Journal of Medicinal Plants Studies
www.PlantsJournal.com

ISSN (E): 2320-3862
ISSN (P): 2394-0530
NAAS Rating 2017: 3.53
JMPS 2017; 5(2): 338-342

Received: 17-01-2017
Accepted: 18-02-2017

El Houssine Bouiamrine
Laboratory of Soil Microbiology and Environment, Department of Biology, Moulay Ismail University, Faculty of Sciences, Meknes, Morocco

Lamiae Bachiri
Laboratory of Soil Microbiology and Environment, Department of Biology, Moulay Ismail University, Faculty of Sciences, Meknes, Morocco

Jamal Ibijbijen
Laboratory of Soil Microbiology and Environment, Department of Biology, Moulay Ismail University, Faculty of Sciences, Meknes, Morocco

Laila Nassiri
Laboratory of Soil Microbiology and Environment, Department of Biology, Moulay Ismail University, Faculty of Sciences, Meknes, Morocco

Correspondence
El Houssine Bouiamrine
Laboratory of Soil Microbiology and Environment, Department of Biology, Moulay Ismail University, Faculty of Sciences, Meknes, Morocco

Use of medicinal plants in Middle Atlas of Morocco: potential health risks and indigenous knowledge in a Berber community

El Houssine Bouiamrine, Lamiae Bachiri, Jamal Ibijbijen and Laila Nassiri

Abstract
The indigenous herbal knowledge was studied in Amazigh (Berber) communities through questionnaire and interviews with street vendors and herbalists. The results about the age and sex of vendors of medicinal plants show that the greater parts of vendors are seniors. Their age range is mostly between 66 and 89 years of age and the majority are women. These women make do both the harvesting and trade of plants in the traditional markets. Confusions during plant harvesting were recorded. The most frequent cases of confusion concerned "*Euphorbia resinifera*", whose vernacular name is "Daghmous". This plant is widely used by the local population to treat cysts and cancer. Confusion has also been observed in many scientific articles with species belonging to very distant families. Most of herbaceous fresh plants traded in traditional markets that we studied are whole plants which allow an easy botanical identification. Trees or shrubs are sold in the form of branches, barks or roots, which sometimes makes visual identification difficult. The risk of poisoning by these false medicinal plants can sometimes be high. We also noticed that the Berber women who sell plants possess a perfect control of medicinal plants and their uses than male street vendors. The practice of traditional medicine is deeply rooted in the Amazigh culture of Atlas and is perpetuated from generation to generation thanks to women who have possessed this thousand-year old phytotherapeutic knowledge.

Keywords: Medicinal plants, middle atlas, plant confusion, herbal knowledge, Berber communities

1. Introduction
Medicinal Plants have been used for curing various ailments since the very beginning of human civilization [1, 2]. Today, populations in developing countries still depend on medicinal plants for their primary care. World Health Organization [3] estimates that about 80% of the world's people depend on traditional medicine to meet their primary health care needs.
In Morocco, Medicinal plants occupy an important place in traditional medicine and play an important role in the Moroccan economy. Indeed, the geographical location of Morocco confers to it a great bioclimatic variety and a particular floristic diversity. Morocco is after Turkey the second most biologically diverse country in term of species in the Mediterranean basin [4]. The country is characterized by high vascular plant diversity with an estimated 4200 species and subspecies of which 22% are endemic [5]. Approximately 800 of listed species are aromatic and medicinal plants [6].
Otherwise, Morocco is situated on the northwest side of the African continent. This location makes it a mixture of Africa and Euro-Mediterranean civilizations. The Moroccan population is a harmonious ethnologic assemblage of Berber, Arabic, Jewish, Sub-Saharan and Andalusian cultures. The country is known thus for the richness of phytotherapy and traditional medicine heritage. The traditional Moroccan medicine was able to sustain and enrich itself up to present day thanks to the geographic situation, socioeconomic tradition, and particular characteristics of the country [7]. In Morocco, traditional medicine is still popular and it is an important form of health care of many rural people. But research on traditional pharmacopoeia in different areas of the country is scarce and insufficient. However, interesting studies have been carried out in recent years in different regions of Morocco [8-11].
Ethnobotanical studies provide a valuable source of information on both the plant species used and the diseases treated. This also makes it possible to detect cases of poisoning due to the administered dose or the confusion of ordinary plants with non-medicinal plants.

The uncontrolled use of medicinal plants also has disadvantages and can cause health problems that are sometimes serious. Indeed, the judicious use of medicinal plants is linked to a precise choice of the plants concerned at an appropriate time in their development stage [12]. The public is often misled to believe that all natural treatments are inherently safe. Herbal medicines do carry risks, so research in this area must be intensified [13].

In this context, an ethnobotanical and floristic study of medicinal plants was undertaken in the Middle Atlas region characterized by a very high wealth of aromatic and medicinal plants [14]. This study consists of assembly as much information as possible about the traditional markets of medicinal plants and the therapeutic uses of these by the populations of this region.

2. Materials and methods

2.1 Study area

Middle Atlas is a mountain range in central Morocco located between the Rif and the High Atlas and it is a major component of the Moroccan terrain. It runs about 450 km from the Southwest to the Northeast and covers a total area of 27,550 km2, which is 15% of the country's total mountain area. 15% of its landmass rises above 2,000 meters. The Middle Atlas is a territory rich biodiversity of flora The Middle Atlas Mountains are among the areas of plant diversity in Morocco that host high species diversity, high endemism rates and they are IUCN priority sites for conservation in the Mediterranean region [14]. However, Middle Atlas is one of 10 red alert areas or "hot-spots" situated in the Mediterranean basin [15]. Because of its elevation, snow persists in the Middle Atlas in the winter and can appear starting at 600 m above sea level.

The Study area occupies an important area in Mountain chains of the Middle Atlas (Figure 1) and containing two national parks (Ifrane National Park and Khenifra National Park) considered as Plant Biodiversity Hotspots [16, 17]. It includes villages and rural areas of the cities of Khenifra, Ifrane, Azrou, Mrirt and Lekbab.

Major activity of the rural people depends on agriculture and pastoralism and they have limited access to medical service. Medicinal plants and Plant-derived products are particularly important for people of the region, as they are sometimes the only source of medicine readily available [16]. The conditions of hospitalization of patients and medical cares are difficult.

2.2 Data Collection

Ethnobotanical study on traditional medicinal plants was conducted during 2015-2016 in villages and rural areas of Middle Atlas. The data were collected by conducting interviews with street vendors of medicinal plants and herbalists using purposive sampling method.

2.3 Species identification

The plant species collected during surveys were identified by the botanical team of Environment and Soil Microbiology Unit of Moulay Ismail University's Faculty of Science and using the Flora, the catalogue and various books of botany and medicinal plants. Study data were compiled using Microsoft Office Excel 2010 program.

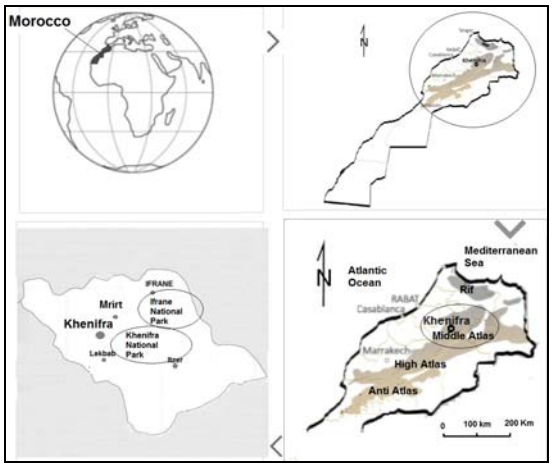

Fig 1: Location map of study area

3. Result and discussion

The results show that 69 medicinal species were inventoried in the study area. These plant species are included into 36 families. The information collected in the survey from fresh plant vendors and herbalists showed that the plants are used in several forms for their administration. The preparations can be made from dry plants (dehydrated) (Figure 2A), fresh plants (Figure 2B) or both. The results presented in the figure show that 67% are in fresh form, 7% are dried and 26% are both dried and fresh (Figure 3).

These data revealed that people of Middle Atlas region depend on fresh resources to prepare herbal remedies. However, the use of dried plants usually involves annual plants that are not available all year round and also leaves deciduous trees, fruit peels or seeds. These fresh medicinal plants are used to treat a many types of ailments. The majority of the medicinal plants traded are harvested from the wild [18]. During this survey, plant vendors argue that fresh materials are very effective in treatment than dried form because their contents are still conserved and not lost. The preference of people for fresh plants has been reported by several authors about several indigenous cultures [19-21].

Fig 2: medicinal plants in traditional market
A: Dry plants, B: Fresh plants

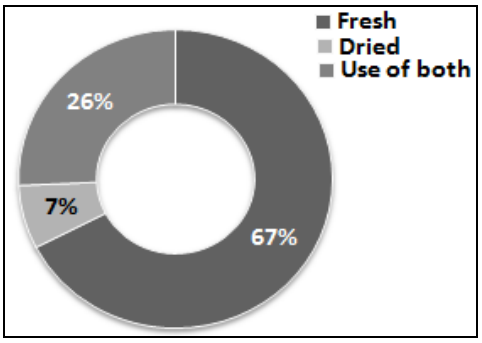

Fig 3: Distribution of age groups of vendors of medicinal plants

The results about the age of vendors of medicinal plants show that there is a large gap between the generations (Figure 3). The majority of vendors are seniors. Their age range is mostly between 66 and 89 years of age and the majority are women (Figure 5A). These women make do both the harvesting and trade of plants in the traditional markets. Most of the interviewees stated that they had learned the tradition of harvesting Medicinal plants and phytotherapy within their tribes and also in family with their parents and grandparents when they were young. Oral tradition is the main means of transmitting this knowledge among the Berber populations of the Middle Atlas. Indeed, according to the survey carried out almost all street plants vendors are illiterate (Figure 5B).

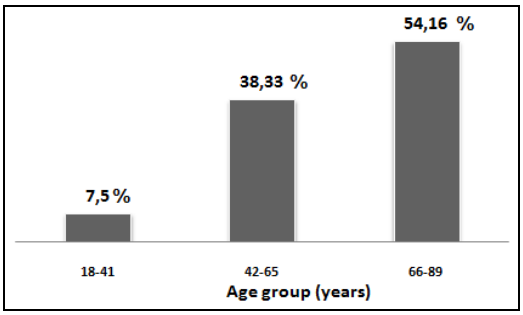

Fig 4: Distribution of age groups of vendors of medicinal plants

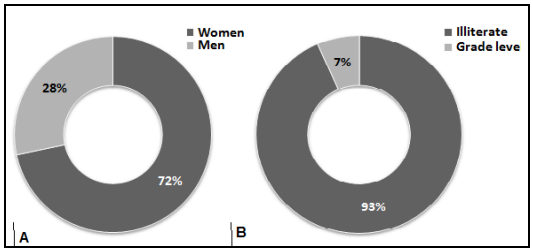

Fig 5: A: Distribution of medicinal plants vendors by sex
B: Distribution of illiteracy rates of plant vendors

The absence of written documents about this indigenous knowledge on the use of medicinal plants can lead loss this thousand-year-old phytotherapy heritage. Similar situations also seem to occur in other countries around the world [22, 23]. However, according Kaido *et al.* (1997) [24], indigenous knowledge of using medicinal plants for healing ailments is in danger of gradually becoming extinct, because this knowledge is passed on orally from generation to generation without the aid of a writing system and because many traditional healers are illiterate. The documenting the results of scientific research into traditional medicine may also help conserves an important part of indigenous people's cultural heritage for future generations [25]. Indeed, in our investigation, this lack of knowledge of plant identification and uses of Medicinal plants was noticed among some male vendors of the age groups "18-41" and "42-65" and yet slightly literate. The taxonomic identification of the plants sold has thus made it possible to discover cases of plants of no therapeutic interest which are taken for medicinal plants.

Confusions during plant harvesting were recorded. These include several species of false nettles belonging to different genera of the family Lamiaceae or Euphorbiaceae. Nettle (family Urticaceae) (Figure 6A) is often confused with *Mercurialis perennis* (family Euphorbiaceae) (Figure 6B). The confusion also concerned shrubs such as the example of *Rhamnus alaternus* (family Rhamnaceae) (Figure 6C) with *Phillyrea latifolia* (family Oleaceae) (Figure 6C).The probable toxicity of these plants should be studied. These examples of confusion are sometimes hard to notice when the plants are dried or processed. Or when sold as fragments of roots, barks or stems. The most frequent cases of confusion concerned "*Euphorbia resinifera*", whose vernacular name is "Daghmous". This plant is widely used by the local population to treat cysts. Moreover it was also used in Moroccan traditional medicines to treat various diseases. It might possess laxative, anti-inflammatory, hypoglycemic as well as anti-tumor activity [26]. Several species belonging to the genus Euphorbia are confused with the species Euphorbia echinus. There is also confusion with distant species such as the case of *Caralluma europaea* belonging to the family of Apocynaceae. This confusion has also been observed in numerous scientific publications. These confusions are probably due to the high number of euphorbia species. Indeed the family Euphorbiaceae comprises 280 genera with the largest genus Euphorbia having about 1600 species [27]. They have characteristic milky latex which contains several toxic compounds. Several cases of intoxicated patients have been reported by the Moroccan Pharmacovigilance Center because of the ingestion of the "Daghmous" [28]. There are cases where some plants have a vegetative stage very similar to other plants before flowering, which causes frequent confusion. For example, ramson, bear garlic or wild garlic (*Allium ursinum*) is a very old medicinal plant known in Northern Europe for its slimming virtues. As such, ramson does not contain harmful substances, but it may be mistaken for poisonous plants. In particular, before flowering, ramson leaves can be confused with autumn crocus and lily of the valley. Several cases of poisoning have been reported in other European countries, even with fatal consequences, as a result of this confusion [29].

Fig 6: A: Nettle; B: *Mercurialis perennis;* C *Rhamnus alaternus*; D: *Phillyrea latifolia*

Furthermore, studies of the adverse effects of phytotherapy in Morocco have shown that most of the harmful effects of medicinal plants are linked to misidentification or failure to observe the correct dose [30]. In addition it should be emphasized that the main question that has not been often answered satisfactorily deal with the triad absorption/metabolism/efficacy of herbs and their extracts and is actually an important unsolved problem in judging their many alleged health effects [31].

Also, most of herbaceous fresh plants traded in traditional markets that we studied are whole plants which allow an easy botanical identification. On the other hand, trees or shrubs are sometimes sold in the form of branches, barks or roots, which sometimes makes visual identification difficult. The risk of poisoning by these false medicinal plants can sometimes be high. Indeed, severe poisoning caused by confusion between medicinal plants and ordinary plants has been reported by several authors [12, 32-34].

The growing success of the use of medicinal plants and traditional herbal medicine has prompted some young people, without any previous knowledge in this field, to convert into plant street vendors and herbalists. This explains the errors found in the identification of plants species and also errors the use and the pathologies treated by plants. According to the survey, we noticed that the Berber women who sell plants possess a perfect control of medicinal plants and their uses. Some of them told us said that male herbalists regularly visited them for advice on plant use. These discreet sages are often ignored and their ethnobotanical knowledge often unexplored by ethnobotanists who tend to refer to male herbalists for information.

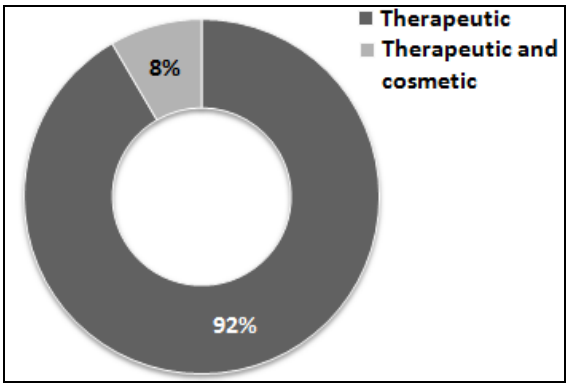

Fig 7: Distribution of cosmetic and therapeutic use of medicinal plants

Women's interest in medicinal plants can be explained by their cosmetic uses. The results presented in Figure 7 show that 8% of the plants are used for both therapeutic and cosmetic purposes. The use of medicinal plants in cosmetics is an ancestral tradition widely spread in Morocco [35, 11]. The use of medicinal plants for cosmetic purposes is also a cultural heritage for many women farmers or mountain people around the world [36-38]. Women are thus regarded by several researchers and ethnobotanists as the holders of traditional phytotherapeutic knowledge and the guarantors of the preservation and transmission of this ancestral knowledge to future generations [39-41, 4]. Lozada *et al.* (2006) [42] analyzed the transmission of knowledge about medicinal plants and concluded that women and especially mothers were the main source of medicinal knowledge. Men are generally large herbalist tradesmen of dry plants who are interested only in the material gain.

4. Conclusion

Fresh plants are widely used in traditional herbal medicine in the Moroccan Middle Atlas. This is due in particular to the richness of the herbaceous flora and the presence of an important protective forest cover in the region. The practice of traditional medicine is deeply rooted in the Amazigh culture of Atlas and is perpetuated from generation to generation thanks to women who have possessed this thousand-year old phytotherapeutic knowledge. They are also the guarantors of its preservation and its transmission to future generations. However, young people today do not seem to be able to perpetuate this culture because of the lack of interest in the traditions of their ancestors. The interest for some of them to medicinal plants is rather due to the material benefit from the trade these. They constitute a serious risk to the health of populations and a threat to biodiversity. The exploitation of medicinal plants and the practice of phytotherapy should not be left to inexperienced traders, and strategies for the scientific and rational exploitation and preservation of ethnobotanical heritage should be adopted to ensure the sustainability of biodiversity and the safety of populations.

5. References

1. Husai A. Exploitation of Medicinal Plants in Medicinal plants: their role in health and biodiversity Tomlinson TR and Akerele O (Eds). University of Pennsylvania Press, Philadelphia. 1998, 240.
2. Eddouks M, Chattopadhyay D, Feo VD, Cho WC. Medicinal plants in the prevention and treatment of chronic diseases. Evid Based Complement Alternat Med. 2012; 458274:1-2.
3. WHO. National policy on traditional medicine and regulation of herbal medicines: Report of a WHO global survey. World Health Organization, Geneva, S witzerland. 2005.
4. Montanari B.Aromatic medicinal plants and vulnerability of traditional herbal knowledge in berber community of Hign Atlas Mountains of Morocco. Plant Diversity and Resources. 2014; 36(3):388-402.
5. Rankou H, Culham A, Jury SL, Christenhusz MMJ. The endemic flora of Morocco. Phytotaxa. 2013;78(1):1-69.
6. Benabid A. Flore et écosystèmes du Maroc, évaluation et préservation de la biodiversité. Ibis Press, Paris. (In french). 2000, 360.
7. Hmamouchi M. Medicinal plants in Morocco: traditional use, marketing, and strategies for conservation and increasing value. Espérance Médicale/ 2002; 9(86):454-458.
8. Jouad H, Haloui M, Rhiouani H, Hilaly JEl, Eddouks M. Ethnobotanical survey of medicinal plants used for the treatment of diabetes, cardiac and renal diseases in the North centre region of Morocco (Fez–Boulemane). Journal of Ethnopharmacology. 2001; 77:175-182.
9. Eddouks M, Maghrani M, Lemhadri A, Ouahidi ML, Jouad H. Ethnopharmacological survey of medicinal plants used for the treatment of diabetes mellitus, hypertension and cardiac diseases in the south-east region of Morocco (Tafilalet). Journal of Ethnopharmacology. 2002; 82:97-103.
10. Bammou M, Daoudi A, Slimani I, Najem M, Bouiamrine EH, Ibijbijen J *et al*. Valorisation du lentisque « Pistacia lentiscus L. Étude ethnobotanique, Screening phytochimique et pouvoir antibactérien. Journal of Applied Biosciences, 2014; 86:7966-7975. In French.
11. Slimani I, Najem M, Belaidi R, Bachiri L, Bouiamrine

EH, Nassiri L *et al*. Ethnobotanical Survey of medicinal plants used in Zerhoun region, Morocco. International Journal of Innovation and Applied Studies. 2016; 15(4):846-863.
12. Dolivo A. Confusion lors de cueillettes de plantes médicinales. Bulletin du Cercle vaudois de botanique. 2003; 32:17-22. In French.
13. Firenzuoli F, Gori L. Herbal medicine today: clinical and research issues. Evid Based Complement Alternat Med., 2007; 4(1):37-40.
14. Radford EA, Catullo G, Montmollin B. de. (eds.) Important Plant Areas of the south and east Mediterranean region: priority sites for conservation. IUCN, Gland, Switzerland and Malaga, Spain. Gland, Switzerland and Malaga, Spain: IUCN. 2011; 8:108.
15. Médail F, Quézel P. Hot-spots analysis for conservation of plant biodiversity in the Mediterranean Basin. Annals of the Missouri Botanical Garden, 1997; 84:112-127.
16. Cuttelod A, García N, Abdul Malak D, Temple H, Katariya V. The Mediterranean: a biodiversity hotspot under threat. In: J.-C. Vié, C. Hilton-Taylor and S.N. Stuart (eds). The Review of The IUCN Red List of Threatened Species. IUCN Gland, Switzerland. 2008.
17. Dernegi D. Mediterranean Basin Biodiversity Hotspot. Critical Ecosystem Partnership Fund, Arlington (USA). 2010, 251.
18. Bouiamrine EH, Bachiri L, Ibijbijen J, Nassiri L. Fresh medicinal plants in middle atlas of Morocco: Trade and threats to the sustainable harvesting. Journal of Medicinal Plants Studies. 2017; 5(2):123-128.
19. Sofowora A. Medicinal Plants and Traditional Medicines in Africa. Chichester John Wiley & Sons New York. 1993, 97-145.
20. Abera B. Medicinal plants used in traditional medicine by Oromo people, Ghimbi District, Southwest Ethiopia. Journal of Ethnobiology and Ethnomedicine. 2014; 10:40.
21. Bouiamrine EH, Bachiri L, Ibijbijen J, Nassiri L. Identification and ethnobotanical study of commercialized medicinal plants in Central Middle Atlas of Morocco. International Journal of Herbal Medicine. 2017; 5(2):18-22.
22. Bussmann RW, Sharon D. Traditional plant use in Northern Peru, Tracking two thousand years of health culture. Journal of Ethnobiology and Ethnomedicine. 2006; 2:47.
23. Tareen RB, Bibi T, Khan MA, Ahmad M, Zafar M. Indigenous knowledge of folk medicine by the women of kalat and khuzdar regions of balochistan, Pakistan. Pakistan Journal of Botany. 2010; 42(3):1465-1485.
24. Kaid TL, Veale DJH, Havlik I, Rama DBK. Preliminary screening of plants used in South Africa as traditional herbal remedies during pregnancy and labour. Journal of Ethnopharmacology. 1997; 55:185-191.
25. Mahwasane ST, Middleton L, Boaduo N. An ethnobotanical survey of indigenous knowledge on medicinal plants used by the traditional healers of the Lwamondo area, Limpopo province, South Africa. South African Journal of Botany. 2013; 88:69-75.
26. Lahlou FA, Hmimid F, Loutfi M, Bourhim N. Antioxidant activity and quantification of phenolic compounds of *Euphorbia echinus*. International Journal of Pharmacy and Pharmaceutical Sciences. 2014; 6(2):357-360.
27. Mitch LW. Intriguing world of weeds – tansy. Weed Technology. 1992; 6:242-244
28. Chabat A. Utilisation de « daghmous », l'alerte du CAPM. Doctinews N° 61. 2013.
29. Pilegaard K. Ramson confusable with poisonous plants. DTU Food. National Food Institute. E-article from the National Food Institute no. 2, 2012. http://www.food.dtu.dk/english/news/2012/04/ramson_confusable_with_poisonous_plants?id=e0f0a9eb-556f-4b54-86ab-ccb326d2f3a6 (Accessed on 20th January 2017).
30. Zeggwagh AA, Lahlou Y, Bousliman Y. Enquête sur les aspects toxicologiques de la phytothérapie utilisée par un herboriste à Fès, Maroc. Pan Afr. Med. J. 2013; 14:125.
31. Firenzuoli F, Gori L, Crupi A, Neri D. Flavonoids: risks or therapeutic opportunities? Recenti Prog Med. 2004; 95:345-51.
32. Vončina M, Baričevič D, Brvar M. Adverse effects and intoxications related to medicinal/harmful plants. Acta agriculturae Slovenica. 2014; 103(2):263-270.
33. Bussmann RW, Paniagua–Zambrana NY, Huanca ALM. Dangerous confusion - Cola de caballo - orsetail, in the markets of La Paz, Bolivia. Economic Botany. 2015; 69(1):89-93.
34. Benkhnigue O, Zidane L, Fadli M, Elyacoubi H, Rochdi A, Douira A. Ethnobotanical Study of Medicinal Plants in the Region of Mechraâ Bel Ksiri (Gharb Region of Morocco). Acta Bot, Barcelona. 2010; 53:191-216.
35. Lahsissene H, Kahouadji A, Tijane M, Hseini S. Catalogue des plantes medicinales utilisées dans la région de zaër (maroc occidental). Lejeunia, Revue de Botanique [En ligne], N° 186, 2009. http://popups.ulg.ac.be/0457-4184/index.php?id=713&file=1&pid=701 (Accessed on 26th January 2017).
36. Ahmad M, Khan MA, Zafar M. Traditional herbal cosmetics used by local women communities in district Attock of Northern Pakistan. Indian Journal Of Traditional Knowledge. 2008; 7(3):421-424.
37. Shaheen H, Nazi J, Firdous SS, Abd-Ur-Rehman KA. Cosmetic ethnobotany practiced by tribal women of Kashmir Himalayas. Avicenna J Phytomed.2014; 4(4):239-250.
38. Elansary HO, Mahmoud EA, Shokralla S, Yessoufou K. Diversity of Plants, Traditional Knowledge, and Practices in Local Cosmetics: A Case Study from Alexandria, Egypt. Economic Botany. 2015; 69:114-126.
39. Howard P. (ed.). Women and Plants. Gender Relations in Biodiversity Management and Conservation. London & New York: Zed Press and Palgrave-Macmillan. 2003, 1.
40. Mehdioui R, Kahouadji A. Etude ethnobotanique auprès de la population riveraine de la forêt d'Amsittène: cas de la Commune d'Imi n'Tlit (Province d'Essaouira). Bulletin de l'Institut scientifique, Rabat, section Sciences de la vie. 2007; 29:11-20. In french.
41. Reyes-Garcia V. The relevance of traditional knowledge systems for ethnopharmacological research: theoretical and methodological contributions. Journal of Ethnobiology and Ethnomedicine. 2010; 6:32.
42. Lozada M, Ladio AH, Weigandt M. Cultural transmission of ethnobotanical knowledge in a rural community of Northwestern Patagonia, Argentina. Economic Botany. 2006; 60:374-385.