis papilionacea*, *Urginea scilla*, *Gladiolus communis*, *Orobancha caryophyllacea* and “chefrada” (table 1). Furthermore, BELLAKHDAR (1986/89, 1997) and SIJELMASSI (l.c.) record toxicological effects of *Mentha pulegium*, *Teucrium chamaedrys*, *Ruta montana*, *Nerium oleander*, *Quercus ilex*, *Agave americana*, *Prunus armeniaca*, *Anagyris foetida*, *Aristolochia longa*, *Artemisia absinthium*, *Cannabis sativa*, *Cynodon dactylon*, *Euphorbia falcata*, *Linum usitatissimum*, *Oxalis cernua*, *Rumex crispus*, *Plantago major*, *Solanum nigrum*, *Vicia ervila*, *Allium sativum*, *Ammi visnaga* and *Papaver rhoeas*.

Among inventoried medicinal species, 11.8% are considered as aromatic ones: *Mentha pulegium*, *Origanum compactum*, *O. vulgare*, *Lavandula dentata*,

*L. stoechas*, *Myrtus communis*, *Mentha rotundifolia*, *Thymus capitatus* and *Mentha spicata*.

Herbalists report that species are used generally in mixture and sometimes with honey or olive oil (Chefchaouen city) because the action in synergism is very common in medicinal plants as related by FLEURENTIN & PELT (1990). Examples of mixtures have been quoted. Roots of *Rubus ulmifolius*, *Cynodon dactylon*, *Laurus nobilis* and leaves of *Myrtus communis* and *Lavandula stoechas* are applied for constipation. Inflorescence of *Trachelium caeruleum*, leaves of *Nerium oleander* and thorny bracts of *Centaurea calcitrapa* are used as scents. Flowers of *Papaver rhoeas* and roots of *Eucalyptus camaldulensis* and *Opuntia ficus-indica* are used for rheumatism and stomachic complications. *Mentha rotundifolia* and *M. pulegium* and flour are employed as strengthening. *Mentha rotundifolia* and olive oil have a diuretic effects. *Trachelium caeruleum* and *Tetraclinis articulata* are applied for digestive infections and renal stones. Seeds of *Linum usitatissimum* and *Zea mays* mixed to honey have a stomachic effects and are used for glycaemia and rheumatism. Settled solution obtained by leaching plant ash is employed against cardiac pains (Chefchaouen city, Location 13).

TABLE 1. Traditional characterisation and use of medicinal, aromatic, toxic and honey-plants from Mokrisset region

<sup>a</sup> medicinal specie; <sup>b</sup> aromatic specie; <sup>c</sup> toxic specie; <sup>d</sup> honey-specie; <sup>e</sup> cultivated or naturalised specie; N, questionnaire forms number.

Specie	Vernacular name	Used part	Treated sicknesses / toxic or medicinal virtues / other utilisation	N
<i>Mentha pulegium</i> a,b,d	flayou	aboveground parts	influenza, fever, injuries / tonic / deodorant, oils, edible	29
<i>Origanum compactum</i> a,b,d	sahtar, essahtar	leaves and inflorescence	hypertension, diarrhoea // additive for figs, olives and coffee, pastoral	23
<i>Origanum vulgare</i> a,b,d	sahtar, essahtar	leaves and inflorescence	hypertension, diarrhoea // additive for figs, olives and coffee, pastoral	23
<i>Centaureum erythraea</i> a,d	kors elhaya, ennouara	inflorescence	/ sedative, stomachic, veterinarian /	20
<i>Dittrichia viscosa</i> a,d	tirreklane, terrkile	leaves, roots	rheumatism / healing, stomachic / conservation of pomegranates, pastoral	14
<i>Arbutus unedo</i> a,d	asennou, sasnou, metroune, boukhannou	roots	/ medicinal virtue / pastoral, edible (fruit), craft industry (woods)	13
<i>Calamintha sylvatica</i> a,d	manta	leaves	disturb digestive for babies // additive for tea	13
<i>Carlina lanata</i> d	marcidane, chokat el âasfour, chouka	-	// pastoral	13
<i>Ceratonia siliqua</i> a,c,d	elkharroub, slaghoua	fruit, bark, branches	diarrhoea / toxic for fish / edible, woods, industry, pastoral	11
<i>Opuntia ficus-indica</i> a,d,e	elhindya	flowers, stems	rheumatism / stomachic / edible, pastoral	11
<i>Lavandula dentata</i> a,b,d	elhalhal	leaves, buds	rheumatism, sicknesses of chickens // pastoral	10
<i>Lavandula stoechas</i> a,b,d	elhalhal	leaves, buds	rheumatism, sicknesses of chickens // pastoral	10
<i>Myrtus communis</i> a,b,d	errayhan	leaves	constipation // pastoral	10
<i>Teucrium chamaedrys</i> a	chendgoura	leaves	rheumatism, asthma //	9
<i>Teucrium webbianum</i> a	chendgoura	leaves	rheumatism, asthma //	9
<i>Trachelium caeruleum</i> a	elkahra, ettahra, hrihra	heads	renal stones / stomachic /	8
<i>Ficus carica</i> d,e	el karmous, el bakor	fruit, leaves	// edible, pastoral	7
<i>Ruta montana</i> a	awerma, rota, elketra	inflorescence	psychic sicknesses "leriah" //	6
<i>Vitis vinifera</i> d,e	el âineb	fruit, leaves, bines	// edible, pastoral	6
<i>Calicotome villosa</i> d	agraz	-	// pastoral	5
<i>Clematis cirrhosa</i> a,c,d	ennar elbarda	leaves	rheumatism, pains of eyes and teeth // pastoral	5
<i>Clematis flammula</i> a,c,d	ennar elbarda	leaves	rheumatism, pains of eyes and teeth // pastoral	5
<i>Mentha rotundifolia</i> a,b,d	mchichtro	aboveground parts	/ tonic /	5
<i>Nerium oleander</i> a	eddefla	leaves in whorls of 4	// scent	5
<i>Pistacia lentiscus</i> a,d	eddrou	leaves, buds, roots	sickness of eyes, intoxication "toukal" // woods, saponifying ashes	5
<i>Quercus ilex</i> d	eddjarb, el bellout	fruit, woods	// edible, craft industry, firewood	5
<i>Thymus capitatus</i> a,b,d	zâitra, echchih, sahtar erroumi	aboveground parts	/ medicinal virtue / food, pastoral	5
<i>Corrigiola litoralis</i> a	serghina	roots	/ medicinal virtue / pastoral	4



Specie	Vernacular name	Used part	Treated sicknesses / toxic or medicinal virtues / other utilisation	N
<i>Daphne gnidium</i> a,c,d	elmetnan	leaves, roots	/ healing, toxic for fish ( traditional fishing) /	4
<i>Erica arborea</i> d	harraka	-	// pastoral, woods for industry and fire	4
<i>Erica cinerea</i> a,d	elkhlenge	branches	/ medicinal virtue / pastoral	4
<i>Eucalyptus camaldulensis</i> a,d	killet	roots	rheumatism / stomachic / pastoral	4
<i>Marrubium vulgare</i> a	mirrwta, mirriwa	leaves	headache, vertigo, cardiac pains //	4
<i>Ammi visnaga</i> a	elbechnikh	inflorescence	headache / active principles / scent	3
<i>Atractylis gummifera</i> a,c	eddada	stumps	/ medicinal virtue /	3
<i>Cistus albidus</i> d	aoukir	woods	// firewood, enclosure	3
<i>Cistus crispus</i> d	chtappa	woods	// firewood, enclosure	3
<i>Cistus monspeliensis</i> d	chtappa	woods	// firewood, enclosure	3
<i>Cistus salvifolius</i> d	chtappa	woods	// firewood, enclosure	3
<i>Citrus sinensis</i> d,e	lechchine	woods	// fruit tree	3
<i>Prunus domestica</i> d,e	el barkouk	woods	// fruit tree	3
<i>Zea mays</i> a,d	eddra ettourkya	styles and stigma	glycaemia, rheumatism / stomachic /	3
<i>Agave americana</i> d,e	essabra, el guerziane	spikes, leaves, stumps	// pastoral, traditional constructions, saponifying leaves	2
<i>Anchusa officinalis</i> a,d	horraïcha	aboveground parts	/ medicinal virtue / edible	2
<i>Centaurea calcitrapa</i> a,d	chouka tenghila	inflorescence, thorny bracts	/ scent "aïn" /	2
<i>Citrullus vulgaris</i> d,e	dellah, elkouar	fruit, stems, leaves	// edible, pastoral	2
<i>Cynara humilis</i> a,d	taïmart	roots	/ medicinal virtue /	2
<i>Eryngium camppestre</i> d	ziwziw	-	// pastoral	2
<i>Eryngium ilicifolium</i> d	ziwziw	-	// pastoral	2
<i>Laurus nobilis</i> a	errand	leaves	rheumatism, constipation // spices	2
<i>Malus pumila</i> d,e	teffah	-	// fruit tree	2
<i>Olea europaea</i> a,d	ezzaïtoun	drupes, leaves	/ diuretic (oil) // sponifying margine	2
<i>Orchis papilionacea</i> a,c	haya miyta	tubers	/ tonic (tuber of the year), debilitating ( ancient tuber) /	2
<i>Papaver rhoeas</i> a,d	bouleâmane	flowers	rheumatism / stomachic /	2
<i>Prunus armeniaca</i> d,e	el mechmach	-	// fruit tree	2
<i>Punica granatum</i> a,d	erroummane	fruit, bark	/ medicinal virtue /	2
<i>Rubus ulmifolius</i> a,d	el ôllik, zerrandou	roots	constipation // pastoral	2
<i>Sedum sediforme</i> a	âkerban	entire	/ medicinal virtue /	2
<i>Solanum tuberosum</i> a,c,d,e	el btata	tubers	/ medicinal virtue /	2
<i>Urginea scilla</i> a,c,d	el boussel	leaves	auricular sicknesses // pastoral	2
<i>Verbena officinalis</i> a	baïmla	leaves, stems	/ healing /	2
<i>Allium sativum</i> a,c	ettaoum, touma	bulbs	/ medicinal virtue /	1

Specie	Vernacular name	Used part	Treated sicknesses / toxic or medicinal virtues / other utilisation	N
<i>Allium triquetrum</i> d	baybross	-	// edible	1
<i>Anabasis aretioides</i> a	chejra lima eddiha errih	aboveground parts	/ medicinal virtue /	1
<i>Anagallis arvensis</i> d	mniwna	-	// pastoral	1
<i>Anagyris foetida</i> a	foul eddiib, aouefna	seeds	ringworm //	1
<i>Andryala integrifolia</i> d	bou remmad	-	// pastoral	1
<i>Arisarum vulgare</i> a,c	ayerna	tubers	/ medicinal virtue / edible	1
<i>Aristolochia longa</i> a	bütakh elgrayen	berries	/ medicinal virtue /	1
<i>Artemisia absinthium</i> a,c	chiba	leaves, buds	psychic depressions "äin" // additive for tea	1
<i>Astragalus</i> sp. d	mad rejlou	-	// pastoral	1
<i>Avena sterilis</i> d,e	el khortal	-	// fodder crops, pastoral	1
<i>Cannabis sativa</i> a,e	elkif	leaves, female inflorescence	/ scent for children "echcham" /	1
<i>Chamomilla recutita</i> d	elgahouane	-	// pastoral	1
<i>Cicer arietinum</i> a	elhommes	seeds	/ medicinal virtue /	1
<i>Citrus limon</i> d,e	el laymoun	-	// fruit tree	1
<i>Coleostephus</i> sp. d	amlal, nouar	-	/ pastoral	1
<i>Coriandrum sativum</i> a,e	elkosbar, elkasbor	leaves, seeds	/ medicinal virtue /	1
<i>Coriaria myrtifolia</i> a,c	ward zlil	leaves, buds, fruit	/ medicinal virtue /	1
<i>Crataegus monogyna</i> a	admam	flowers	/ medicinal virtue / pastoral	1
<i>Cucumis sativus</i> d,e	el khiar	-	// edible (fruits)	1
<i>Cucurbita pepo</i> d,e	el kraâ	-	// edible	1
<i>Cuscuta monogyna</i> a	yebbassa	entire	/ healing /	1
<i>Cydonia oblonga</i> d,e	sfarjel	-	// fruit tree	1
<i>Cynodon dactylon</i> a	ennjim	roots	constipation //	1
<i>Diplotaxis catholica</i> d	awerdal	-	-	1
<i>Adiantum capillus-veneris</i> a	taghalt, hinnet el ma	leaves	/ medicinal virtue /	1
<i>Euphorbia falcata</i> a	hayat ennofous	-	/ medicinal virtue /	1
<i>Gladiolus communis</i> a,c	âliyem hojjaj	leaves	/ medicinal virtue /	1
<i>Juncus maritimus</i> a	asmar	roots	/ medicinal virtue / craft industry, pastoral	1
<i>Juniperus oxycedrus</i> d	ettaq	-	-	1
<i>Linum usitatissimum</i> a	kettan	seeds	glycaemia, rheumatism //	1
<i>Lycopersicum esculentum</i> d,e	maticha	-	// edible	1
<i>Malva sylvestris</i> a	elbkoul	aboveground parts	/ medicinal virtue / edible	1
<i>Melilotus</i> sp. d	fezzaz	-	// pastoral	1
<i>Mentha spicata</i> a,b,e	naânaâ	leaves, stems	/ medicinal virtue / additive for tea	1

Specie	Vernacular name	Used part	Treated sicknesses / toxic or medicinal virtues / other utilisation	N
<i>Myoporum laetum</i> d,e	eddefla erroumia	-	// enclosure	1
<i>Nasturtium officinale</i> d	guerwinnech	-	// edible	1
<i>Orobanchae caryophyllaceae</i> a,c	tahtoh, choual elkhrouf	-	/ medicinal virtue /	1
<i>Oxalis cernua</i> d	hommaïda	-	// edible	1
<i>Plantago major</i> a	messaça	leaves	auricular sicknesses and other //	1
<i>Portulaca oleracea</i> d,e	errejla	-	// edible	1
<i>Prunus amygdalus</i> d,e	ennoua	-	// fruit tree	1
<i>Psoralea sp.</i> d	echbarya	-	// pastoral	1
<i>Pulicaria arabica</i> d	âtassa	-	// hygienic	1
<i>Pyrus communis</i> d,e	ellingas	-	// fruit tree	1
<i>Rosa sempervirens</i> d	âollik de nsara	-	// pastoral	1
<i>Rubia tinctorium</i> a	el foua	roots	/ medicinal virtue /	1
<i>Rumex crispus</i> d	bkoul el horrine	-	// edible	1
<i>Salvia verbenaca</i> a	-	leaves	/ healing /	1
<i>Saponaria ocymoides</i> d	tighicht	-	// formerly saponifying roots (detergent)	1
<i>Scolymus hispanicus</i> a	guernina, el gornine	-	/ stomachic /	1
<i>Solanum nigrum</i> d	bou knina	-	// coating	1
<i>Sorghum bicolor</i> a,e	eddra errkika	seeds	glycaemia, rheumatism //	1
<i>Tamarix gallica</i> a	atraf	leafy branches	chicken sicknesses //	1
<i>Tetraclinis articulata</i> a	el âarâar	branches	renal stones / stomachic /	1
<i>Trifolium sp.</i> d	-	-	// pastoral	1
<i>Triticum monococcum</i> a,e	chentil	seeds	/ medicinal virtue /	1
<i>Triticum aestivum</i> a,e	farina	seeds	/ tonic /	1
<i>Viburnum tinus</i> d	agra	leaves, woods	// pastoral, woods	1
<i>Vicia ervilia</i> a,e	kersanna	seeds	auricular sicknesses // fodder crops	1
<i>Vicia sp.</i> d	glibna	-	// pastoral	1
<i>Ziziphus lotus</i> d	sdir	-	// enclosure	1
<i>Chara vulgaris</i> a	chaïkhokh el ghoul (algae)	entire thallus	chronic fever / scent /	1
- a,c	chefrada (mushroom)	fructification	/ medicinal virtue /	1

### 1.3. Marketing

Medicinal plants are collected essentially from forested and subforested zones, wetlands, fields (adventitious species or fallow ones) and alleys. Forested and public areas would profit by a particular protection to maintain a durable exploitation of natural resources. Nevertheless, many species including *Corrigiola litoralis*, *Trachelium caeruleum*, *Centaurium erythraea* and *Crataegus monogyna* have strongly rarefied because of an excessive premature exploitation, grazing and dryness (Locations 6, 13, 14 and 22). Grafting constitutes an other factor of rarefaction of *Crataegus monogyna* (ENNABILI et al., 1996).

Commercialised species are the most researched. *Lavandula stoechas*, *L. dentata*, *Ruta montana*, *Orchis papilionacea* and *Opuntia ficus-indica* are rather collected by herbalists coming from adjacent cities (Location 13). Herbalists and employed working in field distilleries are minority (8.3%; questionnaire forms number n= 72). While residents are the most implied in the collection of medicinal plants especially minor children and women (children: 48.6%; women: 30.5%; men: 11.4%; households: 1.4%; n= 72). The most of residents do not know how to administer traditional medication and constitute a faithful customers for the foreign herbalist-retailers.

Locally, commercialised species are bought especially by herbalists and local merchants "jemmala" or coming from other regions. Sometimes, these species are sorted (*Origanum compactum*, *O. vulgare*, *Mentha pulegium* and *Centaurium erythraea*) or distilled (*Mentha pulegium* and *Myrtus communis*) in situ (Ouezzane city; Locations 1, 14 and 29). Local merchants import these species from other regions such Bni Idder/Province of Tétouan (Location 1). Medicinal products (entire or sorted plants and essential oils) are destined to national cities: Casablanca, Marrakech, Fes, Tanger, Ouezzane, Oujda, Rabat, Tétouan, Ksar El Kébir, Meknes, Sidi Kacem and Souk Larbaâ. Some of these cities would serve to export these products to France and The Netherlands.

In terms of species and douars, 0.5 to 4.5 tonnes (n= 8) of medicinal and aromatic products are collected annually. For rare species such *Trachelium caeruleum*, this quantity would not attain one tonne in all a rural Commune (Location 14). Yield varies from 15 to 20% in leaves for *Calamintha sylvatica*. It is around 10% in leaves and flowers for *Origanum compactum* and *O. vulgare*, and 12 to 13 litres of oil per tonne for *Mentha pulegium* (Ouezzane city; Location 17).

According to the unit price, *Centaurium erythraea*, *Origanum compactum* and *O. vulgare* are the most important (table 2). Compared to the years seventy and eighty and by integrating the effective minimum wage, we observe a notable increase of the unit price for species relatively rarefied such *Centaurium erythraea*, *Origanum compactum* and *O. vulgare*, but a net diminution for *Mentha pulegium*. The evolution of the unit price depends mainly on precipitation and exploitation rate of species (Location 18).

By holding in account of the theoretical productivity, *Origanum compactum* and *O. vulgare*, and *Mentha pulegium* would generate 13 060 (n= 9) and 11 326 dirhams (n= 11) per hectare respectively. The income per season would not exceed  $32.5 \pm 10.9$  (n= 4),  $1\ 200 \pm 877$  (n= 4) and 1 500 dirhams (n= 1) for children, households and merchants respectively. The employees in this sector, representing a very weak rate, would not touch more than 50 dirhams per day. During the season, contribution of the economic fallen due to this activity would increase up to  $55.1 \pm 30.1\%$  (n= 7) for farmers and  $50 \pm 0.0\%$  (n= 2) for merchants.

TABLE 2. Unit price (dirhams kg-1 of dry or wet matter) in medicinal and/or aromatic species from Mokrisset region (1997).

Specie	Product	
	not stored and usually wet	stored and dried
<i>Centaureum erythraea</i>	4.3 ± 2.5 (n=15)	12.5 ± 2.5 (n=2)
<i>Origanum sp.</i>	1 ± 0.6 (n=9)	24.2 ± 20.2 (n=7)
<i>Mentha pulegium</i>	0.7 ± 0.5 (n=20)	4.8 ± 0.7 (n=5)
<i>Calamintha sylvatica</i>	-	25 ± 10.6 (n=4)
<i>Corrigiola litoralis</i>	2.2 ± 0.8 (n=4)	-
<i>Adinatum capillus-veneris</i>	-	700 (n=1)
<i>Teucrium sp.</i>	0.5 (n=1)	-
<i>Myrtus communis</i>	0.2 (n=1)	-

## 2. Honey-plants and economic fallen

### 2.1. Honey-plants

In general, the interviewees underline the honey interest of all Angiospermae except for *Scolymus hispanicus*, *Nerium oleander*, *Pistacia lentiscus* and *Cannabis sativa* (Locations 5, 16 and 18). The honey-plants represent 78 species belonging to 35 families and 48.7% of them correspond to five families: *Labiatae*, *Compositae*, *Rosaceae*, *Leguminosae* and *Ericaceae*. Introduced species represent 30.8% and belong to 14 families. *Rosaceae* and *Cucurbitaceae* comprise 37.5%. *Carlina lanata* and *Arbutus unedo* blossoming indicates the two principal honeydews: "metroune" and "marcidane". These two honey-species are followed by *Opuntia ficus-indica*, *Ceratonia siliqua*, *Ficus carica*, *Dittrichia viscosa*, *Vitis vinifera*, *Quercus ilex*, *Calicotome villosa* and *Erica arborea* (table 1). Moreover, 34.6% of honey-species we have identified are used in traditional medicine or in essential oil extraction.

Some apiarists relate that honey-flora is so diversified that all plant products for a successful apiculture are locally available (Locations 12 and 14). Honey-plants are essentially represented in subforested groupings (26.0%) and by reforested or fruit species (20.5%). Forest, fields, meadows, wetlands and hedges or alleys would contribute with 15.1%, 13.7%, 11%, 9.6% and 4.1% (n= 73) respectively.

## 2.2. Apiculture

Apiarists are generally sedentary. We estimate that  $13.4 \pm 28.5\%$  (n= 17) of households are interested by apiculture (vs. 40% for the Location 23). Hives number by apiarist is evaluated at  $23.1 \pm 33.2$  (n= 37).

A part from the Location 14 where we have identified modern apiaries (wood hives), traditional hives are more dominant and made with cork of *Quercus suber*, stumps of *Agave americana*, stems of *Arundo donax*, *Vitex agnus-castus*, *Myrtus communis* and *Olea europaea* var. *sylvestris*. Hives made with stems of *Clematis vitalba* and carcasses of *Arundinaria* sp. are used in other countries (LRF, 1990). Apiaries are generally smaller (10 to 20 hives) and localised in abandoned orchards of *Olea europaea* var. *europaea* and *Ficus carica*, or in preserved groupings such marabouts and cemeteries dominated by *Olea europaea*, *Juniperus oxycedrus*, *Calicotome villosa*, *Pistacia lentiscus*, *Staehelina dubia*, *Smilax aspera*, *Cistus albidus*, *Agrostis capillaris*, *Origanum compactum*, *O. vulgare*, *Blackstonia perfoliata*, *Hyparrhenia hirta*, *Paronychia argentea*, *Lonicera implexa*, *Osyris quadripartita*, *Orobanche caryophyllacea*, etc. (Location 14).

Although some apiarists confirm the economic interest of other apiculture products such pollen, propolis, larva of bees, venom and royal frost (Location 14), only the honey and wax are sold in the study area. For example, royal frost could reach 100 dirhams per gram (Location 14). This weak diversification of apiculture products would be due probably to traditional extraction techniques of honey. In fact, a few apiarists from the modern sector use centrifugal extractors and other suitable materials.

Referring to the visited sites, the honey extraction is led one to three times in the year: ends of spring “*metroune*”, summer “*marcidane*” and autumn “*Kbrif*”. According to the hive size, honey yield fluctuates between  $5.9 \pm 5.5$  litres (n= 29) per hive for traditional apiaries and  $25 \pm 5$  litres per hive for the modern ones. Honey is sold for  $179 \pm 56.1$  dirhams (n= 24) per litre, and 14.3% of apiarists having a limited hives number consume all their honey production. The average income per apiarist is very variable ( $5\ 794 \pm 7\ 701$  dirhams per year; n= 17).

Honey is sold locally (houses or souks) for 47.6% of inquired persons (n= 21) and does not present a particular destination. Moreover, it is very advised in traditional medicine because of its general action (ocular and digestive infections,

rheumatism, diarrhoea, cough, etc.). Otherwise, wax is sold for 4 dirhams per kg in the souks (Location 4).

According to BELLAKHDAR (1986/89, 1997), FLEURENTIN & PELT (1990), LRF (1990) and SIJELMASSI (*l.c.*), indigenous species to Mokrisset region such *Urtica dioica*, *Cichorium intybus*, *Ziziphus lotus*, *Bryonia dioica*, *Borrigo officinalis*, *Solanum nigrum*, *Eupatorium cannabinum*, *Clematis vitalba*, etc. have therapeutic traits. Among honey-species inventoried in this study (table 1), 41% present medicinal properties (BELLAKHDAR, 1997). They correspond to introduced, cultivated or natural species. The natural ones are *Quercus ilex*, *Erica arborea*, *Cistus albidus*, *C. crispus*, *C. monspeliensis*, *C. salviifolius*, *Eryngium campestre*, *E. ilicifolium*, *Allium triquetrum*, *Diploaxis catholica*, *Juniperus oxycedrus*, *Nasturtium officinale*, *Oxalis cernua*, *Pulicaria arabica*, *Rumex crispus*, *Solanum nigrum* and *Ziziphus lotus*. Thus, medicinal plants potentially exploitable total 108 species, instead of the 76 identified ones.

Compared to macrophytes which are weakly frequent in the region, medicinal and honey-plants generate a low financial product (vs. 2 430 to 80 341 dirhams ha<sup>-1</sup>; ENNABILI et al., 1996). Referring to the unit price and economic input for some farmers, the carob tree is more profitable (1.9 to 3 dirhams kg<sup>-1</sup> of carobs; 3 840 dirhams year<sup>-1</sup> per farmer; ENNABILI et al., 1997). Furthermore, drug-culture (*Cannabis sativa*) newly known in some locations of the study area, would generate a fluctuating financial product comprised between 30 and 100 thousand dirhams per hectare (LAOUINA, 1993; in AAFI, 1995). Nevertheless, although the net financial product of this cultivated species has been estimated at 2 850 dirhams ha<sup>-1</sup> (ENNABILI et al., 1996), the extensive aspect of this culture would disfavour any development of medicinal and honey-plants exploitation.

Locally, other direct uses are inherent to medicinal and honey-plants seeing that (i) 29.6% of identified species have a pastoral interest or considered as fodder crops; (ii) 24.8% serve for feeding and (iii) 14.4% are employed in other rustic utilisation (firewood, craftsmanship, etc.) (table 1).

## CONCLUSIONS

With the 125 identified species, the Circle of Mokrisset would present a medicinal and honey-flora relatively rich. Spontaneous species reach 75.2%. Local denominations characterise more a thirty species. Traditional uses are lost increasingly while residents are interesting to the species with a mercantile value. Nevertheless, we have noted an indifference towards the conservation of natural honey-species.

At present, trade of medicinal and aromatic plants is of great importance especially for the rarefied species. The interviewees propose reforestation by introduced species in order to sustain this sector (Location 14). For the last years, merchants could not export plant products they have stocked during all the season (Location 8). Other ones mention an imbalance that would exist between natural production and medicinal and aromatic species exploitation (Location 14). More ethnobotanical studies would be necessary to maintain the exploitation of these natural resources and thus the surviving of the man as mentioned by HEYWOOD (1992).

Beside problems inherent in apiculture (epidemics, planning and support failings, wasps' nests, application of pesticides, etc.), apiculture legislation would not be developed. The organisation of this sector escapes all norm especially for swarms acquisition, apiaries installation, transhumance, hives theft, insecticides application and marketing of apiarian products, etc. The hives treatment by commercialised products could have generate problems noticing their use and the honey quality seeing that the apiarists are not trained. The inquired residents have recommended a diversification of apiculture products (honey, wax, royal frost, pollen), apiary equipment, efficient treatment with an accessible price, plantation of new areas by honey-plants, apiarist training, co-operatives establishment, etc. (Locations 6, 7, 8, 13 and 18).

To promote these activities (apiculture, exploitation of medicinal and aromatic plants), the role of associations, non-governmental organisations and the State seems to be efficient by implicating population to all development process. But this remains dependent on the conscience of the population which believes more to lucrative sectors including the drug-culture and to the inefficiency of co-operatives.

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## ANNEX

### QUESTIONNAIRE FORM OF THE INQUIRY

#### FORM N°

#### LOCATION

1. Locality (village or douar/Circle, number of residents)
2. Date of visit

#### INTERVIEWEE

3. Farmer or fellah, apiarist, merchant, other

#### PLANT

4. Vernacular name(s)
5. Genus/specie (botanical name)
6. Medicinal or aromatic plant
7. Honey-plant
8. Other utilisation(s)
9. Blossom season
10. Distribution (grouping type, importance, dominance, other)
11. Natural, cultivated or domesticated specie
12. Sample for herbarium

#### LANDED PROPERTY

13. Private, national, other

#### EXPLOITATION

14. Exploited part of the plant
15. Season of collection or cutting
16. Destination or origin
17. Intermediary(ies)
18. Unit price of sale or purchase
19. Conversion in usual unit (kg, staff, other)
20. Cost price
21. Benefit (contribution rate to the local economy)
22. Quantity produced by unit (area, douar, year, other)
23. Evolution of the market
24. Direct jobs (full time, part-time, other)
25. Indirect jobs (full time, part-time, other)
26. Employee types (children, women, men, natives, other)

#### APICULTURE

27. Bee type(s): variety(ies), clone(s), other
28. Origin of bees (property or acquisition)
29. Hives type(s) (traditional or modern)

30. Hives management: (i) regular visit, (ii) swarming prevention, (iii) feeding, (iv) extraction techniques of honey, (v) preventive treatment
31. Particularities of apiaries (choice of the site, other)
32. Hives number by apiarist
33. Apiarists number by douar or village
34. Apiarist type(s) (itinerant or sedentary)
35. Problems of apiculture (insecticides, support by concerned services, training of apiarists, sicknesses, other)

#### **HONEY**

36. Destination or origin
37. Price of sale or purchase
38. Cost price
39. Benefit (contribution rate to the local economy)
40. Evolution of the market
41. Utilisation type(s) (consumption, marketing, traditional medicine, other)
42. Quantity produced per hive
43. Collects number per year

#### **OTHER OBSERVATIONS**

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