



Knowledge and Access to Medicinal and Aromatic Plants by Women from the Maghrebi Diaspora in Marseille

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Abstract

We analyse the knowledge and utilization of medicinal and aromatic plants (MAPs) among Maghrebi women residing in Marseille, France, as means to maintain their cultural identity and describe their sourcing strategies in a pan-Mediterranean context. Our qualitative and quantitative analyses of interviews with 24 participants indicate that knowledge of MAPs is primarily transmitted through female lineages. Participants cited 131 species; the most frequently mentioned and utilized MAPs are those with multiple uses. Mint and olive oil have significant cultural symbolism in terms of familial traditions and identity and likely constitute cultural keystone species. Religious and spiritual beliefs are reflected in the therapeutic practices (e.g., averting the evil eye). Maghrebi women acquire plants from shops in Marseille and their country of origin. Foraging locally and community gardens are also a source of MAPs. Quality and authenticity of plants are validated through cultural quality markers (e.g., ‘local,’ *beldi* in Arabic) and motivate choice of trusted plant sources. Plants brought directly from North Africa are favoured. Despite the availability of local substitutes, there is minimal replacement of original MAPs due to efficient supply networks and similarities in flora.

Keywords Urban ethnobotany · Migrant ethnobotany · Cultural keystone species · Organoleptic properties · Urban plant foraging · Maghrebi women · Marseille · France

Introduction

Medicinal and aromatic plants (MAPs) are of vital importance to cultural heritage and identity and are central to many relationships between people and nature. MAPs are species used for medicinal, aromatic, or culinary purposes, often simultaneously. Knowledge about these species, often referred as Indigenous and Local Knowledge (ILK), is a “cumulative body of intergenerational knowledge, practices, values, and worldviews, and embedded in the relationships between local people and nature” held by individuals as well as communities (Brondízio et al., 2021). ILK is important globally, as many communities continue to rely on herbal medicine and other natural resources for

health and livelihoods (Cunningham, 1993; Jiofack et al., 2010; Odonne et al., 2021; Olsen, 2005; Pei, 2001). Herbal medicine is still used in areas where modern biomedicine is less developed or accessible (Tabuti et al., 2003), but also in urban contexts where it plays an especially relevant role to migrant communities who may have difficulty accessing biomedical resources and institutions (Tareau et al., 2022). MAPs may be Cultural Keystone Species (CKS) with central roles in cultural identity, fulfilling fundamental dietary, medicinal, and spiritual or social needs (Garibaldi & Turner, 2004; Petelka et al., 2022). Changes in species availability stemming either from changes in plants’ areas of distribution or as a consequence of human migrations that are increasing in frequency and scale can negatively impact both human and ecological health (Bond et al., 2019; Fernández-Llamazares et al., 2021; Reyes-García et al., 2023), raising sustainability questions.

Migrants have adopted a number of strategies to ensure their continued access to culturally important species (Medeiros et al., 2011; Pieroni & Vandebroek, 2007). Several studies have highlighted the fact that migrants bring culturally important MAPs along during migration, which

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are then integrated into the range of intercultural practices in urban areas (Tareau et al., 2020). When possible, known uses of species will be maintained and sourcing strategies to bring plants from the country of origin developed, but adoption of new species and uses is also common (Medeiros et al., 2011; Van Andel & Van't Klooster, 2007; Volpato et al., 2009). The prevalence of each of these strategies for a given migrant population is highly dependent on factors such as (1) the degree of floristic and environmental similarity between the country of origin and the host country, enabling cultivation or collection by gathering, (2) variation in access to health care between the country of origin and the host country, (3) the degree of contact with local populations in the host country, (4) the involvement in migrant social networks and the degree of contact between migrants and their country of origin, and (5) the ability and ease of acquiring plants via importation, commercialization (Medeiros et al., 2011; Tareau et al., 2021, 2022), or by maintaining contact with family or friends in the country of origin (Volpato et al., 2009). The legislative framework governing the entry of plants into the host country can also influence acquisition of these plants (Medeiros et al., 2011; Tareau et al., 2022). Because MAPs are often tied to cultural identities and identities are transformed through migration, this, along with the possible sourcing strategies for plants, will determine what species continue to be used and why.

Migrant populations increasingly build new identities from their own experience of migration (Harzoune, 2022). Diaspora communities comprise migrants and descendants of migrants whose identity and sense of belonging has been shaped by the migration experience and who maintain strong links with their countries of origin (Wihtol de Wenden, 2010). Diaspora communities are aware of their distinct ethnic or cultural identity and nourish relationships with the territory of origin in various forms, including imaginary ones (Raulin, 1991). It is in fact a dual relationship to time (memory) and space (networks of relationships, construction of a place) that crystallises in the condition of diaspora (Cesari, 1997). Once seen as a temporary social and political situation, the diaspora is increasingly becoming a permanent status because of widespread mobility and improved means of communication. Since individual migration is no longer necessarily permanent, the diaspora increasingly involves a constant coming and going between the territory of origin and the place of reception (Cesari, 1997). Diaspora communities embody the phenomenon of globalisation, as the transnational networks that make them up tend to erase borders and the states they cross, reinforcing feelings of belonging to a community over and above states and constituting veritable de-territorialised entities for the exchange of ideas, information, capital, and commercial activities (Wihtol de Wenden, 2010). With diaspora

populations establishing their migrant identities and given the central role that some species have sustaining identities, cultural knowledge, and well-being, relationships with these plants can be key to preserving a rich and essential cultural heritage in new locations (Van Andel & Van't Klooster, 2007). Migration ethnobiology is well known for communities with roots in the African continent currently living in Europe or the Americas (Van Andel, 2015; Voeks & Rashford, 2012), yet the roles of plant species and the sources of plant material for migrant communities at regional scales is overlooked. Unhindered travel and floristic and cultural similarities may facilitate attachment to place and provisioning of plants from the country of origin, favouring different sourcing strategies than those of global migrants.

Maghrebi Women in Marseille

With its rich and endangered flora and contrasting cultural context between shores that have nevertheless exchanged knowledge throughout history and where multiple migration waves have connected its populations for at least the last two millennia (Medail & Quezel, 1997; Touwaide & Appetiti, 2015), the Mediterranean offers an interesting case to study sourcing of plants by migrant communities within regional scales.

Located in south-eastern France, Marseille is the second largest city after Paris, with a highly diverse population of around 900,000 (Fig. 1). It is also the largest port in France on the Mediterranean Sea. Marseille is a cosmopolitan and dynamic city, shaped by its history of immigration and cultural diversity, while facing challenges linked to integration and socio-economic development. The city has a rich and diverse history dating back over 2,600 years, making it one of the oldest cities in Europe (Bertrand, 2018). Founded by the Greeks as Massalia around 600 BC, it became an important trading centre in antiquity, linking Europe to Africa and Asia. Immigration to Marseille has been an important phenomenon throughout its history, contributing to its cultural wealth and economic vitality. During the nineteenth century, Marseille welcomed numerous Italian, Greek, Armenian, and Spanish immigrants, attracted by the economic opportunities offered by the port (Fig. 1). During the colonial period, Marseille was an important entry point for immigrants from French colonies in North Africa, particularly Algeria. After the Second World War, Marseille experienced a wave of immigration from North Africa, with the arrival of many *pieds-noirs* (French people who lived in Algeria during the period of French colonisation, repatriated to France after Algeria's independence) and North African workers (Bertrand, 2018; Gastaut, 2003). In the 1960s and 1970s, Marseille also welcomed immigrant workers from the Maghreb (Northwest Africa, including Mauritania,

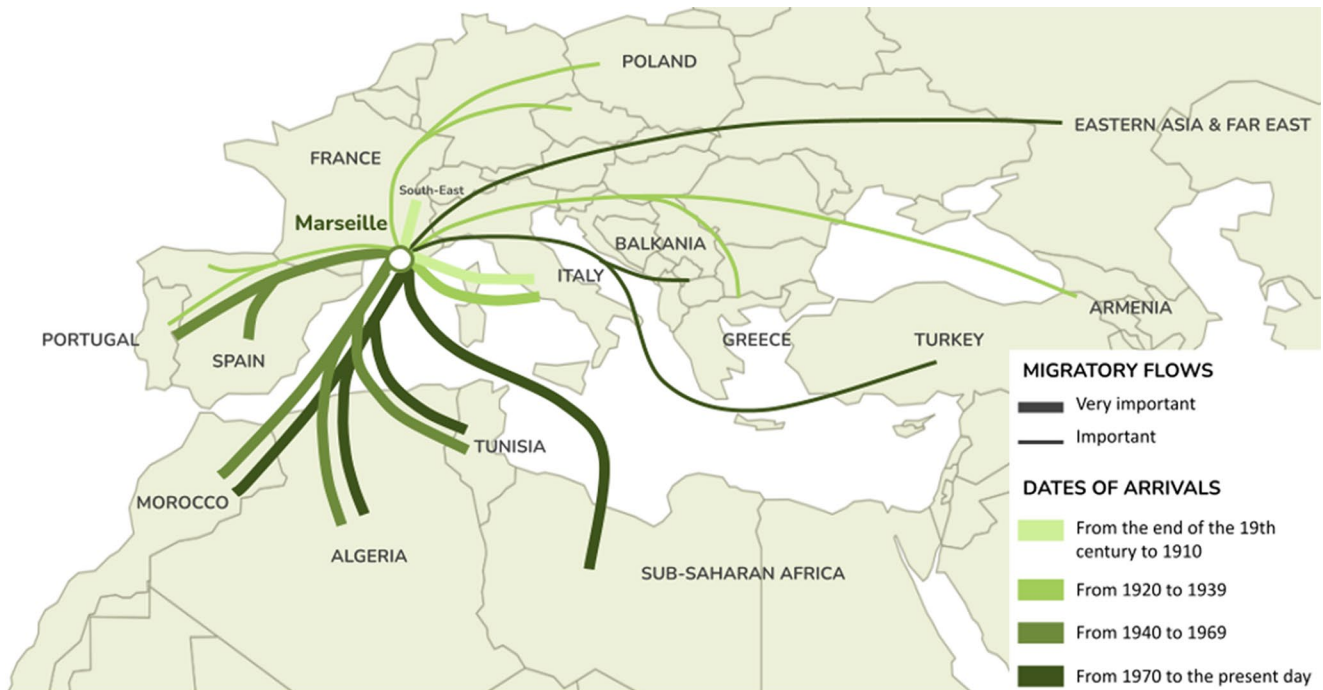


Fig. 1 Origin of migrants settled in Marseille. Adapted from Attard and Temime (1990)

Morocco, Algeria, Tunisia, and Libya) and other parts of the world, attracted by job opportunities in booming industries. More recently, Marseille has seen an increase in immigration from other European countries, sub-Saharan Africa, Asia, and the Middle East. This ethnic and cultural diversity is reflected in daily life through a variety of languages, cuisines, religious traditions, and festivals.

In the Maghreb, women retain an important body of vernacular knowledge on MAPs, distinct and more extensive than that of non-specialist men (Teixidor-Toneu et al., 2021), and as extensive as that of herbalists, who constitute a mostly male professional community specialised in MAPs' properties and uses (El-Ghazouani et al., 2021). In their roles as household health and food providers, women share knowledge about MAPs within and across generations (Fakchich & Elachouri, 2014; Teixidor-Toneu et al., 2021). While in very rural, self-sufficient contexts knowledge on MAPs may be shared between men and women, differences are striking in urban contexts across the Muslim world (Alqethami et al., 2017, 2020; Montanari & Teixidor-Toneu, 2022).

By focusing on Maghrebi women in Marseille, we identify the role of MAPs in shaping the diaspora's cultural identity. Our objectives are (1) to document whether culturally specific MAP knowledge shapes the identity of this diaspora; and (2) to analyse the preferred sources of MAPs. Specifically, our research questions are:

- Are MAPs used by the Maghrebi diaspora and do they contribute to shaping its identity?
- Are the choice of using specific MAPs motivated by a desire to maintain a strong culturally tangible link with their country of origin?
- Or are they influenced more by local availability and the opportunities for acquisition in a new environment?

Methods

We used an ethnobotanical iterative, qualitative, and quantitative mixed-methods approach (Albuquerque et al., 2014) that allowed the best interaction possible with the partners and participants of the study. During the first field visits participant observation and informal discussions permitted an understanding of the community and guided the design of semi-structured interviews. Results from these interviews were used to build structured questionnaires. Thus, results were analysed and interpreted in parallel with data collection, allowing them to inform further steps following participants' knowledge and priorities.

Study Location

We conducted our study with inhabitants of two districts (*arrondissements*) in Marseille (3rd and 13th ; Fig. 2). The 3rd district hosts the highest population from the Maghreb

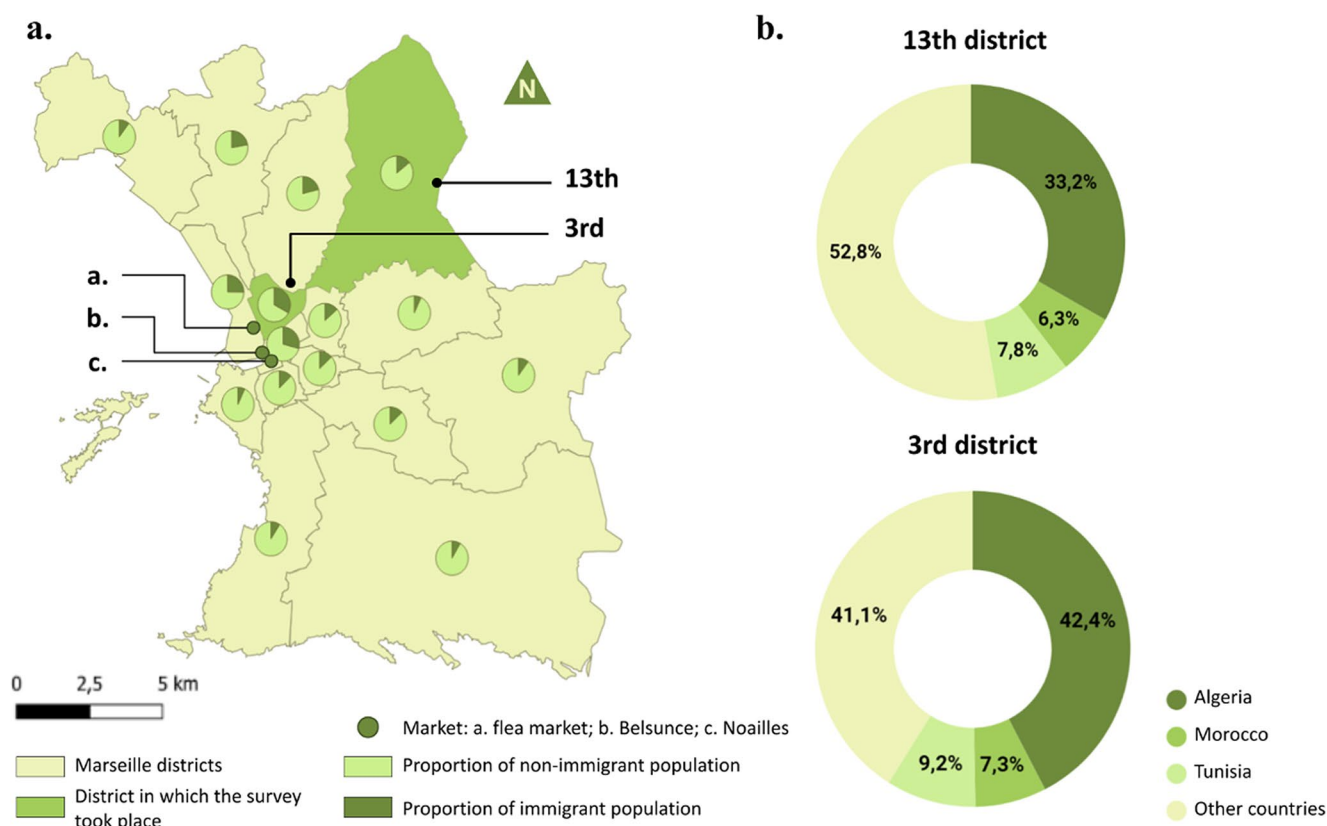


Fig. 2 Socio-demographic data for Marseille's 3rd and 13th districts, including: (a) Map of the proportion of the immigrant and non-immigrant population in Marseille's districts and key supply market areas

(a. flea market, b. Belsunce, c. Noailles); (b) Percentages of immigrants living in the 3rd and 13th districts (Adapted from INSEE, 2022)

in Marseille: 19% of the total population of the district (INSEE, 2022). In the 13th district, commonly called "Frais Vallon," immigrants from Maghreb represent half of the immigrant population, which is of 8% (INSEE, 2022). This district was chosen due to the presence of a social centre with a community garden, which facilitated interaction with the immigrant population. As noted above, specifically women were approached to participate in the study. Marseille is linked with the Maghreb through its population as well as a commercial Euro-Mediterranean network established through the years in well-known locations, such as Belsunce, Noailles, and the flea market (Mazzella, 2004), which constitute key supply areas of MAPs for the diaspora.

Data Collection

The study is place-based and started with an immersion of the first author in the areas where migrants acquire MAPs: shops, markets, and community gardens (May to July 2023). Contact with immigrants from the Maghreb was made mainly through associations assembling people from the diaspora (Frais Vallon Social Centre, CHO3 – Organised Collective of the 3rd district, Tiwizi Amazigh association).

She also conducted participant observation during community activities in the community garden of Frais Vallon (e.g., collective planting sessions, workshops on the value of weeds growing in the gardens; Bogdan & Taylor, 1975) to facilitate direct interactions with future study participants. The first author presented herself and described the research project, before asking for free prior informed consent from community members to participate in the study. From these first contacts, a snowball sampling approach was followed to contact further participants (Albuquerque et al., 2014). All interviews were conducted in compliance with the International Society of Ethnobiology (2006) throughout the project and according to French law n°2016–1087 implementing the Nagoya protocol.

To foster contact with women using MAPs, we organised a workshop in the Frais Vallon Social Centre during the spring festival (24/05/2023) where we provided a selection of species (bay leaf, parsley, thyme, mint, cumin) in dark pots for the participants to smell to generate discussions on the identification, uses, and cultural value of these species. Then, a collaborative poster was drawn and annotated to collect the names of other species. Around 20 women and children participated in the workshop. Exploratory

interviews were conducted which, along with informal discussions, served to design semi-structured interview guides (Supplementary Material 1).

Interviews lasted between 30 min and 4 h and were conducted in participants' homes, in the Frais Vallon Social Centre or in the premises of the CHO3. As all participants spoke French, interviews were conducted in French, but plant names were collected in the participants' mother tongue (Arabic or Amazigh). After collecting non-personal, socio-demographic information (place of origin, age, time lived in Marseille, sources of knowledge of MAPs), we first asked for a free list of MAPs (Albuquerque et al., 2014; Clochey & Aumeeruddy-Thomas, 2017), then posed questions addressing the uses of these species and sources of provisioning (Supplementary Material 1). During interviews, we asked for "*plantes aromatiques et médicinales*" (medicinal and aromatic plants), and when misunderstandings arose, we specified plants used as medicine, to heal oneself and others, but also herbs that are added to culinary dishes. The words food and spices were not used to avoid biasing responses. After we analysed our results, we recontacted four participants for a second in-depth semi-structured interview to further document some of the topics previously discussed.

We conducted an ethnobotanical inventory in shops and markets, notably downtown (Noailles district) and in a flea market often visited by people from the Maghreb, where there are many herbal shops. A stall in the market of Frais Vallon was also inventoried. With the Free Prior Informed Consent (FPIC) of the sellers, photos were taken of the plants on sale. In total, 12 selling points were inventoried. Species cited in the interviews were identified from their vernacular names using Bellakhdar (1997). Photographs were also used to identify plants (Supplementary Material 2) (Greene et al., 2023). Identifications were confirmed by an expert Algerian botanist (Prof. Mohamed Djamel Miara, University of Tiaret, Algeria). Scientific names and families follow the World Flora Online (2024). These inventories also served to inform our analysis of sourcing strategies, as they documented the species diversity available in shops and marketplaces in Marseille. This information was complemented with floristic information on MAPs growing naturally in Marseille (Silene Nature, 2024) and in the Maghreb (*eFlora Maghreb*, 2024).

Data Analysis

We compiled free-list data in Excel©. We categorised information on uses, plant parts used, mode of preparation, use and administration, and source of the plant material (Supplementary Material 3). Classification of medicinal uses drew from the second edition of the International Classification of Primary Care and food uses were classified following

Cook's hierarchical categories (TDWG Economic Botany Subgroup, 1995). We added three further categories: Social, Symbolic, and Ritual uses, Cosmetic uses, and other Household uses. We calculated three ethnobotanical indices: Use Reports (UR; Weckerle et al., 2018), Frequency of Citation (FC; Schrauf & Sanchez, 2008), and Informant Consensus Factor (ICF; Heinrich et al., 1998).

We used a bipartite network analysis to understand the distribution of sourcing preferences among participants (Cavechia et al., 2014; Santos et al., 2020). For each species cited during a free-list, we noted the sources of provisioning and created two incidence matrixes (presence/absence) with the provisioning sources and participants or species (Pires et al., 2011). All quantitative analyses were conducted in R (RStudio Team, 2023). We used theme analyses for qualitative information collected in the field-journal, which informed interpretation of quantitative results (Fig. 3).

Results

Knowledge and Uses of Medicinal and Aromatic Plants

In total, we interviewed 29 participants of whom five were not from the Maghreb and were not quantitatively analysed as they were not part of our target group. Among the 24 participants from the Maghreb, we interviewed four of them twice. Most of the participants were of Algerian origin and were between 30 and 60 years of age (Table 1). Only four participants were second generation immigrants. All participants acquired their knowledge on medicinal and aromatic plants from diverse sources (Table 1), mostly family (mothers and grandmothers) but also the wider family circle. Half of the participants also learnt information from internet. All women who had moved to Marseille during their lifetime ($N=20$) reported having learned to use medicinal and aromatic plants before their arrival in Marseille. They all attested to the important role of their family in their learning process, notably from female relatives. Medicinal and aromatic plant knowledge was strongly associated with maternal lineages, with women describing having learnt from their mothers, as they had from theirs. Several participants spoke of the importance of maintaining these family traditions to their identity and sense of place, that these traditions reflected their relationships with elders who may not have moved with them.

Much plant knowledge is not formally learned but absorbed throughout childhood. During the workshop at the Frais Vallon Social Centre many women participated with their children. During the sensory activity, children identified mint as "it's tea", coriander as "it's salad", and cumin as

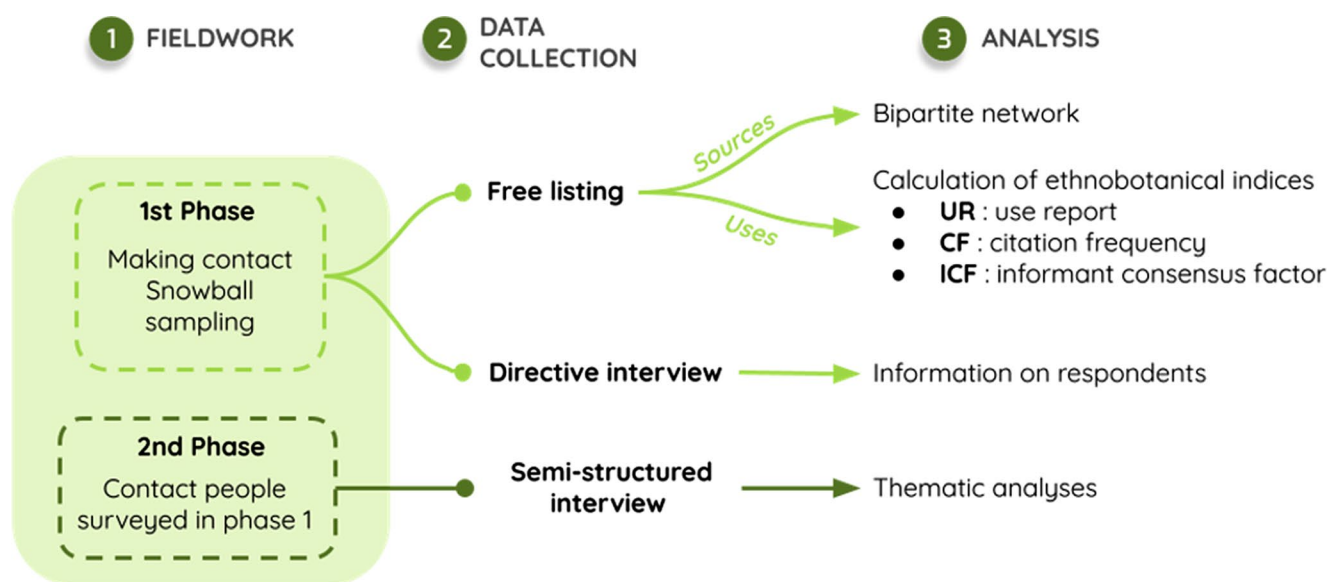


Fig. 3 Data collection stemming from two fieldwork phases and analyses carried out for each of the datasets

Table 1 Socio-demographic characteristics of participating women

	Group	Number (percentage)
Age groups	18–30	2 (8%)
	30–45	10 (42%)
	45–60	9 (37%)
	> 60	3 (13%)
Origin	Algeria	21 (88%)
	Morocco	2 (8%)
	Tunisia	1 (4%)
Years lived in Marseille	0–5	2 (8%)
	5–15	6 (25%)
	15–30	5 (21%)
	> 30	7 (29%)
	Born in Marseille	4 (17%)
Origin of knowledge	Family	24 (100%)
	Other person	21 (88%)
	Internet	13 (54%)
	Books (incl. Koran)	3 (13%)
	Other	4 (17%)

“it’s for when I have stomach ache,” reflecting their everyday experiences.

During interviews, participants cited 131 species in total (1006 UR in total, including all kinds of uses), among which seven were botanically unidentifiable. Some plant mixtures (i.e., *ras el hanout*, *tabel karwiya*, Provençal herbs, curry) and processed plant products (distillates, oils, essential oils) were mentioned along with single plants. Some cereals, pulses, and leaf vegetables were also mentioned despite not being included in the scientific definition of medicinal and aromatic plants. The most frequently mentioned and used species (higher FC and UV) were thyme (*Thymus* spp.), mint (*Mentha spicata*), cumin (*Cuminum cyminum*), clove (*Syzygium aromaticum*), cinnamon (*Cinnamomum verum*),

and ginger (*Zingiber officinale*; Table 2). These are species used both in traditional dishes as condiments (e.g., in *chorba*, *harira*, *tajine*, or *couscous*) and in the preparation of remedies, usually as infusions. Coriander (*Coriandrum sativum*) and bay leaf (*Laurus nobilis*) were also commonly cited but their uses were less diverse, mostly for food.

Mint was always present during interviews in the form of mint tea. One of the participants noted: “Mint is our ethos, we wake up with it, we sleep with it. It is a good stimulant, it smells good, it’s medicinal”. Olive oil (*Olea europaea*) was also omnipresent, always used in food preparation and equally considered medicinal. Most women showed an attachment to olive oil as a connection with their region of origin. One participant from the 3rd district said: “I have grown up with it. I am Kabyle. And the olive oil [that I use] is from Kabyle, from my region Béjaïa, by the sea. In Algeria, the olive oil from my region is the best olive oil.”

Some less cited species with less diversity of use reports nonetheless have an important cultural value (Supplementary Table 3), e.g., henna (*Lawsonia inermis*), which has an important symbolism as it is used to decorate women’s hands during weddings and to bring good luck. Other important species with ritual and symbolic value, along with medicinal value, were rue (*Ruta graveolens*) and nigella (*Nigella sativa*). Of black cumin it was said that “it cures everything except for death,” an expression found in the Koran. Religious and spiritual beliefs were important when plants are used medicinally, as the effect of plants is believed to be modulated by people’s actions and intentions. One participant spoke of the importance of *niyya*, a term meaning intention. Moroccans say “*n nyiia hsen men l amal*”, meaning “good intentions are better than action” and, according

Table 2 Most cited species, FC and UR, and a summary of their uses and plant parts used. Common names are given in English and in the language in which they were documented ([A]=arabic). While Amazigh was the mother tongue of some women, no Amazigh plant names were reported

Family	Scientific name	Common name in English	Common name as given	FC	UR	Uses (UR)	Used part
Lamiaceae	<i>Thymus</i> spp.	thyme	za'tar [A]	22	39	unspecified general medical use (9), respiratory (7), female genital (2), digestive (5), condiment (15), non-alcoholic drinks (2)	leaf, aerial part
Apiaceae	<i>Coriandrum sativum</i> L.	coriander	kosbor [A]	21	26	nutritional (1), urological (1), blood, immune mechanism (1), digestive (1), neurological (1), condiment (21)	leaf, seed, aerial part
Lamiaceae	<i>Mentha spicata</i> L.	mint	na'na' [A], na'na' beldi [A]	20	56	skin cosmetic (1), unspecified general medical use (3), respiratory (4), nutritional (1), female genital (1), blood, immune mechanism (1), digestive (3), cardiovascular (1), musculoskeletal (1), psychological (6), condiment (15), non-alcoholic drinks (20)	leaf, aerial part, root
Apiaceae	<i>Cuminum cyminum</i> L.	cumin	kammûn [A]	19	37	respiratory (1), female genital (5), digestive (15), musculoskeletal (1), psychological (1), condiment (14)	seed
Lauraceae	<i>Laurus nobilis</i> L.	bay leaf	rand [A], wrqa moussa [A], wrqa rand [A]	19	26	hair cosmetic (1), nutritional (2), cardiovascular (2), psychological (1), repellent (1), cleanser (1), condiment (17), protection, affliction rituals (1)	leaf
Oleaceae	<i>Olea europaea</i> L.	olive, olive oil	zit zitûn [A], zit qbayel [A], zitûna [A]	18	53	skin cosmetic (7), hair cosmetic (9), respiratory (8), skin (1), nutritional (4), pregnancy, childbearing, family planning (1), digestive (4), ear (2), musculoskeletal (4), neurological (1), fats (11), other food uses (1)	leaf, fruit
Myrtaceae	<i>Syzygium aromaticum</i> (L.) Merr. & L.M.Perry	clove	qronfel [A], mesma [A], tayeb [A]	16	50	skin cosmetic (1), hair cosmetic (3), other cosmetic (1), unspecified general medical use (9), respiratory (6), skin (3), female genital (2), blood, immune mechanism (3), digestive (12), ear (1), cardiovascular (1), musculoskeletal (2), repellent (3), condiment (4), non-alcoholic drinks (2)	flower
Lauraceae	<i>Cinnamomum verum</i> J.Presl	cinnamon	qarfa [A]	15	34	skin cosmetic (1), unspecified general medical use (2), respiratory (4), nutritional (6), pregnancy, childbearing, family planning (2), female genital (4), blood, immune mechanism (1), digestive (1), condiment (11), non-alcoholic drinks (2)	bark
Apiaceae	<i>Petroselinum crispum</i> (Mill.) Fuss	parsley	debcha [A], kosbor [A], ma'adnûs [A]	15	30	skin cosmetic (2), unspecified general medical use (1), nutritional (1), urological (5), blood, immune mechanism (3), digestive (4), eye (1), cardiovascular (1), condiment (12)	leaf, aerial part
Zingiberaceae	<i>Zingiber officinale</i> Roscoe	ginger	skenjabil [A]	15	34	skin cosmetic (1), unspecified general medical use (3), respiratory (6), nutritional (2), blood, immune mechanism (3), digestive (1), musculoskeletal (2), neurological (1), psychological (1), condiment (12), non-alcoholic drinks (2)	rhizome
Amaryllidaceae	<i>Allium sativum</i> L.	garlic	thoum [A], thoum abiad [A]	13	29	hair cosmetic (3), unspecified general medical use (3), digestive (3), respiratory (2), skin (7), cardiovascular (4), condiment (9)	bulb
Solanaceae	<i>Capsicum annuum</i> L.	paprika	akri [A], felfel [A], felfel ahmar [A], flahamara [A], fufil hulwa [A], naakre [A], fel azina [A], tahmira [A]	13	13	digestive (1), condiment (12)	fruit
Rutaceae	<i>Citrus limon</i> (L.) Osbeck	lemon	qârs [A], lim [A]	13	32	skin cosmetic (4), hair cosmetic (1), other cosmetic (2), unspecified general medical use (2), respiratory (3), nutritional (3), urological (1), eye (1), neurological (2), repellent (2), cleanser (2), non-alcoholic drinks (8), N5 (2)	fruit, fruit skin
Apiaceae	<i>Foeniculum vulgare</i> Mill.	fennel	besbes [A], zerrî'at besbes [A]	13	16	digestive (6), non-alcoholic drinks (1), leaf vegetables (1)	leaf, seed, aerial part

Table 2 (continued)

Family	Scientific name	Common name in English	Common name as given	FC	UR	Uses (UR)	Used part
Ranunculaceae	<i>Nigella sativa</i> L.	nigella	habbet sawda [A], sanūj [A], habbet baraka[A], hajra sawda [A]	13	26	skin cosmetic (1), hair cosmetic (6), unspecified general medical use (5), respiratory (2), skin (2), musculoskeletal (1), psychological (2), condiment (7)	seed
Zingiberaceae	<i>Curcuma longa</i> L.	turmeric	kherqum [A]	12	17	skin cosmetic (1), other cosmetic (1), unspecified general medical use (1), digestive (2), musculoskeletal (1), neurological (1), condiment (10)	rhizome
Fabaceae	<i>Trigonella foenum-graecum</i> L.	fenugreek	halba [A]	12	27	skin cosmetic (2), hair cosmetic (1), unspecified general medical use (3), skin (1), nutritional (8), urological (1), female genital (2), blood, immune mechanism (1), digestive (2), psychological (1), condiment (5), charms (1)	seed, aerial part
Lamiaceae	<i>Ocimum basilicum</i> L.	basil	habq [A], rayhan [A]	11	17	skin cosmetic (1), skin (1), digestive (1), eye (1), repellent (5), condiment (8)	leaf, whole plant
Lamiaceae	<i>Salvia rosmarinus</i> Schleid.	rosemary	iklil [A], iklil al jabal [A], yazir [A]	11	18	skin cosmetic (1), hair cosmetic (4), skin (1), nutritional (1), digestive (2), psychological (1), dye (1), condiment (6), non-alcoholic drinks (1)	leaf, aerial part
Piperaceae	<i>Piper nigrum</i> L.	black pepper	felfel akhal [A], felfel habelkel [A], felfel lekhal [A]	10	10	condiment (11)	fruit

to the participant, a strong belief or faith guarantees the effectiveness of therapeutic treatments.

Species with fewer citations were often plants used for very specific uses in medicine or cosmetics or reflected specific knowledge of the participant. For example, one participant mentioned species that are part of the pharmacopoeia of the Comoros islands (e.g., sweetsop (*Annona squamosa*), and soursop (*Annona muricata*)), which indicates knowledge exchanges among members of different diaspora residing in Marseille.

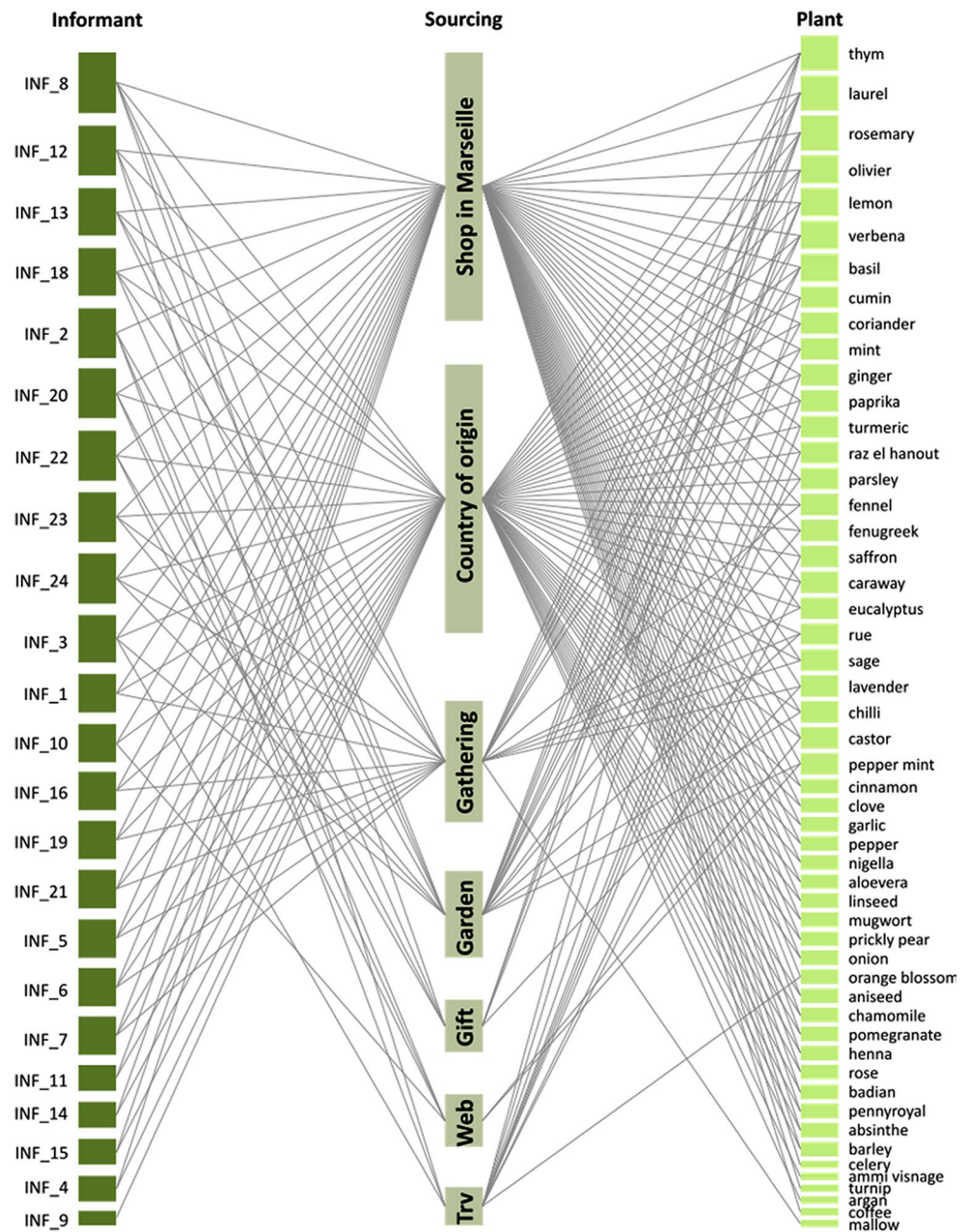
There was greater agreement on the use of species for food than for medicinal uses. Generally, there was wide agreement among participants on many of the food uses, especially on the use of oils (almost only olive oil; ICF 0,9), condiments (ICF 0,8), leaf vegetables (ICF 0,7), drinks (ICF 0,6), and fruits (ICF 0,4). Many of the traditional and everyday dishes typical of North African cuisine use the same condiments and spices. There was a higher diversity in how species are used medicinally (with ICF varying from 0.6 to 0.1 depending on the specific uses). Participants reported using similar species to treat respiratory (ICF 0,6), digestive (ICF 0,6), and urological ailments (ICF 0,5), which were the most common health issues treated. Other types of ailments such as issues of the musculoskeletal (ICF 0,3) and neurologic (ICF 0,3) systems, or ear problems (ICF 0,2), were mentioned by fewer participants, who often did not use the same remedies to treat them.

Sourcing Medicinal and Aromatic Plants

Participants cited several sources of medicinal and aromatic plants: shops (22 citations), the country of origin (22), foraging locally (12), vegetable gardens (7), gifts (4), internet shopping (4), and acquired during a trip to a place other than the country of origin (3). Both sourcing networks have a nested structure, showing a predominance of two sources of plant material by participants and for most species (Fig. 4). Most cited species accumulated a higher diversity of sourcing possibilities. Women cited on average three different sources of plant material, favouring easy access to shops in Marseille, but bringing plants from the country of origin as equally important. These sources were also the main sources of exotic plants (e.g., cinnamon, clove, star anise).

Most participants cited the same shops in the Noailles district, the flea market, and other site in Marseille as sources for medicinal and aromatic plants. Some supermarkets were also mentioned. Their choice was above all pragmatic, these are places frequented by women, close to the participant's home, or selling plants at a good price. Markets were visited for the quality of the plants sold. Another reason given for choosing the shops in Noailles or the stands in the flea market was that plants are directly imported from North Africa. Buying "from Arabs," "from Moroccans," or "from Tunisians" was mentioned by participants as a sign of trust in the identity of plants and their quality. They described

Fig. 4 Bipartite network between respondents, sources of supply and species cited (only species cited more than 3 times were kept, i.e., 52 species retained) with 1: Shop in Marseille, 2: Country of origin, 3: Gathering, 4: Garden, 5: Gift, 6: Internet (“Web”), 7: Travel (“Trv”). Latin names for the species can be found in Supplementary Material 3



how reliance on local shops was greater after Covid-19, as people had to rely more on what was locally available than on the possibility of bringing products from home, either directly or through transport companies. However, participants did not find some plants in shops in Marseille, such as rue, mallow (*Malva sylvestris*), calamint (*Calamintha officinalis*), fenugreek (*Trigonella foenum-graecum*), elderberry (*Sambucus nigra*), and prickly pear (*Opuntia ficus-indica*).

Plants sourced in the country of origin were either bought from shops and market stalls or foraged by the women themselves or their relatives (e.g., prickly pear, thyme). Bringing plants from the home country ensures the identity and quality of the product, but also allows access to lower prices.

Different sourcing strategies allow bringing plants from the country of origin and often people mobilise close family members to do this. Many women mentioned that their family would regularly send packages containing aromatic and medicinal plants, including spices. To send these packages a third person often plays the role of intermediary. This person could be a family member or not, but there is always a relationship of trust for the shipping to be made. Equally important is the fact that when family members living in France, if not the participant herself, travel to the country of origin, they will bring back plants for relatives. Finally, some participants also learned through word of mouth of companies specialising in home deliveries, which are also

advertised through social media. Participants mentioned that it was not always easy to bring back plant products. For example, liquids such as olive oil are not allowed on planes, where the number and size of baggage is also restricted compared to bus or boat transportation. This explains the importance of the services offered by these companies.

Foraging in Marseille was the third most important source of medicinal and aromatic plants and was mentioned as a source by half of the participants. Plants were foraged from the “maquis” (a shrubby arid ecosystem typical of the Mediterranean) around Marseille, but urban foraging in community gardens and collecting non-cultivated plants that grow opportunistically were also mentioned. Floristic and climatic similarities between the north and southern shores of the Mediterranean allow growing and harvesting of native species, such as bay leaf, on both shores of the sea. The most commonly foraged species are thyme (*Thymus* spp.), rosemary (*Rosmarinus officinalis*), fennel (*Foeniculum vulgare*), bay leaf, olive leaves, verbena (*Lippia citriodora*), basil (*Ocimum basilicum*), eucalyptus (*Eucalyptus globulus*), lavender (*Lavandula angustifolia*), and sage (*Salvia officinalis*). Foraging provides access to fresh products as well as to two species not sold in local shops: rue and mal-low. Foraging allows complete trust in the products; women rely on their own knowledge to select the time of foraging and identify and select the plants.

Cultivation of plants is possible for women with access to community gardens (i.e., the community garden of Fraix Vallon and the Levant community garden associated with the CHO3). Some women also grow the most used species in pots on their balconies (e.g., thyme, coriander, parsley, mint, basil).

Regardless of the sourcing choice, participants emphasised the importance of having “the true” plants and carefully examined their smell, texture, and morphology. When the first author interviewed participants in their homes, she was often invited to look at and smell the plants that the women had brought back from their country. To attest to what is the “true” plant and what is not, colours, shape of the plant, quality of transformation process, sensations during ingestion (for example, tingling in the throat for olive oil), and smells were compared between various products (generally condiments).

When purchasing plants in Marseille, the validation of the choice of supply locations is also guided by this sensory experience of the MAPs. Colour and smell allow women to know whether a product was processed a long time ago or not in the case of powdered spices and condiments (dull colour, lack of smell), for example. Some stores offer to grind the products upon request, as stores in the Maghreb also do. This practice is also a guarantee of trust between buyer and seller as well as an indication of the freshness of

the condiments (strong smell). Participants also explained that when buy MAPs in their country of origin, they often shop with a relative who was generally older and more experienced (mother, grandmother, aunt) to be able to refer to them, learn, and make better choices.

The Internet is used to buy only processed plant-based products such as oils and essential oils, and this source was mentioned by only four participants.

Discussion

Knowledge

The use of MAPs is a clear cultural marker in migrant communities that continue to maintain and perpetuate diverse uses outside their country of origin (van Anandel and Carvalheiro, 2013; Volpato et al., 2009; Tareau et al., 2021, 2022), enabling the reproduction of cultural practices (Medeiros et al. 2012). Plant species have an important symbolism for migrant Maghrebi women in Marseille and it is possible that some are cultural keystone species for the diaspora. As many studies suggest, some cultural keystone species continue to hold a central cultural role after migration, even in conditions of difficult access to the species (Ceuterick et al., 2011; Garibaldi & Turner, 2004). The importance of these plant species lies with the link they provide with the place of origin, and the link that the harvest and preparation practices provide with a certain lifestyle in the country of origin too. Shared moments drinking a mint tea, for example, allow the transmission of knowledge, practices and beliefs, for example about the notion of the “evil eye.” A key event in the recent migration history from North Africa to France was the introduction in 1975–1976 of the “*regroupement familial*,” which permitted any migrant worker to invite his/her family to settle with him/her and request residence permits (Beauchemin et al., 2013). This development succeeded a phase of male immigration, often based on short stays. Since its introduction, women became intermediaries between their place of origin and their new home (Renard, 2011). Moreover, the diversity of plant species mentioned by participants seems to vary with age, which can be concomitant to accumulation of knowledge over time (Godoy et al., 2009), rather than with time spent outside the country of origin. Our results do not evidence a change in habits or erosion of knowledge. This could also be due to the sample of the women from North Africa interviewed: housewives with links to social centres or community gardens. Because of our sample strategy through social centres and associations, we did not interview Maghrebi migrant women who have integrated into the French workforce, who may have very different relations with plants and their country of

origin. National politics leading to segregation in peripheral neighbourhoods (Khosrokhavar, 1997) or the importance of identity revindications (Poutignat & Streiff-Fenart, 1995) can also explain the maintenance of knowledge and practice from the country of origin.

During interviews, religious texts (the Koran) as well as ancient medicine and philosophy texts (e.g., of Ibn Sina, preeminent philosopher and physician of the Muslim world who published important writings on medicinal plant, c. 980–1037 CE) were mentioned as constituting guides to plant use. Religious practices are recognized in the Arabic world to generate or support cultural behaviours aiming to preserve health (Deuraseh, 2006; El-Seedi et al., 2019; Rasool, 2018). We observed that mixed ailment aetiologies led to mixed treatments both in Marseille, where biomedicine is readily accessible, and in the Maghreb (Ghazanfar, 1994; Greenwood, 1981; Teixidor-Toneu et al., 2017).

Migrants from the Maghreb are strongly attached to their cultural practices, as is common among migrants who keep close links with (including frequent or regular travel to) their country of origin (Tareau et al., 2022). Because of the mother-to-daughter transmission pathway for MAP knowledge, close family ties, and place attachment, knowledge is not really hybridised (although we observe the use of some plant species from other ethno-pharmacopoeias or gastronomies). This could also be because the society to which they have migrated has largely lost its own MAP knowledge or that Marseille is an urban environment, where human-nature connections are more difficult to establish and maintain. We did not observe important exchanges of knowledge between the French community and North African migrants, but rather among people from other diasporas. This can be due to two reasons: that members of different diasporas are more likely to talk to each other, and that North African and French MAPs are already very similar. Ethnobiological hybridizations can result either from the mixing of elements from different systems through contact or from the coexistence of various systems that are marked by strong socio-cultural heterogeneity (Ladio & Albuquerque, 2014). We observe that although plants enable the reproduction of cultural practices and the maintenance of diaspora identity (Medeiros et al., 2011), hybridization processes take place through the adoption of Comorian species, for example “*konokono*” (soursop). This is to be expected given the high socio-cultural heterogeneity of the Marseille neighbourhoods we studied (Ladio & Albuquerque, 2014). However, Mediterranean societies have a shared history and the development of a shared body of ethnobotanical knowledge is well known (Touwaide & Appetiti, 2015).

Sourcing Plants

The plurality of ways in which diasporas supply plants is well known (Medeiros et al., 2011; Tareau et al., 2020, 2022). Women from North Africa in Marseille maintain strong direct and indirect links with the Maghreb. These links, inherent to the organized and well-established personal and commercial networks in Marseille, are marked by multiple supply routes with the countries of the Maghreb. Several strategies are used to acquire MAPs: they can be brought back by the individual or his or her family and friends, but also sent by a family member via a trusted person or baggage handler. As Tarius (1993) notes, these small transnational businesses help produce a circulation of territories.

The importance of maintaining the use of herbs brought back from the country of origin is characterized by a need for trust in the products purchased, based on established networks and relationships of trust. The local (in Arabic, *beldi*) and often family-related character of the source is an undeniable factor in maintaining this sourcing strategy (Tareau et al., 2020, 2022). In the supply chain described by our participants, the family is omnipresent at every stage of processing and transportation, as mothers play a central role in the preparation and dispatch of MAPs from the *bled* (country, place of origin). The concept of *beldi* (local), as opposed to *roumi* (Western, foreign), is here even more complex to the extent that it also refers to a ceremonial, symbolic, and emotional dimension (Rachik, 1997).

While replacement of botanical resources from countries of origin by local substitutes is highly common by diasporas across the globe, along with strategies for importing plants from their places of origin (Ceuterick et al., 2011; Medeiros et al., 2011; Pieroni & Vandebroek, 2007; Van Andel & Van't Klooster, 2007; Volpato et al., 2009), little replacement was observed in Marseille, as participants reported little difficulty in finding the plants they need. The local flora are very similar and the supply networks are efficient.

Moreover, the importance of spices used as medicinal ingredients is recognized around the Mediterranean. As the continuum between food and medicine is common to several local medicinal systems (Etkin, 2006), the cultural (and medicinal) importance of spices in the Maghreb is probably related to its position as a hub for historical trade between Asia and Europe. Highly valued from the fifth century BCE to the present, many plant species considered spices were imported via terrestrial and marine routes, most of them passing through Mediterranean and allowing several ancient Islamic societies (like the Abbasid Caliphate from 750 to 1258) to flourish (Birlouez, 2013). As a consequence, the salience of Asian species goes far beyond the “imported plants” often discussed in contemporary ethnobotany

(Alencar et al., 2014; Medeiros et al., 2017; Medeiros, 2013). Moreover, most of the plants used as spices have well recognized medicinal properties (Peter, 2001).

Conclusion

Our study of the MAPs used by women residents of North African origin in the 3rd and 13th districts of Marseille indicates that they belong to a common pool of plant species of cultural importance for the whole of the Maghreb. The use of MAPs contributes to maintaining a distinct cultural identity of the diaspora. Future research could explicitly address the place of Cultural Keystone Species among diaspora populations and if differences in these species exist between diaspora and non-migrant populations.

The importance of spices in Maghrebi and Mediterranean cultures is potentially linked to the historical importance of transcontinental trading of aromatic plants, and we found that indeed specialized local traders are the primary source of plants for our participants. Nevertheless, the familial network remains an important source of plants, testifying to very close links between the two shores of the Mediterranean. The third most important source of plants is local gathering (harvesting from the surrounding semi-wild areas and urban foraging), and this deserves more scientific attention. Some of the species gathered are of high cultural importance and the reasons for collection of some of these species perhaps go beyond simple questions of availability. Lastly, the importance of family networks and sources of *beldi* MAPs reinforces the attachment to a territory of origin whose “Mediterranean” similarities to Marseille cannot erase the distance.

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Data Availability Data is provided within the manuscript or supplementary information files.

Declarations

Competing Interests The authors declare no competing interests.

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