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Floristic analysis of Marmoucha's plant diversity (Middle Atlas, Morocco)

Fatima Nassif & Abbès Tanji (*)

Abstract: Nassif, F. & Tanji, A. *Floristic analysis of Marmoucha's plant diversity (Middle Atlas, Morocco). Lazaroa 34: 117-140 (2013).*

As part of an ethnobotanical exploration among the Berbers of Marmoucha in the Middle Atlas in Morocco, a floristic analysis was conducted to inventory the existing plants and assess the extent of plant diversity in this area. Located in the eastern part of the Middle Atlas, the Marmoucha is characterized by the presence of various ecosystems ranging from oak and juniper forests to high altitude steppes typical from cold areas with thorny plants. The fieldwork was conducted over five years (2008-2012) using surveys and informal techniques. The results show that the number of species recorded in Marmoucha is 508 distributed over 83 families and 325 genera, representing 13%, 54% and 33% of species, families and genera at the national level, respectively. With 92 species, the *Asteraceae* is the richest family, representing 18% of the total reported followed by *Poaceae* and the *Fabaceae*. From a comparative perspective, the ranking of the eight richer families of the local flora in relation to their position in the national flora reveals a significant match between the positions at local and national levels with slight ranking differences except in the case of *Rosaceae*. In the study area, the number of endemics is significant. It amounts to 43 species and subspecies belonging to 14 families with the *Asteraceae* counting 10 endemics. The numbers of Moroccan-Algerian and strictly Moroccan endemics compared to other categories of endemics are rather significant. The study area host to 37 species and subspecies distributed in 16 families that could be considered rare or endangered, being *Asteraceae* the richest with 9. We considered Marmoucha an area with a high diversity with an important contigent of endemic, rare, and endangered species. Available information on these species is scarce. Therefore, it is imperative to pay further attention to them for conservation purposes, in order to elaborate the red list in Morocco.

Keywords: Morocco, Middle Atlas, Marmoucha, species richness, endemism, rare species.

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Como parte de una investigación etnobotánica entre los bereberes de Marmoucha, en el Medio Atlas en Marruecos, se realizó un estudio florístico para poder evaluar la magnitud de la biodiversidad de plantas de dicha área. Situado en la parte oriental del Atlas Medio, Marmoucha se caracteriza por la presencia de diversos ecosistemas que van desde bosques de robles y enebros a estepas típicas de las zonas frías de alta montaña que, además, llevan plantas espinosas. El trabajo de campo se llevó a cabo durante cinco años (2008-2012) mediante encuestas. Los resultados muestran que el número de especies registradas en Marmoucha es 508 distribuidas en 83 familias y 325 géneros, que representan el 13%, 54% y 33% de las especies, familias y géneros a nivel nacional, respectivamente. Con 92 especies, *Asteraceae* es la familia más rica, lo que representa el 18% del total registrado en la flora local Marmoucha. En segundo y tercer lugar, las dos familias más ricas son *Poaceae* y *Fabaceae*, respectivamente. Desde una perspectiva comparativa, el ranking de las ocho familias más ricas de la flora local en relación con su posición en la flora nacional revela una coincidencia significativa entre las posiciones a nivel local y nacional, con ligeras diferencias de clasificación, salvo en el caso de *Rosaceae*. En el área de estudio, el número de especies endémicas es significativo, asciende a 43 especies y subespecies pertenecientes a 14 familias con 10 especies endémicas de *Asteraceae*. Los porcentajes de Marruecos y Argelia, así como las especies endémicas de Marruecos son bastante significativos en comparación con otras categorías. El número de especies y subespecies consideradas raras o en peligro de extinción alcanza las treinta y siete, distribuidas en 16 familias. Al igual que en el cómputo total *Asteraceae* cuenta con el mayor número de especies (9). Consideramos que la región de Marmoucha se caracteriza por una gran diversidad, pero escasamente estudiado, por lo tanto, parece necesario aumentar los esfuerzos de cara a su conservación.

Palabras clave: Marruecos, Atlas Medio, Marmoucha, riqueza florística, endemismo, especies raras.

* National Institute for Agronomic Research. CRRA-Settat, Morocco. E-mail: fatima.nassif@gmail.com

INTRODUCTION

Like many countries of the world, Morocco's mountains are centers of plant-diversity and endemism. Studies confirm that mountains are undoubtedly a reservoir of biodiversity and that the main areas for endemism in Morocco are located in the Rif and Atlas mountains, especially at high altitudes and peaks (Fennane 1987; Benabid & Fennane, 1994; Fennane, 2004; Fougrach & *al*., 2007). Mountains are also considered favorable environments for rare plants.

Located in the mountainous part of the Boulemane province, the Marmoucha region exemplifies the typical physical and bioclimatic characteristics of the structural entity generally referred to as the Folded Middle Atlas. These include altitudes of more than 1500 m and a subhumid Mediterranean climate with very cold winters. The region is also characterized by the presence of quite diverse ecosystems including oak, cedar and juniper forests, alfa steppes and high altitudes pastures where xerophytes predominate.

While working with goat farmers in the Aït Bazza community (Nassif & El Amiri, 2011), it was necessary to study pasture plants. As we were trying to learn about prevailing ecosystems and plants, we become fascinated by the plant diversity in such a limited territorial area. Conducting bibliographical research to increase our understanding of the study area, we were surprised by the lack of information at all levels. In the process, our concerns with issues of mountain biodiversity conservation, documentation, and preservation of local knowledge systems led us to start an ethnobotanical exploration in 2008. Since then, fieldwork was intensified and the territorial basis of Aït Bazza was extended to include the neighboring communities making up the Marmoucha area. Most importantly, one of the objectives was to identify the plants present in the Marmoucha territory and to assess the plant diversity in that area. This paper presents the floristic analysis of plants collected in Marmoucha.

MATERIALS AND METHODS

Several methods and research techniques have been used. They include questionnaire surveys, working with key informants, and transects across the Marmoucha territory. Since 2008, several fieldwork activities of varying duration were conducted in the study area. The last fieldwork took place during May of 2012. The main goal was to generate significant primary data. Most important techniques used with relevance to this paper are:

- A survey of 70 goat farmers at Aït Bazza. Although the survey questionnaire focused on goat production, there were questions on pasture ecosystems and vegetation.

- A series of interviews to men and women, which are from the four rural communities of Marmoucha.

- A series of direct observations on the basis of pre-determined transects across the study area (forests, steppes, mountains, along the oueds, near the springs) to ensure adequate coverage of relatively different ecosystems. Unidentified plants were collected for subsequent identification.

In addition, several personal communications were conducted with researchers and academics from various national and international institutions working on plants.

The botanical nomenclature adopted is based on the most relevant documents on Morocco's flora in order to find and verify plant names and their synonyms and to avoid controversial sources of information. Frequently used references are the five volumes of the synonymic index of North Africa plants (Dobignard & Chatelain, 2010-2013) and the two volumes of the vascular flora of Morocco (Fennane & Ibn Tattou, 2005; Ibn Tattou & Fennane, 2009). Additional references include the two volumes of "Flore Pratique du Maroc" (Fennane & *al*., 1999-2007) and the 16 volumes of the "Flore de l'Afrique du Nord" (Maire, 1952-1987).

RESULTS AND DISCUSSION

Location and main characteristics of the study area

Administratively, the Marmoucha area refers to the territorial entity covering the municipality of Imouzzer Marmoucha and the following four

rural communes: Aït Bazza, Aït Elmane, Almis Marmoucha, and Talzemt. This entity is part of the Cercle of Boulemane, Boulemane province.

Geographically, the study area is located in the structural entity indicated in the literature as the Folded Middle Atlas. Boutayeb stated that this part of the Middle Atlas consists of five rows of plain synclines separated from each other by four anticlinal axes. The whole entity is fashioned in limestone and marno-limestone, mainly jurassic series (BOUTAYEB, 1996).

Located in a highly mountainous area, the Marmoucha territory is not uniform in terms of altitude. In fact, altitude levels vary between 1400 m to over 3000 m. The municipality of Imouzzer Marmoucha, which is the urban center of the region, is located at 1650 m (PEYRE, 1976; RAHOU, 1996). High altitudes cover most of the study area. More precisely, with the exception of Almis Marmoucha where the altitude amounts to 1600 m and the mountainous terrain covers 60% of the commune, mountain topography covers between 75% and 86% for Talzemt and Aït Bazza. The rest of the territory consists of basins and valleys near the oueds.

The study area is entirely subject to a Mediterranean climate. It has different bioclimatic and vegetation stages. The main bioclimates are:

- Mesomediterranean (1400 to 1800 m)
- Supramediterranean (1800 to 2200 m)
- Montanomediterranean (2200 to 2700 m)

Precise climate data on different altitudinal gradients in the area are rare or they do not exist. On average, annual rainfall varies from less than 200 mm in the east to 800 mm in the west (BOUTAYEB, 1996). Based on the meteorological station at Imouzzer Marmoucha, PEYRE (1976) gives an average of 438 mm. To explain the low value of rainfall despite the altitude, Peyre wrote, "Despite its altitude and its apparent position in the wind, the station of Imouzzer Marmoucha is not watered because it is partially protected by Tichoukt (2400-2700 m), which blocks much of what remains of moist air masses that have crossed the mountains dominating Azrou and Ifrane" (PEYRE, 1976). Two decades later, RAHOU (1996) reported for Imouzzer Marmoucha an average annual rainfall of 450.9 mm during the period of 1933-1955. The exact amounts of snow are not known, but it is noted that the mountain peaks receive snow between November and May.

With respect to soils, BERKAT AND TAZI (2006) report that brown soils and rendzinas are dominant in the Middle Atlas with lithosols and regosols on steep slopes. As part of the folded part of the Middle Atlas, the study area is characterized by the predominance of clay and limestone soils (BOUTAYEB, 1996), followed by loam and sandy soils. The study area is also characterized by a great diversity of natural ecosystems including green oak and cedar forests, alfa steppes, and high altitude pasture ecosystems.

DIVERSITY OF MARMOUCHA'S FLORA

First, it must be pointed out that the inventory of plant species established in the Marmoucha area is far from exhaustive, but it is very likely that the species recorded represent the majority of the local flora. The number of spontaneous and cultivated species recorded is of 508 (Appendix 1) representing 13% of Morocco's vascular flora which counts 3913 species according to the latest statistics (FENNANE & IBN TATTOU, 2012). Recorded species belong to 83 families and 325 genera representing 54% and 33% respectively of total national families and genera.

Table 1 and Figure 2 list the families according to the number of species inventoried. Of the 83 families identified, 10 families have more than 10 species and 40 families are represented by a single species. *Asteraceae* is the richest family in the local flora of Marmoucha. With 92 species, this family constitutes 18% of the total reported. In second and third places, the two richest families are respectively the *Poaceae* and *Fabaceae*.

Representation and matching local flora and national flora

As indicated in Figure 1, there are eight families with more than one hundred species in Morocco's flora. With 550 species (Table 2), *Asteraceae* ranks first, followed by *Fabaceae* and *Poaceae* in second and third places with 424 and 355 species, respectively. The *Brassicaceae, Caryophyllaceae* and *Lamiaceae* count 212, 204 and 202 species, respectively. Occupying the 7th and 8th ranks, *Apiaceae* and *Scrophulariaceae* count 153 and 134 species respectively.

Table 1
Observed plant families in Marmoucha

Plant family	N. species	Plant family	N. species
Asteraceae	92	*Verbenaceae*	2
Poaceae	48	*Aceraceae*	1
Fabaceae	45	*Agavaceae*	1
Brassicaceae	32	*Amaryllidaceae*	1
Lamiaceae	28	*Apocynaceae*	1
Apiaceae	23	*Araliaceae*	1
Rosaceae	21	*Arecaceae*	1
Amaranthaceae	15	*Aristolochiaceae*	1
Caryophyllaceae	13	*Asparagaceae*	1
Plantaginaceae	11	*Berberidaceae*	1
Solanaceae	10	*Buxaceae*	1
Boraginaceae	7	*Cactaceae*	1
Cistaceae	7	*Cannabaceae*	1
Polygonaceae	7	*Caprifoliaceae*	1
Rubiaceae	7	*Crassulaceae*	1
Ranunculaceae	6	*Cynomoriaceae*	1
Cucurbitaceae	6	*Dipsacaceae*	1
Papaveraceae	6	*Ephedraceae*	1
Salicaceae	6	*Equisetaceae*	1
Convolvulaceae (incl. *Cuscutaceae*)	5	*Ericaceae*	1
Cupressaceae	5	*Gentianaceae*	1
Malvaceae	5	*Grossulariaceae*	1
Oleaceae	5	*Heliotropaceae*	1
Resedaceae	5	*Iridaceae*	1
Euphorbiaceae	4	*Juglandaceae*	1
Primulaceae	4	*Juncaginaceae*	1
Scrophulariaceae	4	*Liliaceae*	1
Thymelaeaceae	4	*Molluginaceae*	1
Alliaceae	3	*Nitrariaceae*	1
Cyperaceae	3	*Onagraceae*	1
Fagaceae	3	*Orobanchaceae*	1
Geraniaceae	3	*Portulacaceae*	1
Hyacinthaceae	3	*Rhamnaceae*	1
Juncaceae	3	*Rutaceae*	1
Moraceae	3	*Santalaceae*	1
Pinaceae	3	*Smilacaceae*	1
Anacardiaceae	2	*Taxaceae*	1
Asphodelaceae	2	*Typhaceae*	1
Campanulaceae	2	*Urticaceae*	1
Lythraceae	2	*Vitaceae*	1
Tamaricaceae	2	*Zygophyllaceae*	1
Tuberaceae	2		

Endemism in Maroucha's local flora

The most comprehensive work on rare, threatened, and endemic species in Morocco is produced by Fennane and Ibn Tattou in 1998. An update is included in the two volumes of the Vascular Flora of Morocco (Fennane & Ibn Tattou, 2005; Ibn Tattou & Fennane, 2009). According to the latest statistics on the current inventory of the vascular flora of Morocco, Fennane & Ibn Tattou (2012) indicates that the number of strict endemics amounts to 640 species, which is 16.3%

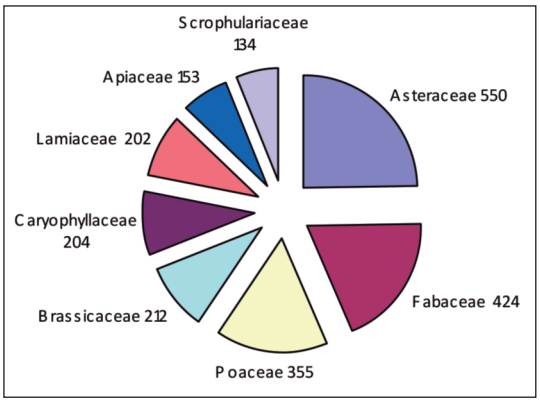

Figure 1. – The eight richest plant families in Morocco's vascular flora.

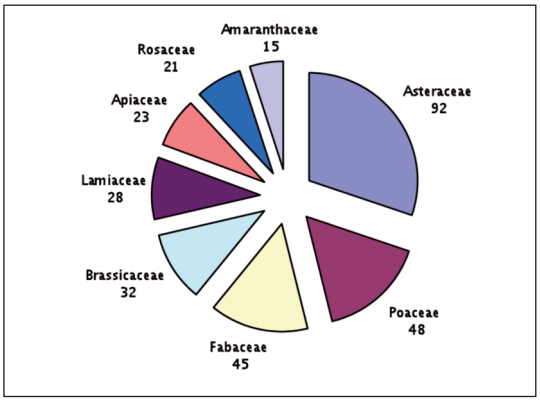

Figure 2. – The eight richest plant families in Marmoucha's local flora.

of the national inventory. The number of subspecies exclusively Moroccan amounts to 280. In addition, Morocco shares an additional 607 endemic species with neighboring areas, with a clear predominance of Iberian-Moroccan endemics (210), Moroccan-Algerian (208), and Ibero-Moroccan-Algerian endemics (130). With a rate of 40%, the *Lamiaceae* occupies the first place for the most endemics. The genus *Teucrium* ranks first (with 50%) for species that are strictly Moroccan, followed by the following four genera *Silene, Centaurea, Ononis*, and *Astragalus* with rates between 22 and 33% (Fennane & Ibn Tattou, 2012).

Table 3 presents the classification of the eight richest families of the local flora in relation to their position in the national flora. It indicates a clear correspondence between the positions of the richest families in the local and Moroccan flora with slight ranking differences except in the case of the *Rosaceae*. In other words, the *Rosaceae* comes in seventh position in the local flora of Marmoucha while it occupies the 13th place in the national flora. This correspondence is not surprising given the diversity of ecosystems in Marmoucha's territory, ranging from forests of cedar or oak to mountain pastures of xerophytes. The *Rosaceae's* visible difference can be explained by the mountainous character of the study area being extremely favorable to the growth of *Rosaceae* in both spontaneous and cultivated forms.

Table 2
Number of species in the Marmoucha flora compared with the distribution of the eight first plant families of the vascular flora of Morocco (families with more than one hundred species)

Plant family	Number of spontaneous species in Morocco's vascular flora (N)	Number of spontaneous and cultivated species inventoried in Marmoucha's flora (n)	n/N*100
Asteraceae	550	92	16.7
Fabaceae	424	45	10.6
Poaceae	355	48	13.5
Brassicaceae	212	32	15.1
Caryophyllaceae	204	13	6.4
Lamiaceae	202	28	13.9
Apiaceae	153	23	15.0
Scrophulariaceae	134	4	3.0
Sub-total	2234	285	12.8
Other families	1679	224	13.3
Total	3913	509	13.0

Table 3
Ranking of the first eight richest plant families in the flora of Marmoucha compared with their rank in the national flora. For every family the number of species in the Marmoucha area (N. Marmoucha), the rank in the local flora (Local Rank) and the Rank in the National flora (Nat. Rank; number of species, n.) is detailed.

Plant family	N. Marmoucha	Local Rank	Nat. Rank (n.)
Asteraceae	92	1	1 (550)
Poaceae	48	2	3 (355)
Fabaceae	45	3	2 (424)
Brassicaceae	32	4	4 (212)
Lamiaceae	28	5	6 (202)
Apiaceae	23	6	7 (173)
Rosaceae	21	7	13 (62)
Amaranthaceae (incl. *Chenopodiaceae)*	15	8	8 (79)

In Marmoucha, the local flora is characterized by the presence of numerous strictly Moroccan, Moroccan-Algerian, or Moroccan-Iberian endemics. Table 4 provides an indicative list of these species using the following categories: E: endemic strictly of Morocco, I: endemic of Morocco and the Iberian Peninsula, A: endemic of Morocco and Algeria, IA: Ibero-Moroccan-Algerian (Fennane & Ibn Tattou, 2012) and AT: endemic of Morocco, Algeria and Tunisia.

Based on Table 4, two important remarks seem necessary. First, the number of endemics in the study area is significant. It amounts to 43 species and subspecies belonging to 14 families. The *Asteraceae* count 10 endemics. Second, the numbers of Moroccan-Algerian and strictly Moroccan endemics compared to other categories of endemics are rather significant. In Morocco, endemics, especially those strictly Moroccan, are still plagued with serious shortcomings. In general, they are the least-studied and least-known species of the national flora. Based on our modest experience with bibliographic searches both in the literature and in the databases available in the Internet, it was noted that when the species was a strictly Moroccan endemic, information, photos and references become scarce. Available information is preserved in specialized institutes and centers where the species specimen is kept.

The importance and need for botanical and ethnobotanical research on strictly Moroccan endemics in particular are justified in more than one respect (Hseini & Kahouadji, 2007; Hseini & *al*., 2007; Salhi & *al*., 2010). Endemics shared with neighboring countries are relatively well studied compared to exclusively Moroccan endemics. Until now, information on the latter is rare. It is paradoxical that there is a lack of information on native plants, while these plants need to be better understood to be protected, valued, and preserved, at least theoretically. Moroccan endemics deserve more attention and special efforts to know and to preserve them and, by the same token contribute to the universal knowledge of plants and biodiversity conservation.

Rare and endangered plants in Marmoucha

In Morocco, the floristic diversity both nationally and locally is exposed to the pressures and threats caused primarily by direct and indirect human activities. Berraho & *al*. (2006) report that the impact of various human activities goes against biodiversity preservation and sustainable management of natural resources. According to these authors, "in extreme cases the negative impact of these activities led to the irreparable loss of animal and plant species and irreversible damage to some ecosystems" (Berraho & *al*., 2006).

As noted earlier, the first catalog for rare, threatened, or endemic plants in Morocco's vascular flora is that published by Fennane and Ibn Tattou in 1998. This catalog inventories 126 families, 2185 species and 634 subspecies. Two volumes on the vascular flora of Morocco (Fennane & Ibn Tattou, 2005; Ibn Tattou & Fennane, 2009) update the 1998 catalog and include

Table 4
Marmoucha endemic plants reported in the literature.
(Endemism type: E, Morocco strictly endemic; A, Morocco-Algeria endemic;
AT, Morocco-Algeria-Tunisia endemic).

Family / species	Endemism type	Reference
Apiaceae		
Bupleurum atlanticum Murb.	E	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Dobignard & Chatelain, 2011
Eryngium triquetrum Vahl subsp. *xauense* (Pau) Jovet & Sauvage	E	Fennane & Ibn Tattou, 1998; Dobignard & Chatelain, 2011
Asteraceae		
Achillea leptophylla M. Bieb.	A	Bellakhdar, 1997; Dobignard & Chatelain, 2011
Anacyclus pyrethrum (L.) Link.	A	Bellakhdar, 1997; Dobignard & Chatelain, 2011
Carduus ballii Hook. f. (incl. *Carduus nutans* L. subsp. *subacaulis* J. Arènes)	E	Fennane & Ibn Tattou, 1998; Ibn Tattou & Fennane, 2009; Dobignard & Chatelain, 2011
Carthamus pomelianus (Batt.) Prain	A	Fennane & Ibn Tattou, 1998; Dobignard & Chatelain, 2011
Centaurea boissieri DC.	E	Fennane & Ibn Tattou, 1998; Ibn Tattou & Fennane, 2009; Taleb & Fennane, 2009; Dobignard & Chatelain, 2011
Centaurea diluta Aiton subsp. *algeriensis* (Coss.& Durieu) Maire	A	Fennane & Ibn Tattou, 1998; Dobignard & Chatelain, 2011
Centaurea nana Desf.	A	Fennane & Ibn Tattou, 1998; Dobignard & Chatelain, 2011
Cynara baetica (Spreng.) Pau subsp. *maroccana* Wiklund	E	Fennane & Ibn Tattou, 1998; Ibn Tattou & Fennane, 2009; Dobignard & Chatelain, 2011
Hypochaeris radicata L. subsp. *platylepis* (Boiss.) Jahand. & Maire	AT	Fennane & Ibn Tattou, 1998; Dobignard & Chatelain, 2011
Leontodon saxatilis Lam. subsp. *mesorhyncus* (Maire) Maire	E	Fennane & Ibn Tattou, 1998; Ibn Tattou & Fennane, 2009; Dobignard & Chatelain, 2011
Ptilostemon dyricola (Maire) Greuter	E	Fennane & Ibn Tattou, 1998; Ibn Tattou & Fennane, 2009; Dobignard & Chatelain, 2011
Berberidaceae		
Berberis hispanica Boiss. & Reuter	A	Bellakhdar, 1997; Fennane & al., 1999; Dobignard & Chatelain, 2011
Boraginaceae		
Echium flavum Desf.	A	Fennane & al., 2007; Dobignard & Chatelain, 2011
Brassicaceae		
Erysimum grandiflorum Desf.	AT	Fennane & al., 1999; Dobignard & Chatelain, 2011
Erysimum incanum G. Kunze	AT	Fennane & al., 1999; Dobignard & Chatelain, 2011
Rorippa africana (Br.-Bl.) Maire = *Nasturtium africanum* Br.-Bl.	E	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Dobignard & Chatelain, 2011
Vella pseudocytisus L.	A	Fennane & Ibn Tattou, 1998; Fennane & al., 1999; Dobignard & Chatelain, 2011
Caryophyllaceae		
Arenaria armerina Bory	E	Fennane & al., 1999; Dobignard & Chatelain, 2011
Bufonia mauritanica Murb.	A	Fennane & al., 1999; Dobignard & Chatelain, 2011
Cerastium gibraltaricum Boiss.	A	Fennane & al., 1999; Dobignard & Chatelain, 2011
Herniaria pujosii Sauvage & Vindt	A	Fennane & Ibn Tattou, 1998; Fennane & al., 1999; Dobignard & Chatelain, 2011

Family / species	Endemism type	Reference
Fabaceae		
Astragalus bourgeanus Coss.	A	Fennane & al., 2007; Valdes & al., 2002; Dobignard & Chatelain, 2012
Astragalus granatensis Lam.	E	Fennane & al., 2007; Valdes & al., 2002; Dobignard & Chatelain, 2012
Genista quadriflora Munby	A	Fennane & al., 2007; Valdes & al., 2002; Dobignard & Chatelain, 2012
Hippocrepis neglecta Lassen	E	Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Dobignard & Chatelain, 2012
Lotus arenarius Brot.	E	Fennane & al., 2007; Dobignard & Chatelain, 2012
Ononis pseudoserotina Batt. & Pit.	E	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Valdes & al., 2002
Ononis thomsonii Oliv.	E	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Valdes & al., 2002; Dobignard & Chatelain, 2012
Lamiaceae		
Nepeta nepetella L. = *Nepeta amethystina* Poiret	A	Fennane & Ibn Tattou, 1998; Fennane & al., 2007; Dobignard & Chatelain, 2012
Origanum elongatum (Bonnet) Emberger & Maire	E	Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Valdes & al., 2002; Dobignard & Chatelain, 2012
Teucrium chamaedrys L. subsp. *gracile* (Batt.) Rech. F.	A	Fennane & Ibn Tattou, 1998; Dobignard & Chatelain, 2012
Thymus munbyanus Boiss. & Reuter	A	Fennane & al., 2007; Valdes & al., 2002; Dobignard & Chatelain, 2012
Thymus zygis L.	A	Fennane & al., 2007; Dobignard & Chatelain, 2012
Oleaceae		
Fraxinus dimorpha Coss. & Durieu	A	Fennane & al., 2007 ; Dobignard & Chatelain, 2013
Pinaceae		
Cedrus Atlantica (Endl.) Carrière	A	Fennane & al., 1999; Valdes & al., 2002; Fennane & Ibn Tattou, 2005; Dobignard & Chatelain, 2013
Plantaginaceae		
Globularia nainii Batt.	E	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Dobignard & Chatelain, 2013
Plantago mauritanica Boiss. & Reut.	A	Valdes & al., 2002; Fennane & al., 2007; Taleb & Fennane, 2008 ; Dobignard & Chatelain, 2013
Plantago rhizoxylon Emb.	E	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Dobignard & Chatelain, 2013
Veronica rosea Desf.	A	Fennane & Ibn Tattou, 1998; Valdes & al., 2002; Fennane & Ibn Tattou, 2005; Dobignard & Chatelain, 2013
Salicaceae		
Salix atrocinerea Brot.	AT	Valdes & al., 2002; Fougrach & al., 2007; Dobignard & Chatelain, 2013
Scrophulariaceae		
Scrophularia macrorrhyncha (Humbert, Litard. & Maire) Ibn Tattou	E	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Dobignard & Chatelain, 2013
Thymelaeaceae		
Thymelaea virgata (Desf.) Endl.	A	Valdes & al., 2002; Fennane & Ibn Tattou, 2005; Fennane & al., 2007; Dobignard & Chatelain, 2013

new rare or threatened taxa. Until today, these two volumes prove to be the most comprehensive sources and most updated information on rare and endangered plants in Morocco. Thus, these references are widely used to identify reported rare and endangered plants that are inventoried in the Marmoucha local flora (Table 5). Degrees of rarity and vulnerability are those used in the catalogs Fennane & Ibn Tattou (1998), Ibn Fennane & Tattou (2005) and Ibn Tattou & Fennane (2009). The six categories are:

- RR: very rare, number of known localities ≤ 5.
- RR?: suspected very rare.
- R: rare
- R?: suspected rare
- V: vulnerable (or appears to be), could become rare in the short term.

Inventoried plants in Marmoucha considered rare or threatened comprise 37 species and subspecies belonging to 16 families. With 9 species, the Asteraceae is the family containing the most rare and endangered species, followed distantly by the remaining families.

Cconservation and protection of local plant diversity

Beyond the immediate uses and services that the Marmoucha people derive from their floristic resources, the most important value of this heritage lies in plant genetic resources and its contribution to national plant diversity. For these reasons, the preservation and conservation of these resources are of outmost importance.

In other words, in the case of *Aegilops* for example, its highest value is not in its use as feed but in its potential use as a breeding parent and the possibility of extracting disease resistance genes or other interesting traits. In fact, many wild species are used in breeding programs. Scientists, particularly breeders and genetic resource specialists, are unanimous on the importance of wild species for plant improvement activities and the development of new varieties of cereals, fodder or food legumes. If we take the example of cereals, *Aegilops*, which is abundant in these mountains, is actually used in crosses of hard and soft wheat to improve their resistance to disease.

Since the United Nations Conference on Environment and Development (Earth Summit) in 1992 and the Conference of Parties to the present, the issue of biodiversity conservation has taken a new dimension. Morocco ratified the Convention in August 1995 and therefore is called to comply with the CBD and COP decisions. For example, Morocco is called to undertake activities towards the achievement of the 16 targets of the updated Global Strategy for Plant Conservation (GSPC) 2011-2020.

In his article on floristic research in Morocco, Fennane (2008) explicitly described the situation in Morocco in relation to the initial GSPC 2002-2010. As pointed out by the author, the strategy aimed at the achievement of 16 targets by 2010. For Morocco the task is non-achievable under prevailing conditions. The author looks at five targets as examples to support his assertion. Selected targets are the following:

- Target 1: A widely-accessible working list of known plants, as a step towards a complete world flora.

- Target 2: A preliminary assessment of the conservation status of all known plant species at national, regional and international levels.

- Target 5: Protection of 50% of the most important areas for plant diversity assured.

- Target 7: 60% of the world's threatened species conserved in situ.

- Target 15: The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy.

In Fennane's words, targets 1 and 15 can be achieved if there is the will, but the other three targets had no chance to be achieved by 2010 (Fennane, 2008). According to this author, "In fact, before conservation and protection, one must know targeted species or environments. But so far, our knowledge in these areas is imprecise, fragmentary, and non-updated" (Fennane, 2008). It must be pointed out that the updated GSPC 2011-2020 is more demanding and presents even greater challenges for Morocco.

Until today, Morocco's flora still experiences serious flaws. In their recent article on the latest statistics concerning Morocco' vascular flora,

Table 5
Rare and endangered species in Marmoucha based on the literature
(For every species the following information is added: Conservation status: RR, very rare, number of known localities ≤ 5; RR?, suspected very rare; R, rare; R?, suspected rare; V, vulnerable, or appears to)

Family / species	Cons. Status	LITERATURE
Amaranthaceae		
Atriplex rosea L.	RR	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Apiaceae		
Bupleurum atlanticum Murb. Subsp. *atlanticum* Murb.	R	Fennane & Ibn Tattou, 1998
Daucus carota L. subsp. *carota* L.	RR	Fennane & Ibn Tattou, 1998
Eryngium triquetrum Vahl subsp. *xauence* (Pau) Jovet & Sauvage	R	Fennane & Ibn Tattou, 1998; Fougrach et al., 2007
Asteraceae		
Carduus ballii Hook. f.	RR	Fennane & Ibn Tattou, 1998
Carthamus pomelianus (Batt.) Prain	R?	Fennane & Ibn Tattou, 1998
Centaurea boissieri DC. subsp. *boissieri* DC.	R	Fennane & Ibn Tattou, 1998; Ibn Tattou & Fennane, 2009
Centaurea diluta Aiton subsp. *algeriensis* (Cosson & Durieu) Maire	RR	Fennane & Ibn Tattou, 1998
Centaurea nana Desf.	R?	Fennane & Ibn Tattou, 1998; Ibn Tattou & Fennane, 2009
Hypochaeris radicata L. subsp. *platylepis* (Boiss.) Jahand. & Maire	RR	Fennane & Ibn Tattou, 1998
Launaea fragilis (Asso) Pau	R?	Fennane & Ibn Tattou, 1998
Leontodon saxatilis Lam. subsp. *mesorhynchus* (Maire) Maire	R	Fennane & Ibn Tattou, 1998
Tragopogon porrifolius L. subsp. *macrocephalus* (Pomel) Batt.	RR	Fennane & Ibn Tattou, 1998
Brassicaceae		
Rorippa Africana (Braun-Blanq.) Maire	R	Fennane & Ibn Tattou, 1998
Vella mairei Humbert	R	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Caryophyllaceae		
Dianthus sylvestris Wulfen subsp. *longibracteatus* (Maire) Greuter & Burdet	R	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Herniaria pujosii Sauvage & Vindt	R?	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Vaccaria hispanica (Mill.) Rauschert subsp. *hispanica*	R?	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Cupressaceae		
Juniperus thurifera L.	V	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Fabaceae		
Astragalus caprinus L.	R	Fennane & Ibn Tattou, 1998
Ononis pseudoserotina Batt. & Pit.	R	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Ononis thomsonii Oliv.	R	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Geraniaceae		
Erodium malacoides (L.) L'Hér. subsp. *brevirostre* (Maire & Sam.) Guitt.	R	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005

Family / species	Cons. Status	LITERATURE
Lamiaceae		
Nepeta nepetella L. subsp. *amethystina* Poiret	RR	Fennane & Ibn Tattou, 1998
Origanum elongatum (Bonnet) Emb. & Maire	V	Fennane & Ibn Tattou, 1998; Fougrach et al., 2007
Teucrium chamaedrys L. subsp. *gracile* Batt. Rech. f.	RR	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Liliaceae		
Tulipa sylvestris L.	RR	Fougrach et al., 2007
Plantaginaceae		
Plantago major L. subsp. *intermedia* (Gigib.) Lange	RR	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Plantago rhizoxylon Emb.	RR	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Veronica rosea Desf. subsp. *virgata* (Emb. & Maire) Dobignard & D. Jordan	RR	Fennane & Ibn Tattou, 1998
Poaceae		
Hordeum murinum L.	RR	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fougrach et al., 2007
Koeleria splendens Presl.	R	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005; Fougrach et al., 2007
Scrophulariaceae		
Scrophularia macrorrhyncha (Humbert, Litard. & Maire) Ibn Tattou	RR	Fennane & Ibn Tattou, 1998
Solanaceae		
Atropa belladonna L.	RR	Fennane & Ibn Tattou, 1998
Lycium europaeum L.	R ?	Fennane & Ibn Tattou, 1998; Fennane & Ibn Tattou, 2005
Taxaceae		
Taxus baccata L.	V	Fennane & Ibn Tattou, 1998; Fougrach et al., 2007
Zygophyllaceae		
Balanites aegyptiaca (L.) Delile	V	Fennane & Ibn Tattou 1998

Fennane & Ibn Tattou (2012) shed explicit doubts on the presence of 157 species and 28 subspecies in Morocco. Besides, according to these authors, there are numerous plant species of which distribution areas are poorly known or ill-known. To bring about solutions to all these problems, it is necessary to conduct field work. The problems are more acute in the case of rare and threatened plants. Most importantly, the authors point out that unfortunately, Morocco does not yet have an 'official' red list that meets the criteria of the International Union for Conservation of Nature (IUCN). The establishment of this list remains a priority for the country. Its consensual nature requires a real voluntary contribution of all actors, including managers and scientists (Fennane & Ibn Tattou, 2012).

The Marmoucha area is an example of the many local mountainous areas where plant diversity is substantial, where endemics are important and where rare and threatened species need further work. It is thus urgent to pay greater attention to the changing dynamics of local and regional flora in Morocco. Some regions are more exposed to exploitation and pressure than others. Scientists and concerned actors in diversity conservation are unanimous regarding the need and the urgency to know, protect, and preserve the national floristic heritage and its local and regional variants.

CONCLUSION

Throughout this article, it is clear that Marmoucha's geographical, ecological, and cultural specificities are accompanied by high plant diversity. Until today, the Marmoucha people, whose main economic activity is small ruminant production, continue to draw their livelihoods from available plant resources. Because of natural as well as human factors, the fragility and vulnerability of this mountainous environment are increasing and the plant resources are at risk of degradation and erosion. Under such conditions, the people's vulnerability is also increasing. Sustainability necessitates a balance between production of goods and services, their use by the people and the preservation of the resource base unique to this environment.

To a certain extent, Marmoucha can be considered representative of other fragile, underdeveloped mountain communities with high poverty and vulnerability rates. In these situations, it would be neither wise nor fair to these areas and their people to establish large protected areas or select species for reforestation on exclusively ecological criteria without any consideration of the people's needs. The challenge is not in the choice of technical solutions and their implementation but in their reconciliation with the socio-economic conditions of these communities and the sustainable use and management of available resources.

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APPENDIX 1

List of spontaneous and cultivated plants recorded in Marmoucha (Middle Atlas, Morocco)

For every species the following information is added: Record number (N.): if the species is cultivated (*), or if the local name has not been collected (#)

N.	Species	Local name (s)
	Aceraceae	
1	*Acer monspessulanum* L.	qiqeb
	Agavaceae	
2	*Agave americana* L.	sabra
	Alliaceae	
3*	*Allium cepa* L.	bsal
4*	*Allium sativum* L.	tichert
5	*Allium* sp.	tichert lekhla
	Amaranthaceae (incl. *Chenopodiaceae*)	
6	*Amaranthus albus* L.	blitou
7	*Amaranthus blitoides* S. Watson	blitou
8	*Amaranthus retroflexus* L.	blitou
9*	*Atriplex nummularia* Lindl.	armaz
10	*Atriplex patula* L.	tibidas
11	*Atriplex rosea* L.	#
12	*Beta macrocarpa* Guss.	tibidas
13*	*Beta vulgaris* L.	barba
14	*Blitum exsuccum* C. Loscos (incl. *Chenopodium foliosum* var. *minus* (Vahl) Asch.)	blitou
15	*Chenopodium album* L.	blitou
16	*Chenopodium ambrosioides* L.	mkhinza
17	*Chenopodium murale* L.	blitou
18	*Chenopodium opulifolium* Schrad.	blitou
19	*Chenopodium vulvaria* L.	blitou
20	*Polycnemum fontanesii* Durieu & Moq.	zour lhasran
	Amaryllidaceae	
21	*Narcissus* sp.	abehlellou
	Anacardiaceae	
22	*Pistacia lentiscus* L.	tidecht, fadis
23	*Pistacia terebinthus* L.	adil n-ouchen
	Apiaceae	
24	*Ammi majus* L.	tawsna

N.	Species	Local name (s)
25*	*Apium graveolens* L.	krafes
26	*Bifora testiculata* (L.) Spreng.	qozber aghioul
27	*Bunium fontanesii* (Pers.) Maire (incl. *B. bulbocastanum* auct. Afr. N.)	aytar, achtar
28	*Bupleurum atlanticum* Murb.	tizleft
29	*Bupleurum spinosum* Gouan	ayrbaz, aguerbaz
30*	*Coriandrum sativum* L.	qozber
31	*Daucus carota* L.	khizzou
32*	*Daucus carota* var. *sativa*	khizzou
33	*Eryngium campestre* L.	aqerchal
34	*Eryngium triquetrum* Vahl	tlatert n-ouchen
35	*Ferula communis* L.	ouffal
36	*Foeniculum vulgare* Mill.	irden wamsa
37	*Helosciadium nodiflorum* (L.) W. D. J. Koch	tithjamine
38	*Hohenackeria exscapa* (Steven) Koso-Pol.	#
39	*Orlaya platycarpos* W. D. J. Koch	fetchras
40*	*Pastinaca sativa* L.	tiâabouzine
41*	*Petroselinum crispum* (Mill.) Fuss	maâdnous
42	*Ridolfia segetum* (Guss.) Moris	#
43	*Scandix pecten-veneris* L.	temchat
44	*Torilis nodosa* (L.) Gaertn.	khizzou n-qnine
45	*Turgenia latifolia* (L.) Hoffm.	fetchras
46	*Visnaga daucoides* Gaertn. (incl. *Ammi visnaga* (L.) Lam.)	bechnikha
	Apocynaceae	
47	*Nerium oleander* L.	alili
	Araliaceae	
48	*Hedera helix* L.	anesfal, tanesfalt
	Arecaceae (Palmae)	
49	*Chamaerops humilis* L.	tizdemt, tizden
	Aristolochiaceae	
50	*Aristolochia paucinervis* Pomel	berrezdem
	Asparagaceae	
51	*Asparagus acutifolius* L.	mezzr-izm
	Asphodelaceae	
52	*Asphodelus acaulis* Desf.	aberway
53	*Asphodelus ramosus* L. (incl. *A. microcarpus* Viv.)	aberway
	Asteraceae	
54	*Achillea leptophylla* M. Bieb.	chih lekhrissi
55	*Anacyclus homogamos* (Maire) Humphries	ghadou mlal
56	*Anacyclus pyrethrum* (L.) Link	tindazt, tawanzawiyis
57	*Arctium atlanticum* (Pomel) H. Lindb.	mezzr-izm
58*	*Artemisia arborescens* (Vaill.) L.	chiba
59	*Artemisia campestris* L.	izri
60	*Artemisia herba-alba* Asso	izri
61	*Atractylis caespitosa* Desf.	achennoud
62	*Atractylis cancellata* L.	tiçennanine insi
63	*Bellis annua* L.	#
64	*Bombycilaena discolor* (Pers.) M. Laínz	#
65	*Calendula arvensis* (Vaill.) L.	#
66	*Carduus ballii* Hook. f. (incl. C. *nutans* L. subsp. *subacaulis* J. Arènes)	assennan
67	*Carduus chevallieri* Barratte	sart aghioul

N.	Species	Local name (s)
68	*Carduus pycnocephalus* L.	ouchen-taddela
69	*Carlina brachylepis* (Batt.) Meusel & Kastner (incl. C. *involucrate* auct. Afr. N.)	ghijghij
70	*Carlina hispanica* Lam.	ghijghij
71	*Carlina macrophylla* (Desf.) DC.	
72	*Carthamus caeruleus* L.	assennan
73	*Carthamus lanatus* L.	assennan
74	*Carthamus pinnatus* Desf.	tit tfounast
75	*Carthamus pomelianus* (Batt.) Prain	ikhef n-skour
76	*Carthamus rhaponticoides* (Pomel) Greuter	tit tfounast
77	*Catananche caerulea* L.	aâban ifigher
78	*Centaurea boissieri* DC.	assennan
79	*Centaurea calcitrapa* L.	chouch mghil, assennan amellal
80	*Centaurea diluta* Aiton (incl. C. elongata Schousb.)	assennan
81	*Centaurea eriophora* L.	#
82	*Centaurea melitensis* L.	assennan
83	*Centaurea nana* Desf.	#
84	*Centaurea pullata* L.	assennan
85	*Centaurea sphaerocephala* L.	assennan
86	*Centaurea sulphurea* Willd.	assennan
87	*Chondrilla juncea* L.	tighmas n-oulli
88	*Cichorium pumilum* Jacq.	tizodia
89	*Cirsium echinatum* (Desf.) DC.	assennan
90	*Cirsium vulgare* (Savi) Ten. (incl. C. lanceolatum (L.) Scop.)	assennan
91	*Cynara baetica* (Spreng.) Pau subsp. *maroccana* Wiklund	tifghit
92*	*Cynara scolymus* L.	kherchef
93	*Dittrichia graveolens* (L.) Greuter	tirrehla
94	*Dittrichia viscosa* (L.) Greuter	tirrehla
95	*Echinops spinosissimus* Turra (incl. *E. spinosus* L.)	taskra
96	*Erigeron bonariensis* L.	tirrehla
97	*Evacidium discolor* (DC.) Maire	#
98	*Filago pygmaea* L.	techroun
99	*Filago pyramidata* L	asselghagh izman, âalk
100	*Galactites tomentosus* Moench	#
101	*Glebionis coronaria* (L.) Spach	ghadou mlal
102	*Hedypnois rhagadioloides* (L.) F.W. Schmidt (incl. *H. cretica* (L.) Dum. Cours.)	aicha
103*	*Helianthus annuus* L.	tebbaâ chems, baïaâ chems
104*	*Helianthus tuberosus* L.	btata qasbia
105	*Helminthotheca echioides* (L.) Holub	#
106	*Hypochaeris radicata* L. (incl. *H. atlantica* Sennen & Mauricio)	#
107	*Jacobaea gigantea* (Desf.) Pelser	touya n-oughi
108	*Jurinea humilis* (Desf.) DC.	#
109	*Lactuca saligna* L.	tifaf
110*	*Lactuca sativa* L.	khos
111	Lactuca serriola L. incl. *L. scariola* L.	tifaf n-sem
112	*Lactuca tenerrima* Pourr.	tifaf
113	*Launaea fragilis* (Asso) Pau (incl. *L. resedifolia* auct. Afr. N.)	tighmas n-oulli

N.	Species	Local name (s)
114	*Launaea lanifera* Pau (incl. *L. spinosa* subsp. *acanthoclada* Maire)	tighmas n-oulli, tifsit
115	*Launaea nudicaulis* (L.) Hook. f.	tighmas n-oulli
116	*Leontodon saxatilis* Lam. (incl. *L. taraxacoides* auct. Afr. N.)	tizodia
117	*Limbarda crithmoides* (L.) Dumort.	tirrehla
118	*Mantisalca salmantica* (L.) Briq. & Cavill.	tazemourt
119	*Micropus supinus* L.	#
120	*Onopordum acaulon* L.	ifris
121	*Onopordum macracanthum* Schousb.	ifris
122	*Picnomon acarna* (L.) Cass.	assennan amellal
123	*Picris hispanica* (Willd.) P.D. Sell	tachefaït
124	*Podospermum laciniatum* (L.) DC.	talma
125	*Ptilostemon dyricola* (Maire) Greuter	#
126	*Pulicaria arabica* (L.) Cass.	#
127	*Rhagadiolus stellatus* (L.) Gaertn.	becher n-yazad
128	*Rhaponticum acaule* (L.) DC.	tifeghouine
129	*Santolina africana* Jord. & Fourr.	tayrart
130	*Scolymus hispanicus* L.	taghediwt
131	*Scolymys maculatus* L.	taghediwt
132	*Scorzonera caespitosa* Pomel (incl. *S. pseudopygmaea* Lipsch., incl. *S. pygmaea* auct. Afr. N.)	tighmas n-oulli
133	*Scorzonera hispanica* L.	talma
134	*Senecio vulgaris* L.	touya n-oughi
135	*Silybum marianum* (L.) Gaertn.	abeâou ntifyout
136	*Sonchus asper* (L.) Hill	tifaf
137	*Sonchus oleraceus* L.	tifaf
138	*Symphyotrichum squamatum* (Spreng.) G.L. Nesom	#
139	*Taraxacum obovatum* (Willd.) DC.	iwjdam
140	*Taraxacum* sp.	tachiria
141	*Tragopogon porrifolius* L.	alamen, aliam ouyiis
142	*Urospermum picroides* (L.) Scop. ex F.W. Schmidt	babghoro
143	*Xanthium spinosum* L.	assennan
144	*Xanthium strumarium* L. (incl. *X. brasilicum* Vell.)	mzzer izm
145	*Xeranthemum inapertum* (L.) Mill.	#
	Berberidaceae	
146	*Berberis hispanica* Boiss. & Reuter	irghis
	Boraginaceae	
147	*Anchusa italica* Retz.	illes oufounas
148	*Borago officinalis* L.	illes oufounas
149	*Echium flavum* Desf.	#
150	*Echium humile* Desf. subsp. *pycnanthum* (Pomel) Greuter & Burdet	#
151	*Echium plantagineum* L.	illes oufounas
152	*Lappula barbata* (M. Bieb.) Gürke	lhenni imisawn
153	*Neatostema apulum* (L.) I. M. Johnst.	#
	Brassicaceae	
154	*Alyssum alyssoides* (L.) L.	#
155	*Alyssum atlanticum* Desf.	#
156	*Alyssum serpyllifolium* Desf.	#
157*	*Brassica oleracea* L.	azegzaw
158*	*Brassica oleracea* L. var *botrytis*	chiflor

N.	Species	Local name (s)
159*	Brassica oleracea L. var *capitata*	kronb
160*	*Brassica rapa* L.	deft, left
161	*Capparis spinosa* L.	taylolout
162	*Capsella bursa-pastoris* (L.) Medik.	lâihiyane
163	*Descurainia sophia* (L.) Webb ex. Prantl	oud doukhan
164	*Eruca vesicaria* (L.) Cav. subsp. *sativa* (Mill.) Thell.	harfi
165	*Erysimum grandiflorum* Desf.	#
166	*Erysimum incanum* Kunze	#
167	*Erysimum* sp.	#
168	*Hirschfeldia incana* (L.) Lagr.-Foss.	#
169	*Hormatophylla spinosa* (L.) Kupfer	ifssi
170	*Hornungia petraea* (L.) Rchb.	#
171	*Isatis tinctoria* L.	lachren
172	*Lepidium draba* L.	#
173	*Lobularia maritima* (L.) Desv.	âdes oujdad
174	*Matthiola fruticulosa* (Lœfl. ex L.) Maire	tachgarga
175	*Moricandia arvensis* (L.) DC.	#
176	*Neslia apiculata* Fisch., C. A. Mey. & Avé- Lall.	#
177*	*Raphanus sativus* L.	fjel
178	*Rhaphanus raphanistrum* L.	bouhamou labiad
179	*Rorippa africana* (Br.-Bl.) Maire	bouâffar
180	*Rorippa nasturtium-aquaticum* (L.) Hayek (incl. *Nasturtium officinale* R. Br.)	aguernouj
181	*Sinapis alba* L.	bouhamou
182	*Sinapis arvensis* L.	bouhamou
183	*Sisymbrium irio* L.	bouhamou
184	*Sisymbrium runcinatum* Lag. ex. DC.	harfi aouragh, lâihiyane
185	*Vella pseudocytisus* L.	aznou, qazdir
	Buxaceae	
186	*Buxus balearica* Lam.	baqs
	Cactaceae	
187*	*Opuntia maxima* Mill.	tazart roumian, hendia
	Campanulaceae	
188	*Campanula filicaulis* Durieu	#
189	*Trachelium caeruleum* L.	#
	Cannabaceae	
190	*Celtis australis* L.	teghzaz
	Caprifoliaceae	
191	*Lonicera pyrenaica* L.	#
	Caryophyllaceae	
192	*Arenaria armerina* Bory	#
193	*Bufonia mauritanica* Murb.	#
194	*Cerastium brachypetalum* Desportes ex. Pers.	#
195	*Cerastium gibraltaricum* Boiss.	#
196	*Dianthus sylvestris* Wulfen	#
197	*Gymnocarpos sclerocephalus* (Decne.) Ahlgren & Thulin	#
198	*Herniaria cinerea* DC.	herres lehjer
199	*Herniaria glabra* L.	herres lehjer
200	*Herniaria pujosii* Sauvage & Vindt	#
201	*Minuartia hamata* (Hausskn. & Bornm.) Mattf. incl. *Queria hispanica* L.)	#
202	*Paronychia argentea* Lam.	tasettaït
203	*Silene vulgaris* (Moench) Garcke	tighighit
204	*Vaccaria hispanica* (Mill.) Rauschert (incl. *V. pyramidata* Medik.)	wawghiyi

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	Cistaceae	
205	*Cistus creticus* L.	innaqrouch
206	*Cistus laurifolius* L.	ouchtobou
207	*Cistus salviifolius* L.	innaqrouch
208	*Helianthemum cinereum* (Cav.) Pers.	ighes n-terfas
209	*Helianthemum croceum* (Desf.) Pers.	ighes n-terfas
210	*Helianthemum pergamaceum* Pomel	aïchout
211	*Tuberaria lignosa* (Sweet) Samp. (incl. *Helianthemum tuberaria* (L.) Mill.)	ighes n-terfas
	Convolvulaceae (incl. *Cuscutaceae*)	
212	*Convolvulus arvensis* L.	asser-remram
213	*Convolvulus lineatus* L.	louwaya
214	*Cuscuta epithymum* (L.) L.	achekous n-temghart
215	*Cuscuta planiflora* Ten.	achekous n-temghart
216*	*Ipomoea batatas* (L.) Lam.	btata hlouwa
	Crassulaceae	
217	*Sedum* sp.	tifednine n-temghart
	Cucurbitaceae	
218*	*Citrullus lanatus* (Thunb.) Matsum. & Nakai	dellah
219*	*Cucumis melo* L.	bettikh
220*	*Cucumis sativus* L.	khiar
221*	*Cucurbita maxima* L.	takhssait
222*	*Cucurbita pepo* L.	takhssait
223*	*Lagenaria leucantha* var. *longissima*	slawi
	Cupressaceae	
224*	*Cupressus sempervirens* L.	aârâar roumi
225	*Juniperus oxycedrus* L.	taqa
226	*Juniperus phoenicea* L.	aârâar
227	*Juniperus thurifera* L.	awal, tawalt
228	*Tetraclinis articulata* (Vahl) Mast.	aârâar, aârâar lhor
	Cynomoriaceae	
229	*Cynomorium coccineum* L.	hemzellou
	Cyperaceae	
230	*Bolboschoenus glaucus* (Lam.) S. G. Sm. (incl. *Scirpus maritimus* auct. Afr. N.)	azlaf
231	*Carex halleriana* Asso	#
232	*Cyperus fuscus* L.	azlaf
	Dipsacaceae	
233	*Lomelosia stellata* (L.) Raf.	#
	Ephedraceae	
234	*Ephedra major* Host.	tiziad
	Equisetaceae	
235	*Equisetum ramosissimum* Desf.	#
	Ericaceae	
236	*Arbutus unedo* L.	sasnou
	Euphorbiaceae	
237	*Euphorbia chamaesyce* L.	tinougha, tineqout
238	*Euphorbia helioscopia* L.	tinougha, tineqout
239	*Euphorbia hirsuta* L. (incl. *E. pubescens* Vahl)	#
240	*Euphorbia nicaeensis* All.	tinougha, tineqout
	Fabaceae	
241	*Astragalus alopecuroides* L.	#
242	*Astragalus armatus* Willd.	assennan oufounas

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243	*Astragalus bourgaeanus* Coss.	tinifine oujdad
244	*Astragalus caprinus* L.	ibawn ighatan
245	*Astragalus granatensis* Lam. (incl. *A. boissieri* Fisch.)	tighardemt
246	*Astragalus hamosus* L.	ibawn lekhla
247	*Astragalus sesameus* L.	tinifine oujdad
248*	*Cicer arietinum* L.	hammes
249	*Coronilla repanda* (Poir.) Guss.	#
250	*Coronilla scorpioides* (L.) W. D. J. Koch	ibawn lekhla
251	*Cytisus balansae* (Boiss.) Ball	bourssoud
252	*Erinacea anthyllis* Link	bounehar
253	*Genista quadriflora* Munby	ilouki
254	*Hedysarum coronarium* L.	#
255	*Hippocrepis monticola* Lassen (incl. *H. scabra* DC.)	#
256	*Hippocrepis neglecta* Lassen	#
257*	*Lens culinaris* Medik.	âdes
258	*Lotus arenarius* Brot.	becher n-yazad
259	*Medicago doliata* Carmign.	fessa
260	*Medicago minima* (L.) L.	fessa oujdad
261	*Medicago orbicularis* (L.) Bartal.	fessa
262	*Medicago polymorpha* L.	fessa
263*	*Medicago sativa* L.	fessa
264	*Medicago suffruticosa* DC.	fessa oujdad
265	*Medicago truncatula* Gaertn.	fessa oujdad
266	*Melilotus indicus* (L.) All.	wawbhir
267	*Melilotus sulcatus* Desf.	wawbhir, fessa dighardaïn
268	*Onobrychis humilis* (L.) G. Lopez	saboun immissawn
269	*Ononis hispida* Desf.	akchoud
270	*Ononis pseudoserotina* Batt. & Pit.	henna
271	*Ononis spinosa* L.	bouqsib
272	Ononis thomsonii Oliv.	akchoud, asghar
273*	*Phaseolus vulgaris* L.	loubia
274*	*Pisum sativum* L.	jelbana, tinifine
275	*Scorpiurus muricatus* L.	tamazought n-tighsi
276	*Scorpiurus vermiculatus* L.	tamazought n-tighsi
277	*Trifolium isthmocarpum* Brot.	fessa oughioul
278	*Trifolium resupinatum* L.	fessa oughioul
279*	*Trigonella foenum-graecum* L.	helba
280	*Trigonella monspeliaca* L.	fessa
281	*Trigonella polyceratia* L.	fessa
282*	*Vicia faba* L.	ibawn
283	*Vicia lutea* L.	kersenna
284	*Vicia monantha* Retz.	tinifine, tinifine ifigher
285*	*Vicia sativa* L.	tinifine, kersenna
	Fagaceae	
286	*Quercus coccifera* L.	akerrouch ilef
287	*Quercus faginea* Lam.	tachta
288	*Quercus rotundifolia* Lam.	kerrouch
	Gentianaceae	
289	*Centaurium pulchellum* (Sw.) Druce	#
	Geraniaceae	
290	*Erodium guttatum* (Desf.) Willd.	tisennaf n-temghart
291	*Erodium malacoides* (L.) l'Hér.	tisennaf n-temghart

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292	*Erodium moschatum* (L.) L'Hér.	tisennaf n-temghart
	Grossulariaceae	
293	*Ribes uva-crispa* L.	qars moumou
	Heliotropiaceae	
294	*Heliotropium europaeum* L.	#
	Hyacinthaceae	
295	*Drimia maritima* (L.) Stearn	bsel-ilef, bsel lhellouf
296	*Muscari comosum* (L.) Mill.	bsel n-iqzine
297	*Ornithogalum narbonense* L.	bsel n-iqzine
	Iridaceae	
298	*Gladiolus italicus* Mill. (incl. *G. segetum* Ker-Gawl.)	tafrout n-ouchen
	Juglandaceae	
299*	*Juglans regia* L.	guergaâ
	Juncaceae	
300	*Juncus acutus* L.	azlaf
301	*Juncus inflexus* L.	azlaf
302	*Juncus maritimus* Lam.	azlaf
	Juncaginaceae	
303	*Triglochin palustris* L.	#
	Lamiaceae	
304	*Ajuga chamaepitys* (L.) Schreb.	timchouzzatine
305	*Ajuga iva* (L.) Schreb.	timchouzzatine
306	*Lamium amplexicaule* L.	naânaâ lma
307*	*Lavandula angustifolia* Mill.	khzama
308	*Lavandula stoechas* L.	ahelhal
309	*Marrubium alysson* L.	timersat
310	*Marrubium vulgare* L.	timersate timerriwine
311	*Mentha longifolia* (L.) L.	timersat
312	*Mentha pulegium* L.	flyou dial lma, flyou ifounasen
313*	*Mentha spicata* L. (incl. *M. viridis* (L.) L.)	naânaâ, liqama
314	*Mentha suaveolens* Ehrh. (incl. *M. rotundifolia* auct. Afr. N.)	timersat n-waman
315*	*Mentha x piperita* L.	naânaâ meskaoui
316	*Nepeta nepetella* L. subsp. *amethystina* (Poir.) Briq.	timersat tibouriyine
317*	*Ocimum basilicum* L.	hbaq
318	*Origanum elongatum* (Bonnet) Emb. & Maire	istahdar, saâter
319	*Rosmarinus officinalis* L.	azir
320	*Salvia argentea* L.	aferghous n'ariou
321	*Salvia officinalis* L.	belghabou, belghanbou
322	*Salvia phlomoides* Asso	if tfounast
323	*Salvia verbenaca* L.	tiltit n-tmessi, lâarf n-yazad
324	*Sideritis hirsuta* L.	menta
325	*Teucrium chamaedrys* L.	#
326	*Teucrium fruticans* L.	azzou
327	*Teucrium polium* L.	tayrart, tayrirt
328	*Thymus algeriensis* Boiss. & Reut.	marad
329	*Thymus munbyanus* Boiss. & Reut.	zouchen
330	*Thymus zygis* L.	zouchen
331	*Ziziphora hispanica* L.	flyou abouri
	Liliaceae	
332	*Tulipa sylvestris* L.	#
	Lythraceae	

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333	*Lythrum junceum* Banks & Sol.	#
334*	*Punica granatum* L.	romman
	Malvaceae	
335*	*Abelmoschus esculentus* (L.) Moench	mloukhia
336	*Althaea longiflora* Boiss. & Reut.	tibbi
337	*Hibiscus trionum* L.	#
338	*Malva neglecta* Wallr.	tibbi
339	*Malva parviflora* L.	tibbi
	Molluginaceae	
340	*Corrigiola telephiifolia* Pourr.	tawsarghint
	Moraceae	
341*	*Ficus carica* L.	tazart
342*	*Morus alba* L.	tout labiad
343*	*Morus nigra* L.	tout lekhal
	Nitrariaceae	
344	*Peganum harmala* L.	harmel
	Oleaceae	
345	*Fraxinus angustifolia* Vahl	aderdar
346	*Fraxinus dimorpha* Coss. & Durieu (incl. *F. xanthoxyloides* auct. Afr. N.)	touzzelt
347*	*Olea europaea* L. subsp. *europaea*	azemour, zitoun
348	*Phillyrea angustifolia* L.	inouktal
	Onagraceae	
349	*Epilobium hirsutum* L.	#
	Orobanchaceae	
350	*Orobanche crenata* Forssk.	hemzellou
	Papaveraceae	
351	*Fumaria agraria* Lag.	tifsit n-oujdad, chiba
352	*Fumaria parviflora* Lam.	tifsit n-oujdad, chiba
353	*Glaucium corniculatum* (L.) H. Rudolph	benaâmam ifigher
354	*Hypecoum pendulum* L.	tabellaâmant dighardain
355	*Papaver rhoeas* L.	benaâmam
356	*Roemeria hybrida* (L.) DC.	tabellaâmant
	Pinaceae	
357	*Cedrus atlantica* (Endl.) Carrière	idil
358	*Pinus halepensis* Mill.	tayda
359	*Pinus pinaster* Aiton	tayda
	Plantaginaceae	
360	*Antirrhinum majus* L.	#
361	*Chaenorrhinum villosum* (L.) Lange	#
362	*Globularia alypum* L.	tasselgha
363	*Globularia nainii* Batt.	siwrigh
364	*Plantago albicans* L.	almzeimer
365	*Plantago coronopus* L.	messassa, talamine
366	*Plantago major* L.	messassa
367	*Plantago mauritanica* Boiss. & Reut.	#
368	*Plantago rhizoxylon* Emb.	#
369	*Veronica anagallis-aquatica* L.	aguernouj
370	*Veronica rosea* Desf.	#
	Poaceae	
371	*Aegilops geniculata* Roth	harziz
372	*Aegilops triuncialis* L.	harziz
373	*Agrostis gigantea* Roth	#
374	*Alopecurus arundinaceus* Poir.	#

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375	*Ampelodesmos mauritanicus* (Poir.) Dur. & Schinz	adles
376	*Anisantha madritensis* (L.) Nevski	bahma
377	*Anisantha rigida* (Roth) Hyl.	bahma
378	*Anisantha rubens* (L.) Nevski	bahma
379	*Anisantha tectorum* (L.) Nevski	bahma
380	*Anthoxanthum odoratum* L.	ajdir tbadart
381	*Arundo donax* L.	aghanim, ghanim
382*	*Avena sativa* L.	tamensikht
383	*Avena sterilis* L.	tamensikht
384	*Brachypodium retusum* (Pers.) P. Beauv.	oubbal
385	*Bromus hordeaceus* L.	oubbal saguia
386	*Ctenopsis pectinella* (Delile) De Not.	#
387	*Cynodon dactylon* (L.) Pers.	njem
388	*Dactylis glomerata* L.	tachaboubt
389	*Dasypyrum breviaristatum* (H. Lindb.) Fred. (incl. D. hordeaceum (Coss. & Dur.) P. Candargy)	#
390	*Digitaria sanguinalis* (L.) Scop.	#
391	*Echinaria capitata* (L.) Desf.	tiçennanine ou-mouch
392	*Echinochloa colona* (L.) Link	#
393	*Elytrigia repens* (L.) Desv. ex Nevski	njem
394	*Eragrostis* sp.	#
395	*Hordeum murinum* L.	taghardait
396*	*Hordeum vulgare* L.	tomzine
397	*Koeleria splendens* C. Presl	aghesmir
398	*Lolium multiflorum* Lam.	taghesmirt, medhouna
399	*Lolium rigidum* Gaud.	taghesmirt, medhouna
400	*Lygeum spartum* L.	tasennaght
401	*Macrochloa arenaria* (Brot.) Kunth	tadaft
402	*Macrochloa tenacissima* (L.) Kunth	ary, algdim
403	*Melica cupanii* Guss.	#
404	*Paspalum distichum* L.	#
405	*Phalaris minor* Retz.	acheboub
406	*Phragmites australis* (Cav.) Steud. (incl. *Ph. communis* Trin.)	tnala, ghanim, aghanim
407	*Polypogon monspeliensis* (L.) Desf.	#
408	*Schedonorus arundinaceus* (Shreb.) Dumort.	#
409	*Schismus barbatus* (Lœfl. ex L.) Thell.	#
410*	*Secale cereale* L.	tasehdit
411	*Setaria verticillata* (L.) P. Beauv.	memâach
412*	*Sorghum bicolor* (L.) Mœnch	abaâli
413	*Sorghum halepense* (L.) Pers.	tatkhant
414	*Stipa lagascae* Roem. & Schult.	anezd ou-winnouz
415	*Trachynia distachya* (L.) Link	taghardait
416*	*Triticum aestivum* L.	farina
417*	*Triticum durum* Desf.	irden
418*	*Zea mays* L.	dra
	Polygonaceae	
419	*Emex spinosa* (L.) Campd.	tasemount
420	*Polygonum aviculare* L.	asseremram
421	*Rumex bucephalophorus* L.	tasemount
422	*Rumex conglomeratus* Murray	#
423	*Rumex crispus* L.	imejan aghioul, tasemount
424	*Rumex pulcher* L.	tasemount
425	*Rumex roseus* L.	#
	Portulacaceae	

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426	*Portulaca oleracea* L.	timeqsine, rejla
	Primulaceae	
427	*Androsace maxima* L.	#
428	*Coris monspeliensis* L.	#
429	*Lysimachia arvensis* (L.) U. Manns & Anderb.	alellou
430	*Lysimachia fœmina* (Mill.) U. Manns & Anderb.	alellou
	Ranunculaceae	
431	*Adonis aestivalis* L.	tit n-teskourt
432	*Adonis microcarpa* DC.	tit n-teskourt
433	*Consolida orientalis* (J. Gay) Schrodinger	azbibi
434	*Delphinium obcordatum* DC.	#
435	*Ranunculus arvensis* L.	fetchras
436	*Ranunculus trilobus* Desf.	touya n-bouzelloum
	Resedaceae	
437	*Reseda alba* L.	tajellalt izimer, ajellal n-tghat
438	*Reseda lanceolata* Lag.	tajellalt izimer
439	*Reseda lutea* L.	tajellalt izimer
440	*Reseda luteola* L.	tajellalt izimer
441	*Reseda phyteuma* L.	tajellalt izimer
	Rhamnaceae	
442	*Rhamnus alaternus* L.	amliles
	Rosaceae	
443	*Amelanchier ovalis* Medik.	tazart imisawn
444	*Cotoneaster granatensis* Boiss.	ameqsou
445	*Crataegus laciniata* Ucria	admam
446	*Crataegus monogyna* Jacq.	admam
447*	*Cydonia oblonga* Mill.	sferjel
448*	*Eriobothrya japonica* (Thunb.) Lindl.	mzah
449*	*Fragaria vesca* L.	fraize
450*	*Malus pumila* Mill.	teffah
451	*Potentilla reptans* L.	tiliban taria
452*	*Prunus armeniaca* L.	mechmach
453*	*Prunus avium* (L.) L.	hab lemlouk
454*	*Prunus cerasus* L.	hab lemlouk
455*	*Prunus domestica* L.	berqouq
456*	*Prunus dulcis* (Mill.) D.A. Webb	louz
457*	*Prunus persica* (L.) Batsch.	khoukh
458	*Prunus prostrata* Labill.	aberqouq imisawn
459*	*Pyrus communis* L.	tfirast, bouaouid
460	*Rosa canina* L.	tabgha
461*	*Rosa* sp.	ward beldi
462	*Rubus ulmifolius* Schott	tatchelt
463	*Sanguisorba minor* Scop.	touya n-ifigher
	Rubiaceae	
464	*Asperula arvensis* L.	menned
465	*Asperula hirsuta* Desf.	menned
466	*Galium aparine* L.	menned
467	*Galium mollugo* L.	menned
468	*Galium tricornutum* Dandy	menned
469	*Galium verrucosum* Huds.	fetchras
470	*Rubia peregrina* L.	taroubia
	Rutaceae	
471	*Ruta montana* (L.) L.	iwermi
	Salicaceae	

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472	*Populus alba* L.	asefsaf
473	*Populus nigra* L.	asefsaf
474	*Salix alba* L.	afssas, tafssaft
475	*Salix atrocinerea* Brot.	afssas roumi
476	*Salix babylonica* L.	swalef aïcha
477	*Salix purpurea* L.	afssas
	Santalaceae	
478	*Viscum cruciatum* Boiss.	mejbar
	Scrophulariaceae	
479	*Scrophularia auriculata* L.	saboun taria, saboun naria
480	*Scrophularia canina* L.	chtaba, ilzwine
481	*Scrophularia macrorrhyncha* (Humbert, Litard. & Maire) Ibn Tattou	chtaba, ilzwine
482	*Verbascum dentifolium* Delile	aferghous n-ariou
	Smilacaceae	
483	*Smilax aspera* L.	anesfal, tanesfalt
	Solanaceae	
484	*Atropa belladonna* L.	chaoulou, adil n-ouchen
485	*Capsicum annuum* L.	ifelfel
486	*Datura stramonium* L.	taborzizt
487	*Hyoscyamus albus* L.	inyad
488	*Hyoscyamus niger* L.	guinguet
489	*Lycium europaeum* L.	âwej, âadlouj
490*	*Lycopersicum esculentum* Mill.	maticha
491	*Solanum melongena* L.	denjal
492	*Solanum nigrum* L.	adil n-ouchen
493*	*Solanum tuberosum* L.	btata
	Tamaricaceae	
494	*Tamarix aphylla* (L.) H. Karst.	hadba
495	*Tamarix canariensis* Willd.	tamimaït
	Taxaceae	
496	*Taxus baccata* L.	dakhch
	Thymelaeaceae	
497	*Daphne gnidum* L.	alzaz
498	*Daphne laureola* L.	#
499	*Thymelaea tartonraira* (L.) All.	talzazt
500	*Thymelaea virgata* (Desf.) Endl.	tasra
	Tuberaceae	
501	*Terfzia* sp.	tirfas tizougaghine
502	*Tirmania* sp.	tirfas timellaline
	Typhaceae	
503	*Typha angustifolia* L.	tabouda
	Urticaceae	
504	*Urtica urens* L.	tiqzinine, taqzinte
	Verbenaceae	
505*	*Aloysia citrodora* Palau	louiza
506	*Verbena officinalis* L.	#
	Vitaceae	
507	*Vitis vinifera* L.	adil
	Zygophyllaceae	
508*	*Balanites aegyptiaca* (L.) Delile	tmar-tork, tmar lkhaoui