

Ethnobotanical survey of medicinal plants used in cosmetics in Ketama (North of Morocco)

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Abstract. Medicinal plants serve as a significant source of bioactive molecules, with their utilization in the medical realm dating back to ancient times through herbal preparations. In Morocco, the utilization of plants remains integral to traditional medicine. Despite numerous studies documenting indigenous knowledge regarding plant use, scant attention has been given to northern Morocco, particularly the Rif region. This study seeks to enrich and consolidate our understanding of plant utilization in this area. The ethnobotanical investigation was centred on medicinal plants employed in cosmetics within northern Morocco. A questionnaire was disseminated, gathering data encompassing plant names, utilized plant parts, and preparation methods. The study identified 32 plant species utilized in cosmetics, including *Cannabis sativa* L., *Ditrichia viscosa* (L.) Greuter, *Juglans regia* L., and *Rubus fruticosus* L. Leaves emerged as the most used plant parts, with decoction and infusion being the predominant preparation methods. This survey facilitated a comprehensive examination of ethnobotanical knowledge, shedding light on the primary plants employed in cosmetics. Prudent management of these resources is imperative to prevent future shortages.

1 Introduction

Throughout history, the incorporation of medicinal plants into traditional healthcare practices has been fundamental. Globally, there are an estimated 391,000 plant species, each possessing unique medicinal attributes. Remarkably, 88% of these plants, totalling 31,000 species, have been recognized for their current or potential therapeutic benefits [1]. In Africa, traditional ethnomedicine use for skin care is widespread [2]. More than 250 plants are used in South Africa for skin lightening as sunscreens and for skin diseases [3]. 36 plants belonging to 26 families in Cameroon have been identified for use as cosmetics [4]. The utilization of natural products in cosmetics has gained substantial attention due to increasing consumer demand for eco-friendly and sustainable beauty solutions. Ethnobotanical surveys serve as pivotal tools in identifying and documenting the rich biodiversity of plants used in traditional cosmetics, thereby bridging the gap between traditional knowledge and modern cosmetic science. These surveys not only unveil the potential of indigenous plants in cosmetic formulations but also contribute to the conservation of local plant species and the preservation of cultural heritage.

Morocco's geographical position has given it a wide range of ecological and plant species, creating a rich floral diversity [5]. Several recent ethnobotanical studies have been carried out in northern Morocco to document the use of plants in metabolic [6], cardiovascular diseases [7] and general illnesses [8]. However, to our knowledge, there has been no ethnobotanical survey documenting traditional knowledge of plant use in the Ketama area. This work aims to fill this research gap by conducting a comprehensive ethnobotanical survey in Ketama, focusing specifically on plants traditionally used in cosmetic preparations.

2 Materials and methods

2.1 Study area

The region of Ketama, located in the Rif Mountains of Northern Morocco, belongs to the Al-Hoceima province and is subdivided into four communal areas: Abdelghaya Souahel in the south, Ketama and Tamsaout in the middle, and Issaguen in the north (geographical

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coordinates of Ketama: 3454857 N latitude, 43407 W longitude). Figure 1 Renowned for its diverse flora and centuries-old traditions of herbal medicine and cosmetic practices, Ketama offers a treasure trove of untapped botanical resources with immense potential for cosmetic applications. Despite its rich cultural and botanical heritage, Ketama remains underexplored in the context of ethnobotanical surveys, presenting a compelling opportunity for groundbreaking research.

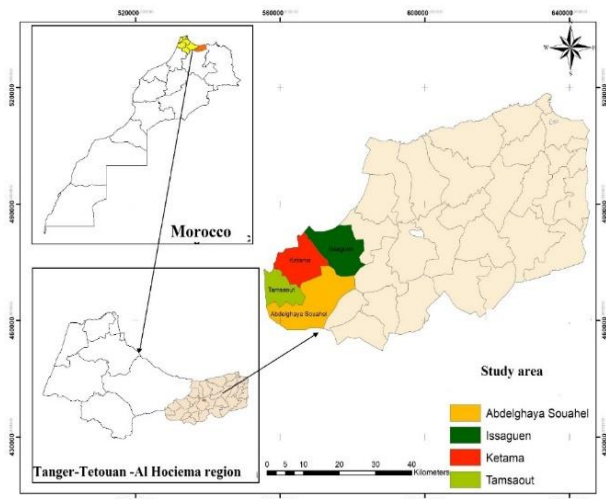


Fig. 1. Map of the study area localisation.

2.2 Study design

We conducted this survey in the Ketama prefecture from August 2020 to August 2021, employing simple random sampling. Four field trips were undertaken to gather ethnobotanical information. The study included 74 informants, all of whom were natives of Ketama. During these excursions, informants were interviewed using a questionnaire encompassing general data such as age, sex, family situation, and place of residence. The interviews were conducted in Darija, a Moroccan dialect. Field methods for conducting ethnopharmacological studies adhered to the recommendations outlined by Heinrich et al.[9].

2.3 Plant identification and conservation

Plant species were collected in all four seasons during the study period. Carefully dried samples were pressed and mounted on herbarium sheets, adhering to the methods outlined by Gary J Martin [10]. Taxonomic classification was conducted utilizing the Moroccan flora guide [11] and the catalogue of vascular plants specific to northern Morocco [12].

2.4 Statistical analysis

The information initially collected was recorded on raw data sheets and subsequently transferred into a database for statistical analysis using Microsoft Excel software. The data were organized in tabular form, detailing vernacular, scientific, and botanical names of all documented plants, along with information regarding

their traditional usage, such as utilized parts, preparation methods, and routes of administration.

3 Results and discussion

3.1 Demographic characteristics of the informants

Our study spanned approximately a year, during which we conducted four field trips to gather ethnobotanical data from various villages in Ketama. A total of 74 informants participated in this ethnobotanical survey, with women accounting for half of the participants (51.35%), while men comprised 48.65%. This gender distribution may be attributed to the prevalent use of plants by women for cosmetic purposes.

This finding is consistent with other recently published ethnobotanical work that has pointed to the dominance of women among the interviewees [13] [8]. The age group of 30-60 years was the most represented in our sample, constituting 66.22%, while 63.51% of informants were found to be illiterate. Among them, 29.73% had attended elementary school, and only 6.76% had secondary education, largely due to limited access to educational resources (refer to Table 1). It's noteworthy that all informants are fluent in Darija, the Moroccan dialect, and Rifiya, the Amazigh language specific to the Rif community.

Table 1. Demographic description of the informants.

Variables	Category	Number	Percentage
Sex	Female	38	51.35
	Male	36	48.65
Age	<30 years	7	9.46
	30-60 years	49	66.22
	> 60 years	18	24.32
Educational level	Illiterate	47	63.51
	Primary	22	29.73
	Secondary	5	6.76
Civil status	Not Married	9	12.16
	Married	65	87.84

3.2 Plant species used for cosmetics

The plants used in cosmetics at Ketama are listed in Table 2. According to family, scientific name, vernacular name, part used and method of preparation. A total of 29 species belong to 23 families.

The Lamiaceae family is the most represented with 4 species, followed by the Compositae, Rosaceae and Lythraceae families with 2 species, while the other families were represented by a single species per family (Figure 2).

Table 2. Plants used in Ketama for cosmetics application.

Family	Scientific names of species	Vernacular name	Parts used	Methods of Preparation	State of plant parts	Use (UR)
Amaryllidaceae	<i>Allium sativum</i> L. (KA1S016)	Thouma ثوم	Bulb	Infusion	Fresh	Hair care (1)
Apocynaceae	<i>Nerium oleander</i> L. (KA2O020)	Tefla دفلة	Leaf, Flower	Decoction, cataplast	Dried	antiseptic (1) skin wounds (1) cutaneous infections (1)
Aristolochiaceae	<i>Aristolochia longa</i> L. (KA3L013)	Bareztem برزطم	whole plant	Cataplast	Fresh	cutaneous infections (1)
Cactaceae	<i>Opuntia ficus-indica</i> (L.) Mill. (KC1F018)	Chemrra شمرة	Bark	Cataplast	Fresh	skin ulcers (1)
Cannabaceae	<i>Cannabis sativa</i> L. (KC2S010)	AL'kif الكيف	Seed	Cataplast, Raw, Cooked	Dried	Skin protection (1) hair tonic (7)
Cistaceae	<i>Cistus albidus</i> L. (KC3A030)	Arguill أركيل	Leaf	Cataplast	Dried	cutaneous infections (1)
Compositae	<i>Artemisia herba-alba</i> Asso (KC4H024)	Achih الشيح	Leaf, Flower	Decoction, Cataplast, Cooked	Dried	skin wounds (2) Skin protection (1)
	<i>Ditrichia viscosa</i> (L.) Greuter (KC4V017)	Tarklaane تركلان	Leaf, Flower, whole plant	Decoction, Cataplast, Cooked	Fresh and Dried	skin wounds (3) skin ulcers (1) Skin protection (1) cutaneous infections (3)
Cupressaceae	<i>Tetraclinis articulata</i> (Vahl) Mast. (KC5A014)	Aarar العرعر	Leaf	Infusion, Cataplast	Fresh and Dried	skin wounds (1)
Fagaceae	<i>Quercus suber</i> L. (KF1S018)	Balloutte بلوط	Bark	Cataplast	Dried	skin wounds (1) skin ulcers (1)
Juglandaceae	<i>Juglans regia</i> L. (KJ1R012)	Guergae الكركاع	Bark	Infusion, Raw	Dried	mouth infections (3) tooth care (1) dental hygiene (1)
Lamiaceae	<i>Rosmarinus officinalis</i> L. (KL1O013)	Azir أذير	Leaf	Infusion, Decoction	Dried	Anti-inflammatory (1) cutaneous infections (1)
	<i>Lavandula x abrialis</i> L (KL1A016)	Lkhazama الخزامة	Leaf, Flower	Decoction, Cataplast	Dried	skin wounds (1) Skin protection (1)
	<i>Mentha rotundifolia</i> (L.) Huds. (KL1R019)	Mchichtro مئشيترو	Leaf	Cataplast	Dried	skin wounds (1)
	<i>Thymus algeriensis</i> Boiss. & Reut. (KL1A032)	Zaitra زعيرة	Leaf	Decoction	Dried	skin wounds (1)
Leguminosae	<i>Retama raetam</i> (Forssk.) Webb (KL2R028)	Rettam رطم	Leaf, Flower	Decoction, Cataplast, Raw	Dried	Dermatitis (1) skin ulcers (1) skin wounds (1) cutaneous infections (1)
Lythraceae	<i>Lawsonia inermis</i> L. (KL3I014)	Henna حناء	Leaf	Decoction	Dried	skin wounds (1) hair tonic (2)
	<i>Myrtus communis</i> L. (KL3C015)	Arrayhan الريحان	Leaf	Cooked	Dried	hair tonic (1)
Oleaceae	<i>Olea europaea</i> var. <i>sylvestris</i> (Mill.) Lehr (KO1E019)	Zitoune barri الزيتون البري	Fruit	Cataplast	Fresh	cutaneous infections
Plantaginaceae	<i>Plantago major</i> L. (KP1M017)	Massassa مصاصة	whole plant	Cataplast	Fresh	skin wounds (1)
Poaceae	<i>Triticum aestivum</i> L. (KP1A012)	Ighemmeh القمح	Seed	Raw	Dried	skin ulcers (1)
Polygonaceae	<i>Emex spinosa</i> (L.) Campd (KP2S013)	Houmida Lkbira حميضة الكبيرة	whole plant	Raw	Fresh	skin ulcers (1)
Rosaceae	<i>Rubus fruticosus</i> G.N.Jones (KR1F010)	Assetif اسنتيف	Leaf	Cataplast, Raw	Dried	hair tonic (2) skin wounds (1)
	<i>Prunus amygdaloides</i> Schltr. (KR1A011)	Louz اللوز	Fruit	Cataplast	Dried	hair tonic (1)
Rutaceae	<i>Citrus limon</i> (L.) Osbeck (KR2L016)	Alhammed الحمض	Seed	Cooked	Dried	skin ulcers (1)
Thymelaeaceae	<i>Daphne gnidium</i> L. (KT1G010)	Al'Matnan متنان	Leaf, Flower, Brak	Infusion, Decoction, Cataplast	Dried	hair tonic (2) skin wounds (2)
Urticaceae	<i>Urtica dioica</i> L. (KU1D026)	Ihoriga الحريقة	Leaf	Cataplast	Dried	hair tonic (1) skin wounds (1)
Xanthorrhoeaceae	<i>Asphodelus ramosus</i> L. (KX1R020)	Barwag برواغ	Bulb	Raw	Fresh	Eczema (1)
Zygophyllaceae	<i>Etraena gaetula</i> (Emb. & Maire) Beier & Thulin (KZ1G026)	Tazallout تزولت	Flower	Cataplast	Fresh	cutaneous infections (1)

The most frequently cited plants are, *Drtrtrichi viscosa* L. used to heal wounds, also against skin ulcers and skin infections. *Cannabis sativa* L. seeds, on the other hand, are used to stimulate hair growth and protect the skin. *Juglans regia* L. is another plant widely used for oral hygiene, the bark of the stem being used against tooth caries. In addition, *Daphne gnidium* L. leaves are used to prevent hair loss, and some informants report that *Daphne gnidium* L. leaves are mixed with *Lawsonia inermis* L. leaves to stimulate hair growth. *Rubus fruticosus* L. is used for hair tonic and, skin wounds, in a recent study this highlighted the anti-inflammatory properties of the polyphenolic extract through COX-2 inhibition [14].

3.3 The plant parts used

The plant parts mentioned in this study were dried before use. Leaves (50%), seeds (15%), bark (11%) and flowers (10%) are the most frequently mentioned plant parts, while bulbs, fruits, roots, and the whole plant are the least used (14%) (Figure 3.A). Our results are similar to those obtained in Morocco [15,16].

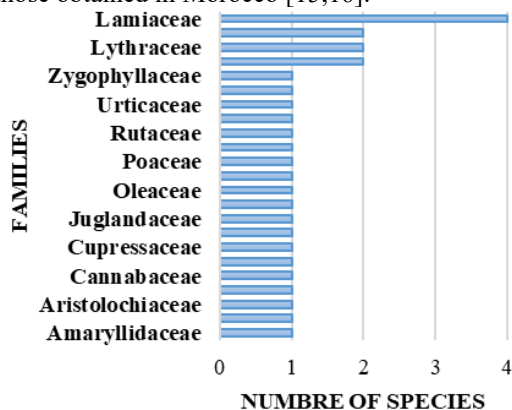


Fig. 2. Families of species used in cosmetics.

3.4 Methods of Preparation

To facilitate the administration of the active principles of the plant, several modes of preparation are used such as decoction, infusion, maceration, fumigation, powdered, and cooked in this study plant-based remedies prepared for cosmetics 42% by poultice, 18% in fresh form, 15% infusion, 13% decoction and 12% cooked (Figure 3. B). Most traditional medicines have been prepared in water.

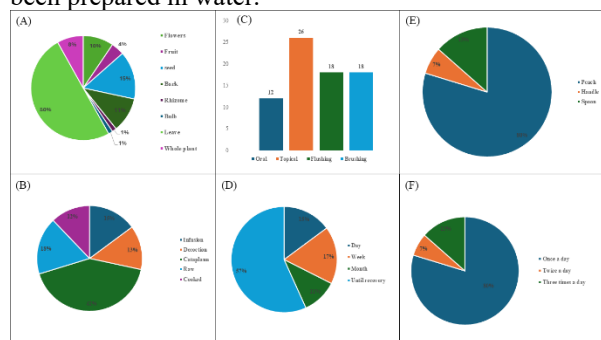


Fig. 3. Plant parts used; (A) Methods of Preparation, (B) Methods of Administration (C) Duration of treatment (D) Quantity of plant used (E) Frequency of use (F)

3.5 Methods of Administration and duration of treatment

The mode of administration plays an essential role in the medicine. In this study topical application is the most mentioned followed by flushing and brushing (18%), oral route (12%) is the least mentioned (Figure 3.C). The predominance of topical application may be explained by that burn treatments commence with the application of a soothing, protective, and anti-infective agent topically to ward off infections [17]. The quantity of plant used to prepare remedies varies according to the type of preparation. In this study, informants did not indicate a precise quantity with a unit of measurement, but approximate quantities: 80% pinch, 13% pick, 7% handful (Figure 3.E). The duration of treatment indicated by the informants varied from one day to recovery, 57% for one day, 17% one week, 15% until recovery and 11% one month (Figure 3.D). The frequency of use of these herbal remedies varied, according to informants 80% once a day, 13% three times a day and only 7% twice a day (Figure 3.F).

4 Conclusion

A total of 29 medicinal plant species used as cosmetics and to treat skin ailments have been recorded and documented. The most frequently mentioned plants are *Dittrichia viscosa* (L.) Greuter and *Cannabis sativa* L. Due to high costs and difficult access to medicines, communities still need to use these plants to treat various illnesses. The majority of species reported are wild, requiring urgent attention to conserve these vital resources in order to optimize their use in the primary healthcare system. Currently, many factors linked to the modernization of the region are jeopardizing traditional knowledge.

References

1. RBG Kew, The State of the World's Plants Report – 2016. Royal Botanic Gardens, Kew (Island Press/Center for Resource Economics, 2016)
2. N. C. Dlova, M. A. Ollengo, Traditional and ethnobotanical dermatology practices in Africa. Clin. Dermatol. **36**, 353–362 (2018). <https://doi.org/10.1016/j.clindermatol.2018.03.009>
3. N. Tabassum, M. Hamdani, M. Hamdani, M. Hamdani, Plants used to Treat Skin Diseases. Pharmacogn. Rev. **8**, 52–60 (2014). <https://doi.org/10.4103/0973-7847.125531>
4. E. F. Fongnzossie, Z. Tize, P. J. Fogang Nde, C. F. Nyangono Biyegue, I. S. Bouelet Ntsama, S. D. Dibong, B. A. Nkongmeneck, Ethnobotany and pharmacognostic perspective of plant species used as traditional cosmetics and cosmeceuticals among the Gbaya ethnic group in Eastern Cameroon. South. Afr. J. Bot. **112**, 29–39 (2017). <https://doi.org/10.1016/J.SAJB.2017.05.013>
5. M. Fennane, M. Rejdali, Aromatic and medicinal plants of Morocco : Richness , diversity and threats.

- Bulletin de l'institut Scientifique, Rabat, Section Sciences de la Vie, **38**, 27–42 (2016)
6. N. Chaachouay, O. Benkhigui, M. Fadli, H. El Ibaoui, & L. Zidane, Ethnobotanical and ethnopharmacological studies of medicinal and aromatic plants used in the treatment of metabolic diseases in the Moroccan Rif. *Heliyon*, **5**, e02191 (2019)
<https://doi.org/10.1016/j.heliyon.2019.e02191>
 7. N. Chaachouay, A. Azeroual, B. Bencharki, L. Zidane, Herbal medicine used in the treatment of cardiovascular diseases in the Rif, North of Morocco. *Front. Pharmacol.* **13**, 131–153 (2022).
<https://doi.org/10.3389/fphar.2022.921918>
 8. Y. El-Mernissi, A. Zouhri, A. Labhar, N. El Menyiy, M. Ahari, S. El Barkany, A. Salhi, A. Bouyahya, L. Hajji, H. Amhamdi, Indigenous Knowledge of the Traditional Use of Aromatic and Medicinal Plants in Rif Mountains Ketama District. *Evid. Based Complement. Alternat. Med.* **2023**, 1–16 (2023).
<https://doi.org/10.1155/2023/3977622>
 9. M. Heinrich, A. Lardos, M. Leonti, C. Weckerle, M. Willcox, W. Applequist, A. Ladio, C. Lin Long, P. Mukherjee, G. Stafford, Best practice in research: Consensus Statement on Ethnopharmacological Field Studies – ConSEFS. *J. Ethnopharmacol.* **211**, 329–339 (2018).
<https://doi.org/10.1016/j.jep.2017.08.015>
 10. G. J. Martin, *Ethnobotany* (Routledge, 2010).
<https://doi.org/10.4324/9781849775854>
 11. M. Fennane, M. I. Tattou, J. Mathez, Á. Enrique, S. Tierra, *Flore Pratique du Maroc* (1999).
<https://doi.org/10.13140/RG.2.1.3227.8889>
 12. V. Castrillón, A. El Kadmiri, S. Leonard, *Catalogue des plantes vasculaires du nord du Maroc. Volume II* (2002).
 13. H. Hamrouni, S. Idoudi, M. Romdhane, W. Elfalleh, Ethnobotanical study of medicinal plants used in southern Tunisia. *Euro-Mediterr. J. Environ. Integr.* **2023**, 8:4, **8**, 807–821 (2023).
<https://doi.org/10.1007/S41207-023-00417-8>
 14. F. Van de Velde, D. Esposito, M. H. Grace, M. E. Pirovani, M. A. Lila, Anti-inflammatory and wound healing properties of polyphenolic extracts from strawberry and blackberry fruits. *Food Res Int*, **121**, 453–462 (2019).
<https://doi.org/10.1016/j.foodres.2018.11.059>
 15. H. N. Mrabti, L. Doudach, M. Mekkaoui, Z. Khalil, K. Harraqui, F. Fozia, N. Naceiri Mrabti, M. El-Shazly, A. Alotaibi, R. Ullah, M. E. A. Faouzi, & A. Bouyahya, Profile of Medicinal Plants Traditionally Used for the Treatment of Skin Burns. *Evid. Based Complement. Alternat. Med.* **2022**, 1–10 (2022).
<https://doi.org/10.1155/2022/3436665>
 16. N. Salhi, A. Bouyahya, S. Fettach, A. Zellou, & Y. Cherrah, Ethnopharmacological study of medicinal plants used in the treatment of skin burns in occidental Morocco (area of Rabat). *South Afr. J. Bot.* **121**, 128–142 (2019).
<https://doi.org/10.1016/j.sajb.2018.10.038>
 17. E. F. Fedoung, T. Zra, C. F. N. Biyegue, A. N. Bissoue, S. Baraye, N. Tsabang, Herbal cosmetics knowledge of Arab-choa and Kotoko ethnic groups in the semi-arid areas of far North Cameroon: Ethnobotanical assessment and phytochemical review. *Cosmetics*, **5** (2), 13 (2018).
<https://doi.org/10.3390/cosmetics5020031>