

FLORISTIC DIVERSITY AND POTENTIAL OF SITE OF BIOLOGICAL AND ECOLOGICAL INTEREST BRIKCHA, PRÉRIF (NORTH-WEST MOROCCO)

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Abstract

Studies on the flora of the protected areas of the Prérif and particularly the mainland Site of Biological and Ecological Interest (SBEI) Brikcha are very limited. It is with this in mind that we carried out this study in order to identify the vascular flora and highlight the potential of this region. Using a combination of two methods, stratified probability sampling and the itinerant inventory, we carried out 50 days of field surveys between March 2023 and May 2024. The results obtained have allowed us to establish an exhaustive catalogue of 326 species, the emblematic species of which is *Quercus faginea*. In addition, six species have been reported for the first time in North Atlantic Morocco-1 (Man-1), of which SBEI is a part: *Biscutella pseudolyrata*, *Coriaria myrtifolia*, *Gagea fibrosa*, *Hedera helix* subsp. *maroccana*, *Laurus nobilis* and *Tamarix canariensis*. The species recorded are grouped into 253 genera and 81 botanical families, five of which have the highest species richness: Asteraceae (41 species, 12.58%); Fabaceae (31 species, 9.51%); Poaceae (30 species, 9.20%); Apiaceae (18 species, 5.52%) and Lamiaceae (14 species, 4.29%). A clear dominance of dicotyledons (75.46%) was also noted. *Cistus* and *Quercus* are the two most species-rich genera with four taxa each. The spring season is the preferred flowering time for 56.77% of the flora. Life forms are mainly represented by therophytes (46.01%), followed by geophytes (17.49%) and phanerophytes (14.11%). Twenty of the species inventoried are endemic (6.13%), seven of which are strictly Moroccan, six are threatened with extinction. Eleven species are rare in the broad sense of the term.

Due to the richness and original diversity of its flora, the SBEI Brikcha constitutes a real phylogenetic reservoir in the Prérif, it deserves to be qualified as priority 1.

Keywords: SBEI Brikcha, floristic richness, Prérif, Ouezzane, Morocco

INTRODUCTION

On the scale of the Mediterranean basin, Morocco is distinguished by a great diversity of ecosystems and natural resources. This diversity gives the country an exceptional heritage value in terms of

the natural environment (Benabid, 2000; Médail and Diadema, 2006). In the Mediterranean basin, Moroccan biodiversity is second only to that of the Anatolian region (Turkey), with an overall endemism rate of 20% (Ilmen and Benjelloun, 2013). Aware of the importance of its natural



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resources and of the serious and ever-increasing threats due mainly to anthropogenic activities and climatic constraints, Morocco has actively committed itself to a policy of sustainable preservation of its natural resources. Thus, on the basis of the Dahir of 1917 on the protection and conservation of forests (Bulletin officiel, 1917) and the Dahir of 1934 on the creation of National Parks (Bulletin officiel, 1934), the beginning of the fifth decade of the 20th century (1942) was marked by the birth of the first National Park which is the Toubkal National Park. Since then, the number, type and size of protected areas have steadily increased. Currently, there are 11 National Parks (Toubkal, Ifrane, Souss-Massa, Khénifra, Iriqui, High Eastern Atlas, Khenifiss, Talassemtane, Al Hoceima, Tazekka and Dakhla) together constitute a total area of 2.84 million hectares (Cour des Comptes, 2020). There are four biosphere reserves (The Arganeria Biosphere Reserve (ABR), the Oasis of Southern Morocco (OSMBR), the Atlas Cedar Biosphere Reserve (ACBR) and the Intercontinental Biosphere Reserve of the Mediterranean (IBRM)). The Site of Biological and Ecological Interest (SBEI) network defined by the master plan for protected areas (AEFCS, 1996) has been increased from 154 to 160 natural sites grouped into three priority lots: priority 1 for 48 sites; priority 2 with 50 sites; priority 3 comprising 62 sites. These SBEIs are representative of natural ecosystems and are grouped into three categories (Terrestrial, wetland, coastal and marine). Out of a total area of 205,000 hectares, the SBEIs in the coastal area are 12 priority 1; 17 priority 2 and 12 priority 3. The SBEIs of the continental domain, wetlands are 12 of priority 1; 17 of priority 2 and 12 of priority 3 with a total area of 202,000 hectares. There are 79 SBEIs in the continental domain, terrestrial areas, belonging to three priorities: 25 priority 1, 21 priority 2 and 33 priority 3. They cover a total area of 840,000 hectares (Centre d'échange d'information sur la biodiversité du Maroc, 2023). Although these SBEIs have in common the maintenance of biodiversity, they are different in terms of shape, area, altitude, flora, fauna and habitats.

However, despite commendable efforts and encouraging progress in terms of the creation and extension of protected areas, Morocco is still a long way from achieving the Aichi targets. These call for at least 17% of terrestrial and inland water areas and 10% of marine and coastal areas to be conserved by 2020. Today, terrestrial protected areas cover 2.5 million ha and marine protected areas 175,180 ha, i.e. 3.7% and 0.25% respectively of the country's surface area (Cour des Comptes, 2020).

The geographical distribution of protected areas covers all regions of the country, with a very satisfactory representation of major plant formations and main habitat types (Fennane, 2004). The North-West of Morocco is home to several types of protected area, including the Talassemtane National Park in the province of Chefchaouen and

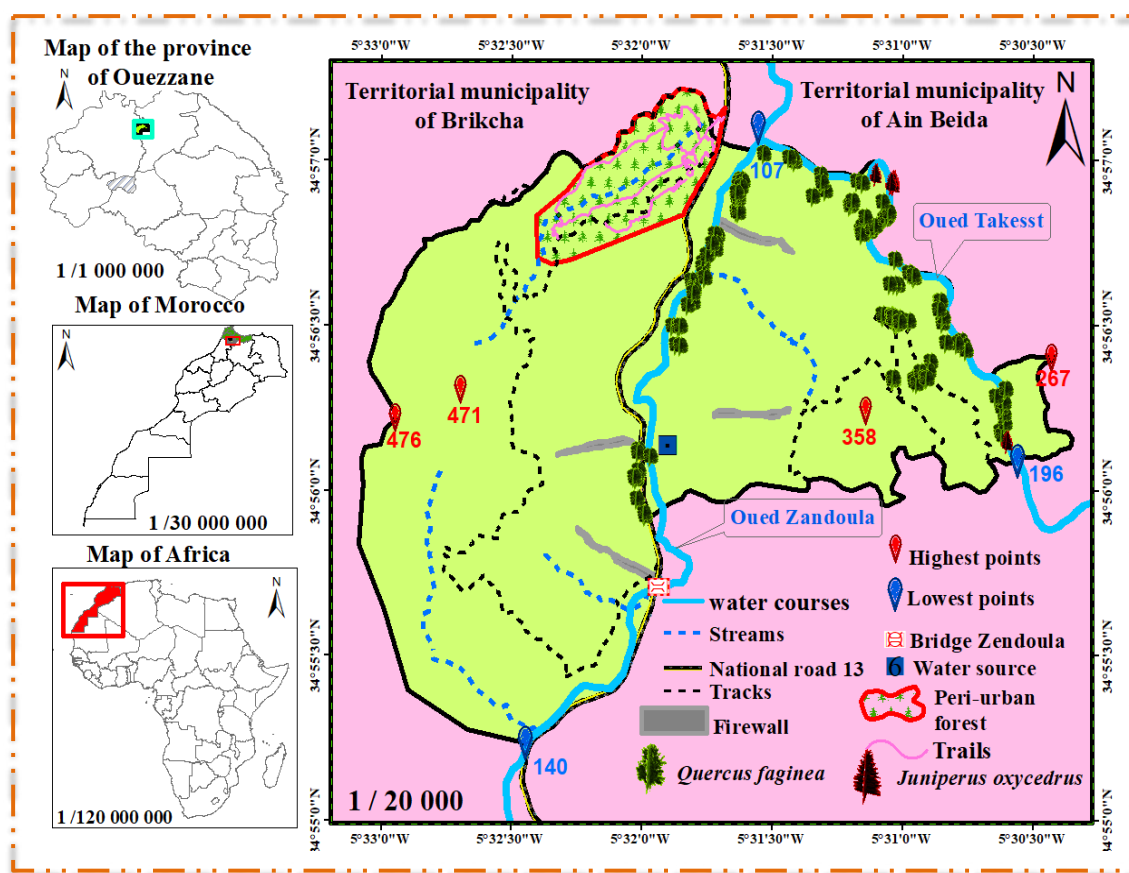
the province of Tétouan, internationally renowned for its endemic *Abies marocana* species. The Jbel Bouhachem SBEI, where the forest formations are among the most beautiful in Morocco, with a high floristic biodiversity. The Ben Karrich SBEI of 22,100 ha with a well-diversified flora (AEFCS, 1996). Well known for its Izarène massif, the province of Ouezzane has two SBEIs: the Brikcha SBEI and the Souk El Had SBEI. According to the latter's data sheet (AEFCS, 1996), the two SBEIs are the only Moroccan climax sites dominated by kermes oak (*Quercus coccifera*). The two SBEIs account for just 0.56% of the province's total forest area of 30,927 ha, or 15% (Monographie de la Province de Ouezzane, 2016). Hence the need to increase this percentage through the creation of other protected areas. Both sites are part of the Intercontinental Biosphere Reserve of the Mediterranean (IBRM). This is a transboundary biosphere reserve recognized by UNESCO in 2006, covering 907 185.02 ha divided almost equally between Northern Morocco and Southern Spain. 10% of the Moroccan part of the IBRM is located in the province of Ouezzane. Given that the Brikcha SBEI is a remarkable natural area and stands out for its diversity, it has been classified as a protected area and given priority 2 status (Fennane, 2004).

In 2012, according to Fennane and Ibn Tattout, the Mediterranean flora in general and Moroccan flora in particular was much better known than around twenty years ago. Certainly, nowadays it is more known than in 2012. Nevertheless, floristic studies devoted to SBEIs are partial, insufficient and limited, and do not reflect the real role these sites play in preserving biodiversity. Studies of this kind are essentially dedicated to National Parks and other types of protected areas. These include Hammada *et al.* (2004), Hammada (2007) and Taleb and Fennane (2008). Surrounded by three mountains, Mountain Moulay Abdeslam de Rebettat, mountain Lalla Aroussa and mountain Sidi Ali, the Brikcha SBEI enjoys a remarkable singularity by contrasting the biological diversity of the said mountains. Although it is representative of the natural environment prevailing in the Prérif, until now, the SBEI Brikcha has not benefited from an exhaustive floristic study. It was with this in mind, and in order to fill this gap and gain a better understanding of its floristic diversity, that we carried out this study, the first to be carried out in this region.

Our study is therefore a continuation of the studies carried out in the Izarène massif (Orch *et al.*, 2013, 2015, 2021; Laouzazni *et al.*, 2018), the main objective of which is to draw up an inventory of the vascular flora of the Brikcha SBEI.

Study Area

This study focuses on the floristic diversity of the Brikcha SBEI, classified as a priority 2 SBEI in the continental terrestrial domain (AEFCS, 1996). It is located approximately 17 km North of the town of Ouezzane and crossed by national road 13 (Fig. 1).



1: Geographical location of Brikcha SBEI

It lies between parallels $34^{\circ}55'13''$ and $34^{\circ}57'13''$ North latitude and meridians $5^{\circ}30'21''$ and $5^{\circ}33'5''$ West longitude. With a perimeter of 15.10 km and an average altitude of around 240.6 m, it covers an area of 801.54 ha divided unequally between two territorial municipalities: the territorial municipality of Brikcha (498.10 ha) and the territorial municipality of Ain Baida (303.44 ha). Oued Zandoula river divides the SBEI into two unequal and asymmetrical parts in terms of surface area, altitude, topography and administrative affiliation. Administratively, it belongs to the cercle du Mokrissat, province of Ouezzane and Tanger Tetouan El Hoceima region.

Because the Brikcha SBEI lies at the boundary between the Préfif mountains (Outer furrow of the Rif chain) and the Gharb domain, it has a mountainous backbone criss-crossed by flexure lines. Its rugged, low mountainous relief is made up of two blocks formed by a series of ridges generally oriented S-N and separated by Oued Zandoula river. The Oued Takesst river forms a natural border running from East to North. In the extreme western corner of SBEI, the highest point rises to 476 m, while in the North, at the confluence of Oued Zandoula river and Oued Takesst river, the lowest point is 107 m. The Brikcha SBEI shows a variation in exposure according to the four directions. 52.25% of the slopes are unevenly oriented between North

(39.12%) and West (13.13%), distinguished by dense vegetation cover. Less dense vegetation cover is found on the East- and South-facing slopes, which account for 26.93% and 20.82% respectively.

Located in the province of Ouezzane, the Brikcha SBEI enjoys a sub-humid mediterranean climate, characterized by dry and hot summers and cold to mild winters. The thermal regime is characterized by very high temperatures in July and August, ranging from 26°C to 44°C , and low temperatures in February, varying from 1°C to 8°C . The amount of precipitation received varies between 700 mm/year and 900 mm/year with interannual and interannual irregularity (Tetouan Investment Center, 2019).

The main feature of the hydrological network is the presence of the lower reaches of two Oueds. Oued Zandoula river flows in an S-N direction along its entire 4.41 km length, 2.27 km of which lies firmly within the SBEI, generally generating Western and Eastern flanks. Oued Takesst river meanders in an S-E and N-W direction and flows into the SBEI over a distance of around 3.06 Km, its course subject to abrupt changes in topography. North of the SBEI, the confluence of two Oueds forms a watercourse that diverges into the left Oued Loukkos river watershed. At the height of summer and in certain stretches, small discontinuous white layers of salt cover the stones and the bottom of the two Oueds.

MATERIALS AND METHODS

In order to establish the most exhaustive floristic inventory possible, several materials were used as well as a combination of two sampling methods was implemented. The technical devices are essentially made up of a camera, a 20 meter long tape and recording sheets. The 1:100 000 scale map of the study area (Agence Nationale de la Conservation Foncière du Cadastre et de la Cartographie, 2022), Landsat 7 ETM+ satellite images and the satellite image provided by the SAS planet image sensor were also useful. In addition to the SBEI cartography, ArcMap 10.8 software was used, via query formulation, to calculate surfaces, perimeters, wadi and track lengths, altitudes, slopes, exposures and other elements. A database was set up in the Excel spreadsheet to enter and analyze the floristic list qualitatively and quantitatively (Family, genus, species, life form, bioclimatic stage, endemism/degree of rarity, flowering period, geographical distribution, etc). The methodological approach adopted is based on floristic inventories carried out following the combination of two sampling methods. These are stratified probability sampling and the itinerant survey method. Stratified probabilistic sampling consists of processing all the information acquired on the SBEI and its vegetation in order to divide it into homogeneous subunits sampled separately. This method has already been used by Tahri *et al.* (2011), Orch *et al.* (2013) and Benkhniue *et al.* (2023). Following the geomorphology of the SBEI, several criteria were taken into account during its division: vegetation density, exposure, topography, altitude, pedology, relief and areas almost bare of vegetation (The four parent fire trenches). In order to complete the floristic list, the itinerant survey method was used. This is a quick and simple method already used by several authors (Gnahoré *et al.*, 2018; Gueulou *et al.*, 2018; Sehoun, 2021). It involves traversing the SBEI in different directions and listing all newly observed species. For the study of Oued Zendoula river and Oued Takesset river vegetation, the method used is that of Grasmück *et al.* (1993), which consists in dividing the watercourse into homogeneous segments (Geological substratum, slope and width). In order to achieve as complete a coverage as possible, surveys were carried out on homogeneous stretches of 50 m to 100 m in length, in relation to the changing appearance of the Oued.

The fieldwork took place over the period from March 2023 to May 2024, i.e. 50 survey days. This enabled the SBEI to be explored at different times of the year, especially during the two main seasons (Spring and summer) of vegetative growth and propitious flowering for most plants. In order to cross-reference autumn-flowering plants and increase the number of species recorded, free outings were made during winter and autumn.

All species encountered (Trees, shrubs, lianas and grasses) were collected for identification without being preserved in a herbarium. Given our accumulated knowledge of the flora of the region to which the SBEI belongs, the majority of species encountered could be recognized in the field. Unidentified species were carefully collected and taken to the Botany and Plant Ecology Laboratory of the Rabat Scientific Institute, where they were identified. Species identification was based on relevant literature: the three volumes of Practical Flora of Morocco (Fennane *et al.*, 1999, 2007, 2014), Vascular Flora of Morocco: Inventory and Chorology (Fennane and Ibn Tattou, 2005; Ibn Tattou and Fennane, 2008) and webographic references. The IPNI online database (<https://www.ipni.org/>) served as the basis for updating the taxon nomenclature.

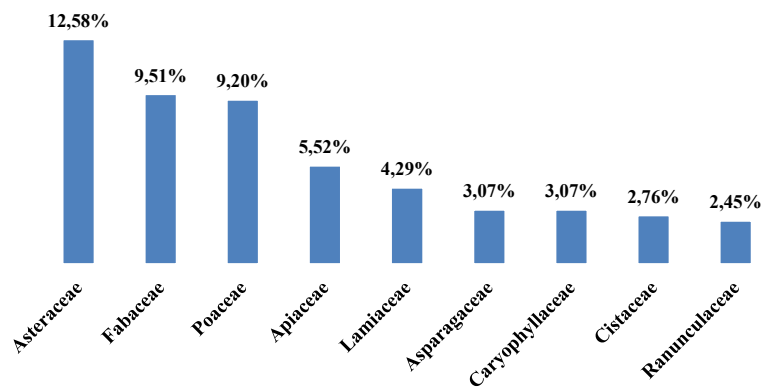
The characterization of rare, threatened or endemic species present on the SBEI was carried out on the basis of rarity criteria established in the Catalog of Rare, Threatened or Endemic Vascular Plants of Morocco (Fennane and Ibn Tattou, 1998). The conservation status or degree of threat of extinction of the species recorded was determined by consulting the Red Book of the Vascular Flora of Morocco (Fennane, 2021).

The taxa inventoried are grouped according to the order of systemic groups, families and genera. For each species, we have mentioned the form of life according to Raunkier (1934), bioclimatic stage, flowering period, assessment criteria, endemism/rareness and biogeographical distribution as listed in the Practical Flora of Morocco (Fennane *et al.*, 1999, 2007, 2014).

RESULTS

Floristic Analysis

The floristic inventory shows that the SBEI has 326 species belonging to 253 genera and 81 families. These species are divided into three systematic groups (Pteridophytes, gymnosperms and angiosperms). Pteridophytes are represented by six families (Adiantaceae, Aspleniaceae, Dennstaedtiaceae, Equisetaceae, Polypodiaceae and Selaginellaceae), six genera (*Anogramma*, *Asplenium*, *Equisetum*, *Polypodium*, *Pteridium* and *Selaginella*) and seven species (*Anogramma leptophylla*, *Asplenium adiantum-nigrum*, *Asplenium ceterach* subsp. *ceterach*, *Equisetum ramosissimum*, *Polypodium vulgare*, *Pteridium aquilinum* and *Selaginella denticulata*). Gymnosperms are represented by a single family (Cupressaceae), a single genera (*Juniperus*) and a single species (*Juniperus oxycedrus* subsp. *oxycedrus*). Angiosperms include 74 families, 246 genera and 318 species. Among the latter, dicotyledons dominate with 246 species (75.46%) distributed between 189 genera and 58 families. Monocotyledons are represented by 72 species (22.09%) belonging to 57 genera and 16 families.



2: The most preponderant families with at least 8 species

Of all the flora surveyed in the SBEI, the best represented families in terms of number of species (Fig. 2) are, in order of importance: Asteraceae (41 species, 12.58%); Fabaceae (31 species, 9.51%); Poaceae (30 species, 9.20%); Apiaceae (18 species, 5.52%); Lamiaceae (14 species, 4.29%); Asparagaceae and Caryophyllaceae (10 species, 3.07%); Cistaceae (9 species, 2.76%) and Ranunculaceae (8 species, 2.45%). They alone account for 171 species or 52.45%, while the remaining families (72) contribute 47.55% of the total. The flora of the study area includes XV families with between IV and VI species, VIII families with III species, XIV families with II species and XXXV families with one species.

The SBEI is home to 253 genera. Since the total number of genera in the national vascular flora is 940 genera (Ibn Tattou et Fennane, 1989), the SBEI represents 26.91%. In fact, the species recorded are not evenly distributed between the 253 genera. From one species to four, the number varies from one genus to another. Tab. I shows the thirteen (13) main genera.

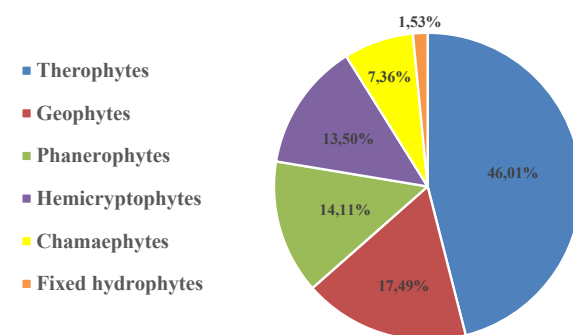
I: Species richness for the best-represented genera

Genera	Number of species
<i>Cistus</i>	4
<i>Quercus</i>	4
<i>Allium</i>	3
<i>Anagallis</i>	3
<i>Campanula</i>	3
<i>Carex</i>	3
<i>Centaureum</i>	3
<i>Geranium</i>	3
<i>Ononis</i>	3
<i>Ophrys</i>	3
<i>Plantago</i>	3
<i>Ranunculus</i>	3
<i>Trifolium</i>	3

Among the genera identified, forty-five genera are composed of two species while one hundred and ninety-five genera are each composed of a single species.

Life Forms

As far as life forms are concerned, analysis of Fig. 3 shows that therophytes represent 46.01%. Asteraceae, Fabaceae, Poaceae and Caryophyllaceae make up 47.33%. The remainder is made up of perennial species (53.99%) divided into five life forms of unequal proportion. Geophytes occupy the second position with 17.49% of which the Apiaceae, Asparagaceae, Amaryllidaceae and Poaceae, together with 43.86% form their essential. Phanerophytes come in third place with 14.11% and are mainly represented by Fabaceae (15.22%) and Fagaceae (8.70%). Asteraceae (29.55%) and Poaceae (15.91%) are the main components of hemicryptophytes (13.50%). In fifth place, chamaephytes (7.36%) are made up mainly of three families (Lamiaceae (20.83%), Cistaceae (16.67%) and Asteraceae (12.50%)). In last place, fixed hydrophytes are the least abundant, with five species (1.53%).



3: Life forms of spontaneous species recorded in the flora of Brikcha SBEI

Richness in Endemic Species

The study enabled us to identify twenty endemic species in the Brikcha SBEI, representing an endemism rate of 6.13% of the total flora. Seven

taxa are endemic to Morocco (E): *Andryala integrifolia* var. *cedretorum*, *Biscutella pseudolyrata*, *Fumaria ouezzanensis*, *Narcissus broussonetii*, *Silene martyi*, *Stachys circinata* subsp. *zaiana* and *Teucrium decipiens*). Five taxa endemic to Morocco and the Iberian Peninsula (EI): *Arenaria hispanica*, *Campanula lusitanica*, *Fedia cornucopiae*, *Origanum compactum* and *Ornithogalum broteroi*. Six endemics to Morocco, the Iberian Peninsula and Algeria (EIA): *Aristolochia baetica*, *Cytisus arboreus* subsp. *baeticus*, *Linum tenue*, *Malva hispanica*, *Melilotus speciosus* and *Trachelium caeruleum*. A taxon endemic to Morocco and Algeria (EA): *Pallenis spinosa* subsp. *maroccana*. A taxon thought to be endemic to Morocco, the Iberian Peninsula, Algeria and the Canary Islands (EIAC?): *Cynara humilis*. We note that the number of endemic species in Morocco, the Iberian Peninsula and Algeria (EIA) and the number of endemic species in Morocco and the Iberian Peninsula (EI) is 11 or 57.89%.

The 20 species are divided between 13 families, the most represented being the Asteraceae and Lamiaceae (3 species each). The Campanulaceae, Caryophyllaceae and Fabaceae families are represented by 2 species each. The remaining 8 families: Amaryllidaceae, Aristolochiaceae, Asparagaceae, Brassicaceae, Linaceae, Malvaceae, Papaveraceae and Valerianaceae share the remaining 8 species equally between them.

Rich in Rare and Threatened Species

Overall, eleven species or 3.37% of the taxa recorded are classified as rare in the broadest sense of the term. Five species belong to the very rare class (RR): *Andryala integrifolia* var. *cedretorum*, *Daucus carota* subsp. *carota*, *Dittrichia graveolens*, *Stachys circinata* subsp. *zaiana* and *Valerianella dentata*. The rare category (R) is represented by *Fumaria ouezzanensis*, *Silene martyi* and *Laurus nobilis*. Suspected rare (R?) is the status of three species that are *Astragalus depressus*, *Bromus scoparius* and *Elaeoselinum meoides*. The eleven species are divided between the Apiaceae and Asteraceae families (Two species each), Caryophyllaceae, Fabaceae, Lamiaceae, Lauraceae, Papaveraceae, Poaceae and Valerianaceae (One species each).

Referring to the Red Book of Moroccan Vascular Flora, the 326 taxa assessed belong to seven categories (Tab. II), of which the non-threatened (LC) category is largely dominant with 294 (90.19%). The near threatened (NT) 11 species (3.37%), the not applicable (NA) category is represented by 8 species (2.45%) and data deficient (DD) taxa are the status of seven species (2.15%). Finally, the endangered category is represented by six species (1.84%). In fact, three species are vulnerable (VU) (*Astragalus depressus*, *Laurus nobilis* and *Origanum compactum*), two species are critically endangered (CR) (*Aristida congesta* and *Polypodium vulgare*) and one is endangered (EN) (*Biscutella pseudolyrata*).

II: Number of species by category and their percentages recorded in the flora of Brikcha SBEI: CR: Critically endangered; DD: Data Deficient; EN: Endangered; LC: Least Concern (Low risk of extinction); NA: Not applicable; NT: Near Threatened; VU: Vulnerable.

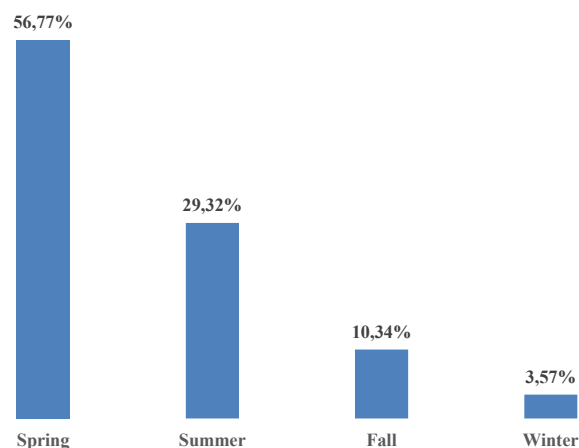
Category	Number of taxa	%
LC	294	90.19
NA	11	3.37
NT	8	2.45
DD	7	2.15
VU	3	0.92
CR	2	0.61
EN	1	0.31

It should be noted that according to the categories of the IUCN Red List (www.iucnredlist.org), *Laurus nobilis* is classified in the LC category.

Flowering Period

Fig. 4 shows that the SBEI flora blooms throughout the year. However, these flowerings are not uniform and sometimes show significant seasonal variations. For example, more than half (56.77%) of species flower in spring, while the rest (43.23%) are divided between 29.32% in summer, 10.34% in winter and 3.57% in autumn.

The flowering period of the most species-rich families varies from season to season. The majority of Asteraceae (86.91%) find spring and summer almost equally favourable flowering seasons. The same applies to Fabaceae (88.1%), but with a clear preference for the spring season (69%). Flowering periods in the Poaceae are strictly spread over three seasons. The flowers of 55.56% of species open in spring, 40% in summer and only 4.44% in autumn. Apiaceae flower from March to September. Some 62.5% of species are spring-flowering, while 37.5% are summer-flowering.



4: Flowering period of the vascular flora of Brikcha SBEI

DISCUSSION

The flora of Brikcha SBEI comprises 326 species in 253 genera and 81 families. In fact, ten of the sixty-five species listed in the SBEI (AEFCS, 1996) (*Agrimonia eupatoria*, *Andryala rothia*, *Balansaea glaberrima*, *Biscutella laevigata*, *Draba hirsuta*, *Geranium lucidum*, *Moehringia pentandra*, *Poa bulbosa*, *Ranunculus spicatus* and *Stachys germanica*) were not encountered during our surveys. There are several possible explanations for this situation. Among others, floristic surveys have not coincided with growth and flowering periods, or anthropogenic activities have led to a reduction in their numbers. Hence the need, in the future, to carry out investigations at different times of the year and over several successive annual cycles to confirm the presence of these 10 species and even discover others. These bibliographical additions bring the total to 336 species and 257 genera.

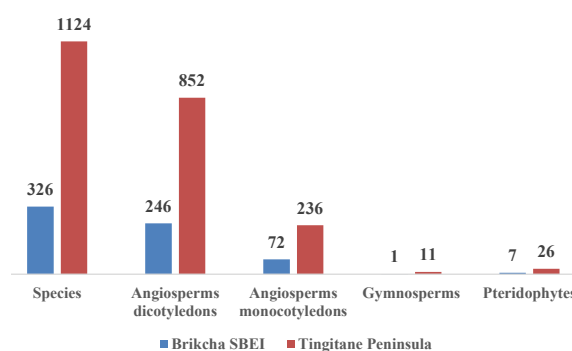
In the Brikcha SBEI, which is part of the Prérif (Man-1), we inventoried the species *Biscutella pseudolyrata* which is strictly Moroccan. This species was first recorded in the Gharb region (Between Rabat and Larache) by Vicent *et al.* (2019) and was also cited in the Moulay Driss Zerhoun region by Boudik *et al.* (2024). These results encourage us to multiply our botanical surveys with the aim of finding other species not mentioned in previous studies.

In terms of the total number of species, our results are similar to those obtained by Taleb and Fennane (2008) for the Haut Atlas Oriental National Park, which covers the province of Khénifra to the North and the province of Errachidia to the South. These authors counted 227 species, 21 subspecies and 55 varieties, i.e. 303 taxa divided into 56 families and 192 genera. The number of families and genera shows that the flora of the SBEI is more diversified. Considering that the small surface area of Brikcha SBEI represents only 1.63% of the park's surface area, estimated at 49,000 ha, its flora appears rich and diversified.

In comparison with the results obtained by the same authors for Jbel Ayachi and Jbel Maâsker, Brikcha SBEI is home to a higher number of people than either of the two Jebels. Jbel Ayachi comprises 197 taxa (140 species, 15 subspecies and 42 varieties) belonging to 42 families, while Jbel Maâsker comprises 96 species, 9 subspecies and 18 varieties in 31 families. The differences in edaphic, climatic and topographical conditions between Brikcha SBEI and the Eastern High Atlas National Park, Jbel Ayachi and Jbel Maâsker, are certainly at the origin of this heterogeneity in floristic richness.

Floristic richness, which corresponds to the number of species present in a given site, varies greatly from one protected area to another. In order to situate the floristic potential of the Brikcha SBEI in relation to other studies on a national scale or elsewhere, we had recourse to a rapid national and African biogeographical overview. The richness of

the SBEI is lower than that found in the Tingitane Peninsula, where Chambouleyron (2012) recorded 1124 taxa (Fig. 5). It covers an area of approximately 90,000 ha, 82% of which is located below 1 000 m altitude, the lowest point rising to 80 m and the highest point to 1821 m (Jbel Kelti). Precipitation in this region exceeds 2 000 mm per year on the mountains (Benabid, 1984) and three bioclimates are represented (Benabid, 1982), essentially according to an altitudinal gradient: sub-humid, humid and per-humid.



5: Comparison of species richness between the Brikcha SBEI and Peninsula Tingitane

Ibn Tattou (2006) identified 366 species (436 if we take into account the Belghazi working taxa) distributed in 62 (64) families in the Tamga SBEI, richer than the Brikcha SBEI but less diverse. The Tamga SBEI covers an area of 13959.70 ha and the analysis of the vegetation shows that there are three bioclimatic units, corresponding to different altitudinal levels (Aboulabbès, 2007):

- A unit characterized by a cool upper semi-arid bioclimate, marked by formations of red juniper (*Juniperus phoenicia*) and thuja (*Tetraclinis articulata*). The altitudinal levels corresponding to this bioclimatic stage range between 1 000 m and 1 600 m.
- A second bioclimatic unit belonging to the cool to cold sub-humid, is found at altitudes of 1 500 m to 2 200 m. The vegetation characterizing this unit consists of holm oak (*Quercus rotundifolia*) associated with oxycedar juniper (*Juniperus oxycedrus*).
- Finally, the third bioclimatic unit is that of the cold semi-arid which goes from 1 500 m to 2 500 m. The vegetation which characterizes this level is the thuriferous juniper associated, in the high-altitude steppes, with *Ormenis scariosa* and thorny xerophytes.
- We can conclude that the altitudinal gradient from 1 000 m to 2 500 m and climatic variations favored the installation of rich vegetation in the SBEI Tamga.

In the same context, the richness of Brikcha SBEI is lower than that obtained in some African countries. In Ivory Coast, in the mountain Péko National

Park with an area of 34,000 ha, Sidibé *et al.* (2020) identified 470 species belonging to 326 genera and 90 families while in the Southern Tai National Park (536,000 ha), Adou Yao and N'Guessan (2005) counted 908 species in 550 genera and 116 families. According to Medjahdi *et al.* (2009) in the Trara Mountains (North-western Algeria) revealed the existence of 558 taxa belonging to 87 families and 306 genera (Fig. 6).

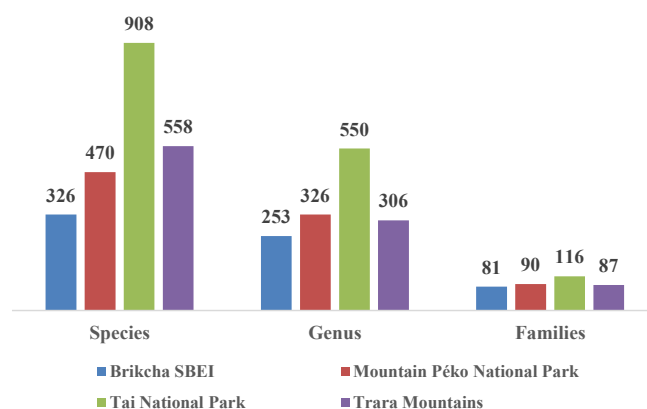
However, the number of taxa is higher than in other regions. In Chad, the Manda Park which is classified in category II, covers an area of 114,000 ha and its altitude varies from 344m to 691m was studied by Djimarabeye *et al.* (2021). This study revealed the existence of 142 species divided into 115 genera and 56 families. The most diverse families at the specific level are respectively Fabaceae, Poaceae, Combretaceae and Moraceae (Fig. 7).

In Senegal, the work of Diedhiou *et al.* (2014) in the agroforestry parks of the Island region of Mar Fafaco (Fatick, Senegal) inventoried 54 species divided into 24 families and 43 genera with the predominance of Caesalpiniaceae, Mimosaceae and Anacardiaceae. The Island of Mar in the Fatick region covers an area of 91.2 km², overall its relief is flat with a few low pressure areas constituting the valleys, the banks of the bolongs or the Saloum arm of the sea. Given that its geographical position makes it a strategic area, it is very popular with tourism promoters. In Burundi, Masharabu *et al.* (2010) recorded 270 and 146 species

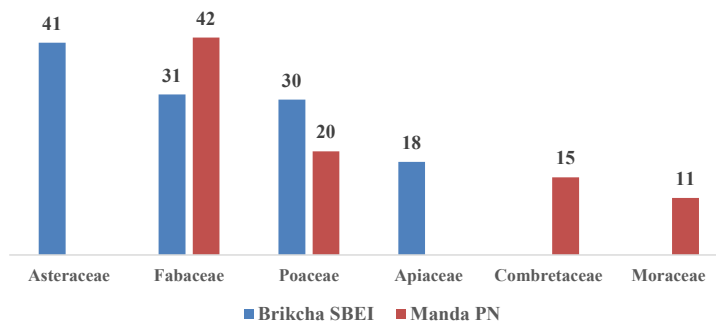
respectively in the savannahs and gallery forests of Ruvubu National Park. It should be added that this park covers an area of 50,800 ha, or approximately 1.8% of the Burundian national territory with an altitude which varies from 1 350 m to 1 830 m.

The richness of the Brikcha SBEI could be explained, on the one hand, by its membership of the IBRM and the "Betico-Rifain Complex" phytodiversity hot spot. On the other hand, the fact that surveys were carried out at the optimum time for plant development and were spread over the four seasons, the sufficient number of field trips, the combination of the two the sampling method and the investigations were carried out in different geomorphological units. The area's geographical position at the foothills of the Rif mountains, its edaphic structure, its geological history and its current and past climatic conditions provide particularly favorable conditions for the development of a rich and diverse flora. This richness could be linked to the low level of human activity to which the SBEI is subjected. This activity leads to the loss or degradation of natural areas. This reality in the field favors species survival and, consequently, biodiversity conservation. According to Kouassi *et al.* (2015), the more anthropized an environment is, the less diverse it is.

In terms of specific richness, angiosperms occupy first place, with 318 species, or 8.29% of Moroccan angiosperms. Next come the pteridophytes, there



6: Comparison of species richness between the Brikcha SBEI, mountain Péko National Park, Tai National Park and Trara Mountains



7: Comparison of the first four families between Brikcha SBEI and Manda PN

are 7 species, representing 10.93% of the national species; finally, the gymnosperms, with a single species, representing 5.88%. This representativeness is comparable to that of Orch *et al.* (2013) in the Izarène massif and Boudik *et al.* (2024) in the Moulay Driss Zerhoun region. These results could be explained by the fact that our study area and these last two regions belong to the same geographical floristic division of North Atlantic Morocco (Man). It should be noted that the region of Moulay Driss Zerhoun extends over an area of 55,800 ha with an altitude which goes from 300 m at the level of the plain to 1000 m altitude at the summit of Jbel Zerhoun. While the Izarène massif covers an approximate forest area of 14,600 ha with an altitude varying between approximately 350 m and 680 m.

Asteraceae (41 species, 12.58%); Fabaceae (31 species, 9.51%); Poaceae (30 species, 9.20%) are the three best-represented families, together accounting for 31.29% of the total. They are the same and in the same order as those of the national flora (Fennane and Ibn Tattou, 2012). The same is true of the study carried out by Tahri *et al.* (2011) in the Ben Slimane region (Western Morocco), but their order has changed. The authors found that out of a total of 450 species belonging to 66 families and 257 genera, the Fabaceae coming in first position (67 species), followed by Poaceae (54 species) and finally Asteraceae (52 species). From a climatic point of view, the majority of this region is subject to a semi-arid climate with the exception of the coastal strip (Bouznika-Temara) which is subject to a sub-humid climate while our region is in a sub-humid climate. Certainly the climatic factor is partly at the origin of this difference. In the Tamga SBEI (Ibn Tattou, 2006), Poaceae ranked second after Asteraceae, instead of third in our flora. Elsewhere, the results reported by N'da *et al.* (2008) in the Marahoué National Park, in the center-west of Ivory Coast, show that among the 607 species recorded, Fabaceae come first with 49 species, followed by Rubiaceae (48 species) and Euphorbiaceae (28 species). It should be noted that the Marahoué National Park (PNM) covers an area of 101,000 ha with an average altitude of 250 m. It is a climatic transition zone between the wetter Southern half (1200 to 1800 mm rainfall/year) and the drier North (1100 to 1600 mm rainfall/year).

The SBEI surveys led to the discovery of six species never before reported in Man-1. Indeed, *Biscutella pseudolyrata*, *Coriaria myrtifolia*, *Gagea fibrosa*, *Hedera helix* subsp. *maroccana*, *Laurus nobilis* and *Tamarix canariensis* have enriched its biodiversity. These additions reflect the fact that this territory boasts a rich flora that still includes taxa whose existence we didn't even know existed.

Of the 253 genera recorded, fifty-eight (58) include at least two (2) species and 195 genera are represented by a single species. In contrast to the classification of the first three families, the order of genera by number of species is far from identical

in the SBEI and the flora of Morocco. In the latter, *Silene* and *Ononis* are the most species-diverse, while in Brikcha SBEI, the most species-diverse genera are *Cistus* and *Quercus* with four species each. On a provincial scale, in the Izarène massif (Orch *et al.*, 2013), the genera *Cistus*, *Lathyrus* and *Silene* are the three richest genera with five species each, while the genera *Convolvulus*, *Geranium*, *Plantago*, *Ranunculus*, *Torilis* and *Vicia* occupy second place with four species each. Our results are not in line with those of other studies carried out in different regions. Tahri *et al.* (2011) found that the genera with the highest number of species were *Trifolium* with 18 taxa, followed by *Medicago* (9 taxa) and *Erodium* (taxa 8). Evariste *et al.* (2019) in the Ngog-Mapubi-Dibang forest massif (Cameroon) confirmed that the most diverse genera are *Cola*, *Macaranga*, *Trichilia*, *Ficus* and *Albizia*.

It should be noted that, like the number of species, it is the Asteraceae family which is best represented in terms of number of the genus (31 genera). However, in contrast to the number of species, it is the Poaceae family (26 genera) which occupies second position instead of Fabaceae (22 genera).

Our observations of species collected in the field enabled us to identify six life forms (Raunkier, 1934), of which therophytes represent 46.01%. This is in line with the study by Orch *et al.* in the Izarène massif, and confirms that therophytes are the most widespread life form in the region. The same is true in the Ajdir-Itzer - Boumia - Midelt region (Middle Atlas), where Hachi and Rahou (2021) found that therophytes represented 49%, and in the Haouz-Rehamna region, where Benkhniue *et al.* (2023) confirmed the dominance of therophytes. This richness in therophytes is a feature of Mediterranean and arid zones where high-water stress prevails (Daget, 1980; Madon and Médail, 1996). Furthermore, according to Nègre (1966), the richness of therophytes is a sign of the aridity of the environment.

The rate of therophytes in SBEI is lower than that (51%) found in Assaba (Mauritania) by Ould Mohamed Vall *et al.* (2011). On the other hand, it is higher than that found in the Zegla forest, Merine district (Western Algeria) by El Bouhissi *et al.* (2021) (25.33%) and in the Souf (Algerian Northern Sahara) by Medjber (2014) (45.16%).

Phanerophytes rank third with 46 species (14.11%). Given that the SBEI is a pre-forest area, this high percentage could be explained by the presence of woody plants, i.e. trees, shrubs, bushes and lianas. These include the following species: *Quercus faginea*, *Quercus suber*, *Fraxinus angustifolia*, *Olea europaea* subsp. *oleaster*, *Phillyrea latifolia*, *Quercus rotundifolia*, *Rhamnus alaternus*, *Quercus coccifera*, *Crataegus monogyna*, *Tamarix canariensis*, *Myrtus communis*, *Vitex agnus-castus*, *Nerium oleander*, *Viburnum tinus*, *Pistacia lentiscus*, *Cistus monspeliensis*, *Cistus albidus* and *Lavandula stoechas*. These phanerophytes dominate the generally verdant plant landscape, and by creating

microclimates, they encourage the development of other forms of life. Kazimna *et al.* (2022) found a much higher rate (65.44%) in the mountain ranges of the Kabyé country (North Togo).

As far as endemic species are concerned, twenty species are recognized as endemic, i.e. 6.13% of the total SBEI species, divided into five categories of endemism. The rarity rate of endemic species is 20%, while one species is threatened (*Origanum compactum*).

If we refer to the study by Fennane (2004), we can see that the rate of endemism of the Moroccan vascular flora as a whole (21.1%) is significantly higher than our own. Equally, it is relatively low compared with those found in other regions: 12.35% in the Mabi classified forest in South-Eastern Ivory Coast according to Amba *et al.* (2021); 7.27% in the Izarène massif according to Orch *et al.* (2013); 7.26% mountains de Saida (Algeria) as reported by Aouadi *et al.* (2020) and 6.22% in Jbel Zerhoun according to Boudik *et al.* (2024). Indeed, our rate of endemism is equal to that found in the Achach forest (6.13%), central plateau (Morocco) by Bammi and Douira (2004). However, it is almost equal to that found by Hamel *et al.* (2013) in the Edough peninsula (North-East Algeria) (6.09%) and relatively high to that found by Hammada (3.52%) in the coastal dunes of Oued El Maleh (Martil) and lower Tahaddart.

The three best-represented endemism categories are Moroccan category (7 species) Ibero-Algero-Moroccan category (6 species) and Ibero-Moroccan category (5 species). The presence of six endemic species in Morocco, the Iberian Peninsula and Algeria (EIA) and five endemic species in Morocco and the Iberian Peninsula (EI), i.e. a total of 11 species (57.89%) confirms that the SBEI is an integral part of the Bético-Rifain Hotspot (Shared by the Iberian Peninsula, Morocco and Algeria) (Médail and Quézel, 1997). The importance of Algerian-Ibero-Moroccan endemics has been demonstrated in the Izarène massif by Orch *et al.* (2013) and in the Tlemcen National Park (Algeria) by Letreuch-Belarouci, 2009. As a result, the two regions belonging to the same Hotspot. Endemics are mainly therophytes (50%) and geophytes (20%). Seven species are strictly endemic to Morocco, representing 2.14% of the total. In the Tazekka massif (Taza region, Morocco), Fougrach *et al.* (2007) found a rate of 8.8%. The rate of endemism differs from region to region and is no longer proportional to species richness. It depends on several parameters, of which altitude is the most important. The difference in the rate of endemism could be explained by the low altitude of the SBEI, where the average altitude is around 240.6 m, whereas in the Tazekka massif altitudes range from 500 to 1980 m. Indeed, several authors have reported that the rate of endemism increases with altitude. Among others, Ouhammou (2003, 2005) has clearly shown the strong correlation between altitude and endemism rate, and Quézel (1995, 1999) has emphasized the

role of high mountains in the evolutionary processes of local progressive speciation. This is supported by the results obtained in the Ayachi massif by Taleb and Fennane (2008). Its orographic diversity and high altitude (3 757 m) have led to the establishment and individualization of a flora that is very rich in endemic taxa, with around 72 taxa, representing an endemism rate of 36.54%.

In terms of the surface area occupied by the SBEI, however small it may be and its altitude of 240.6 m, it has a remarkable level of endemism.

Of the 326 species recorded in this region, eleven are rare in the broad sense of the term, i.e. 3.37%, belonging to three categories of rarity: five very rare taxa (RR); three suspected rare taxa (R?) and three rare taxa (R). According to Myres *et al.* (2000), efforts to conserve endemic, rare and endangered species should be a priority. This rarity rate is lower than that recorded in the Tazekka massif (11.4%). Therophytes dominate the rare taxa with 63.64%.

The majority of species inventoried (90.19%) belong to the category of minor concern (LC). Our results are similar to those found by Boudik *et al.* (2024) in the Moulay Driss Zerhoun region, where the authors found (92.4%).

The presence of emblematic species gives the SBEI a high biodiversity value and demonstrates its contribution to preserving the original footprints of the plant history of the Prérif hills. In fact, it is home to four species of oak: kermes oak (*Quercus coccifera*), cork oak (*Quercus suber*), the holm oak (*Quercus rotundifolia*) and the Zen oak (*Quercus faginea*). Indeed, as an indicator species and of considerable ecological, socio-economic and heritage interest, *Quercus faginea* is the emblematic species. The circumference of some trunks exceeding 3 m in circumference and 6 m in height. It is found on particular sites. An analysis of where it grows shows that it is scattered mainly on the Northern slopes of Oued Takesset and the Western slopes of Oued Zandoula in the territorial municipality of Ain Baida. It grows best on the banks of these wadis. These places are wetter, shadier, with cooler exposures and less intensive sunshine. The altitudinal range is from 112 m to 295 m. Natural regeneration was observed, with the presence of very small seedlings.

The second species is *Laurus nobilis*. It was observed in three different locations. Indeed, in the territorial municipality of Brikcha, a single plant was identified in a temporary watercourse located to the far West of SBEI in the locality named Ain Bekar. Two other plants were found in a North-facing location at an altitude of 240 m. Both places are damp and shady. In the territorial municipality of Ain Beida, and downstream of a permanent water source, a few plants were found not far from the East of the SBEI at the bed of a watercourse. As a medicinal and aromatic plant renowned for its many beneficial therapeutic effects, its leaves are much sought-after by the local population. They use



8: *Juniperus oxycedrus* subsp. *oxycedrus*: Appearance and habit of the plant in its environment, Northern slope of Brikcha SBEI near Oued Takkesset (Chriqui in June 2024)

it mainly to flavor dishes and to prepare remedies based on traditional medicine. As a result, it has been over-exploited, causing a decline in its habitat and a remarkable drop in the number of trees. This situation has worsened with the recurrence of drought years over the last two decades, causing the death of shoots and other plants due to water stress.

The third species is *Juniperus oxycedrus* subsp. *oxycedrus*. Only six plants have been identified in three different locations on the Oued Takesset bed (Fig. 8). These plants are persistent remnants and seem, on the one hand, to confirm that the Prérif,

until recently, was the preferred natural area for a wider variety of forest species than is the case today. And on the other hand, they suggest that its past had a wider horizontal and vertical distribution.

In our opinion, particular attention should be paid to all three species, as well as to endemic, rare and endangered species. Additional protection efforts must be made to better preserve them from any disruptive threats.

The presence of many species is limited to very confined places with only a few plants, or even one, as in the case of *Anagyris foetida*. A single plant has been identified halfway up the extreme Western slope of the SBEI Brikcha at an altitude of 380 m. It is a 2.30 m shrub, cited by Bellakhdar *et al.* (1991) as being commonly used in traditional medicine to treat burns or other stomach “ailments”. As a result, its natural regeneration by direct sowing of seeds or artificial regeneration would be desirable, allowing it to multiply and thus ensuring its long-term survival.

Our field surveys revealed the existence of three exotic forest species (*Acacia saligna*, *Pinus canariensis* and *Pinus halepensis*) that have been the subject of previous reforestation operations.

Like other protected areas facing the combined effect of harsh climatic conditions and, above all, human activity, the Brikcha SBEI is not spared these problems that threaten its integrity. Indeed, some very rare illegal logging operations have been observed, as well as pastoral activity based on goat herds. Of course, the efforts made by forest rangers in terms of protection and surveillance have reduced human activity. As a result, the SBEI appears to be well preserved, and remains the best protected of all provincial regions.

CONCLUSION

The Brikcha SBEI remains an exceptional ecosystem in the Prérif region, with significant diversity. The present study has enabled us to gain a better understanding of its floristic taxonomy. It reports the presence of 326 species belonging to 253 genera and 81 botanical families, of which the Asteraceae, Fabaceae and Poaceae are the best represented. Compared to other regions, and despite its small size, its richness is estimated to be high. Therophytes are the most representative life of forms. In terms of special-status species, twenty endemic species of which the Algerian-Ibero-Moroccan and Ibero-Moroccan categories make the SBEI part of the Bético-Rifain Hotspot. Some taxa are of particular importance, as they are rare or endangered species.

This study complements previous work carried out by Prérif. Its results constitute both a reliable database and a reference tool for decision-makers, students, researchers and the general public. They could also help in the decision-making process for any sustainable management strategy, serve to carry out other studies (Phytosociological and phytochemical, etc.) and popularize floristic knowledge. The Souk El Had SBEI is one of the best examples of this kind of study, and its inventory would help establish the most exhaustive regional floristic database possible.

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APPENDIX

Appendix A: Floristic list; Life forms spectrum; Bioclimatic stage; Flowering period; Assessment criteria; Rarity and endemism and Geographic distribution in Morocco of flora of the Brikcha SBEI, Prérif (North-West Morocco).

Abbreviations: Life form spectrum: **Ph**: Phanerophyte; **Ch**: Chamaephyte; **Hem**: Hemicryptophyte; **G**: Geophyte; **Th**: Therophyte; **Hyd**: Fixed hydrophyte. **Bioclimatic stage**: **S**: Saharan; **A**: Arid; **SA**: Semi-arid; **H**: Humid; **SH**: Subhumid; **HM**: High Mountain. **Flowering period**: **F**: Fall; **W**: Winter; **S**: Spring; **Su**: Summer. **Assessment Criteria**: **CR**: Critically endangered; **DD**: Data Deficient; **LC**: Least Concern (low risk of extinction); **NA**: Not applicable; **NT**: Near Threatened; **VU**: Vulnerable. **Distribution in the geographical divisions of Morocco**: **Ms**: Morocco Saharan; **As**: Saharan Atlas; **AA**: Anti Atlas; **HA**: High Atlas; **MA**: Middle Atlas; **Man**: North Atlantic Morocco; **Op**: Eastern Morocco plateaus; **Om**: Mountains of eastern Morocco; **EA**: Mediterranean coastline; **R**: Rif. **Endemism**: **E**: endemic to Morocco; **El**: endemic to Morocco and the Iberian Peninsula; **EA**: Endemic to Morocco and Algeria; **EIA**: Endemic to Morocco Algeria and the Iberian Peninsula; **EIC**: Endemic to Morocco, the Iberian Peninsula and the Canaries; **EIAC**? Suspected. **Rarty**: **R**: Rare; **RR**: Very rare; **R?**: Suspected rare.

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
I - PTERIDOPHYTES						
ADIANTACEAE						
<i>Anogramma leptophylla</i>	Th	(A), SA, SH, H	W, S	LC	AA, HA, MA, Mam, Man, Om, LM, R	
ASPLENIACEAE						
<i>Asplenium adiantum-nigrum</i>	G	SA, SH, H	S, Su	LC	AA, HA, Man	
<i>Asplenium ceterach</i>	G	A, SA, SH, H	W, S, Su, F	LC	As, AA, HA, MA, Mam, Man, Om, LM, R	
DENNSTAEDTIACEAE						
<i>Pteridium aquilinum</i>	G	SH, H	S, Su	LC	HA, MA, Man, R	
EQUISETACEAE						
<i>Equisetum ramosissimum</i>	G	S, A, SA, SH, H	(W), S	LC	All geographic divisions	
POLYPODIACEAE						
<i>Polypodium vulgare</i>	G	SA, SH, H, HM	W, S, (Su)	CR	RR	HA, MA, Man, LM, R
SELAGINELLACEAE						
<i>Selaginella denticulata</i>	Hem	SA, SH, H	W, S	LC		HA, MA, Mam, Man, Om, LM, R
II - GYMNOSPERMS						
CUPRESSACEAE						
<i>Juniperus oxycedrus subsp. oxycedrus</i>	Ph	SA, SH, H	W, S	LC	Man (Ouezzane)	
III - MONOCOTYLEDONOUS ANGIOSPERMS						
ALLIACEAE						
<i>Allium ampeloprasum</i>	G	(A), SA, SH, H	S, Su	LC	As, AA, HA, MA, Mam, Man, Op, Om, LM, R	

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Allium pallens</i>	G	A, SA, SH, HM	S, Su	LC		As, AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Allium triquetrum</i>	G	SA, SH	W, S	LC		Man, LM, R
AMARYLLIDACEAE						
<i>Acis autumnalis</i>	G	SA, SH	(Su), F	LC		MA, Mam, Man, Om, LM?, R
<i>Narcissus broussonetii</i>	G	SH	F, (W)	NT	E	HA?, Mam, Man
<i>Narcissus serotinus</i>	G	A, SA, SH	F	DD		AA (Ait Baha, Tamegdoult), Mam, Man, LM?, R
ARACEAE						
<i>Arisarum vulgare</i>	G	A, SA	W, S, (Su)	LC		All geographic divisions
<i>Arum italicum</i>	G	A, SA, SH, H	S, (Su)	LC		HA, MA, Man, Op, Om, LM, R
ARECACEAE						
<i>Chamaerops humilis</i>	Ch	A, SA, SH	S, (Su)	LC		AA, HA, MA, Mam, Man, Om, LM, R
ARISTOLOCHIACEAE						
<i>Aristolochia baetica</i>	Ph	SA, SH, H	W, S	LC	EIA	AA, HA, Man, Om, LM, R
<i>Aristolochia paucinervis</i>	G	SA, SH, H	S	LC		AA, HA, MA, Mam, Man, Om, LM, R
ASPARGACEAE						
<i>Asparagus albus</i>	Ph	A, SA, SH	Su, F	LC		AA (Tazeroualt; j. Kest), HA, MA, Mam, Man, Op, Om (Bni Snassène), LM, R
<i>Asparagus aphyllus</i>	Ch	A, SA, SH	Su, F	LC		Mam (Haouz Rehamna), Man, Op, Western LM?, R
<i>Dipcadi serotinum</i>	G	A, SA, SH	F, W, S	LC		All geographic divisions
<i>Drimia maritima</i>	G	A, SA, SH, H	Su, F, (W)	LC		All geographic divisions
<i>Hyacinthoides lingulata</i>	G	SA, SH	F, (W)	LC		Mam (Chaouia-Doukkala), Man, Om (Bni Snassène), LM, R
<i>Ornithogalum algeriense</i> subsp. <i>algeriense</i>	G	SA, SH, H	S, Su	LC		AA, HA, MA, Man, Om, LM, R
<i>Ornithogalum broteroi</i>	G	SA, SH, H	S	NT	EI	Mam, Man, LM?, R
<i>Prospero autumnale</i>	G	SA, SH, H	F	LC		HA, MA, Mam, Man, Om, LM, R
<i>Ruscus hypophyllum</i>	G	SA, SH, H	W, S	LC		MA, Mam, Man, Om, LM, R
<i>Scilla peruviana</i>	G	A, SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op, Om (Bni Snassène), LM, R
CYPERACEAE						
<i>Carex distachya</i>	Hem	SA, SH, H	(W), S, (Su)	LC		HA, MA, Mam, Man, Om, LM, R
<i>Bolboschoenus glaucus</i>	G	SH	S, Su	DD		Mam (Daya N de o. Massa)

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Carex divulsa</i>	Hem	A, SA, SH, H	S, (Su)	LC		HA, MA, Mam, Man, LM occidental, R
<i>Carex halleriana</i>	Hem	SA, SH, H	(W), S	LC		AA, HA, MA, Mam, Man, Om, Lm, R
<i>Cyperus longus</i>	HyF	A, SA, SH, H	S, Su, (F)	LC		Ms (sahara), As, AA (Saghtro), HA, MA, Mam, Man, Op, Om (Bni snassène: Oulad Salah), LM, R
<i>Scirpoides holoschoenus</i>	Hem	A, SA, SH, H	(W), S, Su	LC		All geographic divisions
DIOSCOREACEAE						
<i>Dioscorea communis</i>	G	(A), SA, SH, H	(W), S, (Su)	LC		AA (Ifni Mountains), HA, MA, Mam, Man, Om, LM?, R
IRIDACEAE						
<i>Gladiolus italicus</i>	G	A, SA, SH	S	LC		AA, HA, Central MA, Mam, Man, Op, Om?, LM, R
JUNCACEAE						
<i>Juncus bufonius</i>	Th	S, A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Juncus hybridus</i>	Th	A, SA, SH, H	S, Su	LC		Man (Gharb; Ouezzane region), Op, R
LILIACEAE						
<i>Fritillaria oranensis</i>	G	SA, SH, H	W, S	NT		HA (j. Guerdouz above Touflihte)?, MA (Itzer à j. Sâa, 2200m; ari-n-Initif), Man, Op, Om (Bni Snassène; Ghar Roubane), LM, R
<i>Gagea fibrosa</i>	G	A, SA	W, S	LC		As, AA, Mam (Sidi Mohammed Samba; Messjoun N of Caïd Layadi's Azib), Op, Om (Bni Snassène), LM
ORCHIDACEAE						
<i>Barlia robertiana</i>	G	A, SA, SH, H	S	DD		MA (Ifrane, Tazzeke), Mam, Man (Zerhour; Meknes), LM ?, R
<i>Neotinea maculata</i>	G	SH, H	S	LC		HA, MA, Man (j. Zalagh; j. Zerhour), Man (N d'adras Asselalou entre Oulmès et Tifoughaline) Om?, LM, R
<i>Ophrys apifera</i>	G	SA, SH, H	W, S	LC		AA (Ait Taleb of the Ammeln), HA, MA, Mam, Om, LM, R
<i>Ophrys fusca</i>	G	SA, SH, H	S	LC		HA, MA, Mam, Man, Om?, LM, R
<i>Ophrys speculum</i>	G	SA, SH, H	S	LC		HA, MA, Mam, Man, Om?, LM, R
<i>Serapias lingua</i>	G	SA, SH, H	S	LC		HA, MA, Mam, Man, LM?, R
POACEAE						
<i>Aegilops geniculata</i>	Th	A, SA, SH, H	S, Su	LC		As, AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Aegilops neglecta</i>	Th	A, SA, SH, H	S, Su	LC		AA?, HA, MA, Mam, Op, Om LM, R
<i>Ampelodesmos mauritanicus</i>	Hem	SA, SH, H	S, (Su)	LC		MA, Man (Fez and Meknes region), Om (Bni Snassène), LM

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Anisantha tectorum</i>	Th	SA, SH, HM	S, Su	LC		As, AA, HA, MA, Man Op, LM, R
<i>Anthoxanthum ovatum</i>	Th	SA, SH, H	(W), S, (Su)	LC		HA, MA, Mam, Man, Op, LM, R
<i>Aristida congesta</i>	Hem	SA, SH	S, (Su)	CR		Man
<i>Arundo donax</i>	G	(A), SA, SH	Su, F, (W)	LC		All geographic divisions
<i>Avena barbata</i>	Th	A, SA, SH	(W), S, (Su)	LC		Oriental Ms, As, AA, HA, MA, Mam, Man, Op, Om (Bni Snassène), LM, R
<i>Brachypodium sylvaticum</i>	Hem	SH, H	S, (Su)	LC		HA, MA, Man, LM, R
<i>Briza maxima</i>	Th	SA, SH, H	S, Su	LC		HA, MA, Mam, Man, Op, LM, R
<i>Briza minor</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		AA, HA, MA, Mam, Man, Op, LM, R
<i>Bromus hordeaceus</i>	Th	S, A, SA, SH, H	S, (Su)	LC		Ms (O. Aâbar in N of Abattih on Smara-Tantan road), AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Bromus scoparius</i>	Th	SA, SH,	S, (Su)	LC		MA, Mam, Man (Meknes, Fez and its surroundings)
<i>Cynodon dactylon</i>	G	S, A, SA, SH, H	Flowering possible all year	LC		All geographic divisions
<i>Cynosurus echinatus</i>	Th	SA, SH, H	S, Su	LC		MA, Man, Om (Bni Snassène), LM, R
<i>Dactylis glomerata</i>	Th	(A), SA, SH, H, (HM)	S, Su	LC		AA, Mam (Chaouia-Doukkala), Man
<i>Gaudinia fragilis</i>	Th	A, SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op, LM, R
<i>Hordeum murinum</i>	Th	S, A, SA, SH, H	(W), S, Su	LC		All geographic divisions
<i>Hyparrhenia hirta</i>	Hem	S, A, SA, SH	S, Su, F	LC		Ms (lower valley of the western Draâ)?, MA (around Taza, 930 m), Mam (Marrakech)?, Man, LM, R
<i>Lamarckia aurea</i>	Th	A, SA, SH	S, Su	LC		All geographic divisions
<i>Lolium perenne</i>	Hem	SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Lolium temulentum</i>	Th	SA, SH, H	S, Su	LC		HA, MA, Man, Op (Banks of the Moulouya), LM, R
<i>Melica minuta</i>	Hem	A, SA	S, Su	LC		HA, MA, Man, Op, Om, LM, R
<i>Phalaris canariensis</i>	Th	SA, SH	S, (Su)	NA		Mam, Man, Western LM, R
<i>Phragmites australis</i>	G	S, A, SA, SH, H	Su, (F)	LC		All geographic divisions
<i>Poa trivialis</i>	Hem	A, SA, SH, H	S, (Su)	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Polypogon monspeliensis</i>	Th	S, A, SA, SH	(W), S, (Su)	LC		All geographic divisions
<i>Stipa capensis</i>	Th	S, A, SA, SH	S, Su	LC		All geographic divisions
<i>Sorghum halepense</i>	G	(S), A, SA	Su, F	LC		Ms (Kelat Meggipina), HA, MA, Mam, Man, Op, Om, LM, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Trachynia distachya</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		All geographic divisions
SMILACEAE						
<i>Smilax aspera</i>	Ph	SA, SH, H	Su, (F)	LC		As, AA, HA, MA, Mam, Man, Om, LM, R
TYPHACEAE						
<i>Typha angustifolia</i>	HyF	SA, SH, H	S, Su	LC		HA (O. Tifenout), MA (Dayet Aoua ; o.Tizguite ; Ouzoud waterfalls), Mam, Man, Om (Bni Snassène), LM?, R
XANTHORRHOACEAE						
<i>Asphodelus albus</i> subsp. <i>ramosus</i>	G	A, SA, SH, H	(F), S, Su	LC		All geographic divisions
IV - DICOTYLEDONOUS ANGIOSPERMS						
ACANTHACEAE						
<i>Acanthus mollis</i> subsp. <i>platyphylus</i>	Hem	SA, SH, H	S, Su	LC		MA, Man, Om, LM, R
ADOXACEAE						
<i>Viburnum tinus</i>	Ph	SA, SH, (H)	S	LC		HA, MA, Man, Om (Bni Snassène), LM, R
AMARANTHACEAE						
<i>Amaranthus blitoides</i>	Th	SA, SH	Su	LC		MA, Mam, Man
<i>Atriplex prostrata</i>	Th	A, SA, SH	(S), Su	LC		Mam, Man, Op, LM, R
<i>Chenopodium album</i>	Th	S, A, SA, SH, H	S, Su, F	LC		Ms, AA, HA, MA, Mam, Man, Op, R
<i>Chenopodium murale</i>	Th	S, A, SA, SH	W, S, Su	LC		All geographic divisions
ANACARDIACEAE						
<i>Pistacia lentiscus</i>	Ph	SA, SH, H	S	LC		As, AA, HA, MA, Mam, Man, Om, LM, R
APIACEAE						
<i>Ammi majus</i>	Th	SA, SH, H	S	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Ammi visnaga</i>	Th	(A), SA, SH, H	S, Su	LC		All geographic divisions
<i>Apium nodiflorum</i>	HyF	S, A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Bunium bulbocastanum</i>	G	A, SA, SH, H	S	NA		AA, MA, Mam, Man, Op, Om, LM, R oriental
<i>Conium maculatum</i>	Th	A, SA, SH, H	S	LC		HA, MA, Mam, Man, OP, Om, LM, R
<i>Conopodium glaberrimum</i>	G	SA, SH, H	S	LC		HA, MA, Man, Om, LM, R
<i>Daucus carota</i> subsp. <i>carota</i>	Th	A, SA, SH, H	S, Su	LC	RR	HA?, MA, Mam, Man, Om, LM, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Daucus crinitus</i>	G	A, SA, SH, H	S, Su	LC		AA, Western HA, MA, Mam, Man, Op, LM, R
<i>Elaeostelinum foetidum</i>	G	SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, R
<i>Elaeostelinum meoides</i>	G	SA, SH, H	S, Su	LC	R?	AA (Ifni mounts), HA (j. Ouaskal; Isk Rached), MA (Bab Azhar; between Ouauizaght and Taguelft), Mam (Souss; Derouate; Jbilète) LM, R
<i>Eryngium tricuspidatum</i>	Hem	A, SA, SH, H	Su	LC		Ms, AA, HA, MA, Mam, Man, Op, LM, R
<i>Ferula communis</i>	G	A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Kundmannia sicula</i>	G	SA, SH, H	S	LC		AA, HA, MA, Mam, Man, Op, LM, R
<i>Oenanthe crocata</i>	Hem	SH, H	S	LC		MA(Bab Azhar), Man, LM, R
<i>Ridolfia segetum</i>	Th	A, SA, SH, H	S, Su	LC		HA, MA, Mam, Man, Op, LM, R
<i>Smyrnium olusatrum</i>	G	SA, SH, H	W, S	LC		HA, MA, Mam, Man, Op, LM, R
<i>Thapsia transtagana</i>	G	A, SA, SH, H	S	LC		Ms?, HA, MA, Mam, Man, Op, LM, R
<i>Torilis nodosa</i>	Th	A, SA, SH, H	S	LC		All geographic divisions
APOCYNACEAE						
<i>Nerium oleander</i>	Ph	S, A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Vinca major</i>	Hem	SA, SH	S, Su	NA		HA, Man, R
ARALIACEAE						
<i>Hedera helix</i> subsp. <i>maroccana</i>	Ph	SA, SH, H	F	LC		AA, HA, MA, Mam, LM, R
ASTERACEAE						
<i>Anacyclus clavatus</i>	Th	A, SA, SH, H	(W), S, Su	LC		Western Ms, HA, MA, Mam, Man, Op, LM, R
<i>Andryala integrifolia</i> var. <i>cedretorum</i>	Th	SH, H	S	LC	E	Central HA, MA, Man, LM, R
<i>Anthemis arvensis</i>	Th	SH, H	S, Su	LC		HA, Man, Op, LM, R central
<i>Atractylis cancellata</i>	Th	S, A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Bellis annua</i>	Th	A, SA, SH, H	W, S, (Su)	LC		HA, MA, Mam, Man, Op, LM, R
<i>Bellis sylvestris</i>	Hem	SA, SH, H	W, S, Su, (F)	LC		AA, HA, MA, Mam, Man, Op (Lower Moulouya), Om, LM, R
<i>Calendula arvensis</i>	Th	Redural plant	W, S, Su	LC		All geographic divisions
<i>Carlina gummifera</i>	Hem	A, SA, SH	Su, F	LC		HA, MA, Mam, Man, Op, LM, R
<i>Carlina racemosa</i>	Th	A, SA, SH	S, Su, (F)	LC		HA, MA, Mam, Man, Op, LM, R
<i>Centaurea calcitrapa</i>	Th	A, SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op, LM, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Centaurea melitensis</i>	Th	S, A, SA, SH	S, Su	LC		Oriental Ms, As, AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Cichorium intybus</i>	Hem	SA, SH, H	S, Su	LC		HA, MA, Mam, Op, Om, LM, R
<i>Coleostephus myconis</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Crepis vesicaria</i> subsp. <i>taraxacifolia</i>	Hem	A, SA, SH, H	W, S, Su	LC		Non-Saharan Morocco
<i>Cynara humilis</i>	G	SA, SH, H, HM	S, Su	LC	EIAC?	HA, MA, Mam, Man, LM western, R
<i>Dittrichia graveolens</i>	Th	A, SA	Su, F	LC	RR	Man, Op (Lower moulouya), Om (Bni Snassène), LM, R
<i>Dittrichia viscosa</i>	Ch	A, SA, SH, H	Su, F	LC		All geographic divisions (except Non-Saharan Morocco)
<i>Filago gallica</i>	Th	SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op (Lower Moulouya), Om, LM, R
<i>Filago pyramidata</i>	Th	S, A, SA, SH, H	(W), S, (Su)	LC		Ms, AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Galactites tomentosus</i>	Th	A, SA, SH	S, Su	LC		HA, MA, Mam, Man, Op, Om, LM
<i>Hedynois rhagadioloides</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		All geographic divisions
<i>Helminthotheca echioides</i>	Th	A, SA, SH, H	S, Su	LC		Non-Saharan Morocco
<i>Hypochoeris achyrophorus</i>	Th	A, SA, SH, H	S, Su	LC		HA, MA, Mam, Man, Op, Om, LM, R
<i>Hypochoeris radicata</i>	Hem	A, SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Hyoseris radiata</i>	Hem	A, SA, SH, H	S, Su	LC		Non-Saharan Morocco
<i>Leontodon saxatilis</i>	Th	A, SA, SH, H	S, Su	LC		Western AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Leontodon tuberosus</i>	Hem	SA, SH, H	W, S	LC		HA, MA, Mam, Man, Op, Om, LM, R
<i>Pallenis spinosa</i>	Hem	A, SA, SH, H	(W), S, Su	LC		Ms (Errachidia), Mam, Man, Op (Lower moulouya), Om (Bni Snassène), LM, R
<i>Pallenis spinosa</i> subsp. <i>maroccana</i>	Hem	A, SA, SH, H	(W), S, Su	LC	EA	AA, HA, MA, Mam, Man, Op (Lower Moulouya), Om, LM, R
<i>Phagnalon rupestre</i>	Ch	A, SA, SH, H	S, Su	LC		Oceanic Ms (Hassi Zehar), HA, MA, Mam, Man, Op (Lower Moulouya), Om, LM, R
<i>Picnemon acarna</i>	Th	SA, SH, H	(S), Su	LC		HA, MA, Man (Middle Préfif; Sebou), Om, LM, R
<i>Pulicaria inuloides</i>	Hem	S, SA, SH, H	S, Su	LC		All geographic divisions
<i>Pulicaria odora</i>	Hem	SA, SH, H	S, Su	LC		HA, MA, Mam, Man, Op, Om, LM, R
<i>Scolymus hispanicus</i>	Hem	S, A, SA, SH, H	S, Su	LC		Ms (Rissani), AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Senecio glaucus</i> subsp. <i>coronopifolius</i>	Th	S, A, SA, H	W, S, Su	LC		Ms, As, AA, HA, Mam, Op
<i>Senecio lvidus</i>	Th	SA, SH, H, HM	W, S, Su	LC		AA, HA, Mam, Man, LM, R
<i>Silybum marianum</i>	Th	A, SA, SH, H	S, Su	LC		Ms (SW of Guelmim), HA, MA, Mam, Man, Op, Om, LM, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Stachelina dubia</i>	Ch	SA, SH	S, Su	LC		HA, MA, Man (Zerhoun), Om, LM, R
<i>Tolpis barbata</i>	Th	SA, SH	S, Su	LC		Man, Op, Om, LM, R
<i>Urospermum picroides</i>	Th	A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Xanthium orientale</i>	Th	A, SA, SH	Su	LC		Mam (Souss), Man, Op (Lower Moulouya), LM, R
BORAGINACEAE						
<i>Cynoglossum creticum</i>	Th	A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Echium plantagineum</i>	Th	A, SA, SH	S, Su	LC		Non-Saharan Morocco
<i>Heliotropium supinum</i>	Th	A, SA, SH	Su	LC		AA littoral, MA (Daya of Annoeur), Mam, Man, Op, Om (Bni Snassène), LM, R
<i>Myosotis discolor</i>	Th	SA, SH, H, HM	S	LC		AA, HA, Man, R
<i>Neotostema apulum</i>	Th	SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
BRASSICACEAE						
<i>Biscutella pseudolyrata</i>	Th	SH	S, Su	EN	E	Man
<i>Cardamine flexuosa</i>	Th	SA, SH	W, S	NA		HA, R
<i>Cardamine hirsuta</i>	Th	SA, SH, H	W, S	LC		AA, HA, MA, Man, Om, LM, R
<i>Nasturtium officinale</i>	HyF	A, SA, SH	S	LC		All geographic divisions
<i>Raphanus raphanistrum</i>	Th	A, SA, SH, H	S, Su	LC		All geographic divisions except Ms and As
CAMPANULACEAE						
<i>Campanula dichotoma</i>	Th	SA, SH, H	S, Su	LC		All geographic divisions
<i>Campanula lusitanica</i>	Th	SA, SH, H	S, Su	LC	EI	AA, HA, MA, Mam, Man, Om, LM, R
<i>Campanula rapunculoides</i>	Hem	SA, SH, H	S, Su	LC		Western AA, HA, MA, Mam, Man, Om, LM, R
<i>Trachelium caeruleum</i>	Ch	S, A, SA, SH, H	S, Su	LC	EIA	All geographic divisions
CAPRIFOLIACEAE						
<i>Lonicera implexa</i>	Ph	SA, SH, H	S, Su	LC		As, Western AA, HA, MA, Mam, Man, Om, LM, R
<i>Lonolostia simplex</i>	Th	SA, SH, H	S, Su	LC		Western AA, HA, MA, Mam, Man, Om, LM, R
CARYOPHYLLACEAE						
<i>Arenaria hispanica</i>	Th	SA, SH	W, S	LC	EI	HA, Man, R
<i>Corrigiola telephifolia</i>	Hem	SA, SH	S, Su	NT		AA(Siroua), HA, MA, Mam, Man, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Cerastium glomeratum</i>	Th	A, SA, SH, H	W, S, Su	LC		All geographic divisions except Ms
<i>Moenchia erecta</i>				LC		
<i>Paronychia echinulata</i>	Th.	SA, SH	S	LC		HA (Mgouna; Iouaridène), MA, Mam (Khénifra), Man, LM (Meililia), R
<i>Silene cerastoides</i>	Th	A, SA	W, S	LC		Mam, Om, LM, R
<i>Silene martyi</i>	Th	SH, H	S, Su	NT	E; R	Man (Préfif), R (Between Tetouan and Chaouène; between Bab-Taza and Bab-Berre)
<i>Spergularia bocconeii</i>	Th	SH, H	S	LC		AA, HA, MA, Mam, Man, OP, R
<i>Stellaria media</i>	Th	A, SA, SH, H, HM	W, S, Su	LC		All geographic divisions except Ms
<i>Stellaria pallida</i>	Th	SA, SH, H	W, S, Su	LC		AA, HA, MA, Mam, Man, Om, R
CISTACEAE						
<i>Cistus albidus</i>	Ph	SA, SH, H	S	LC		Mam, Man, Om, LM, R
<i>Cistus crispus</i>	Ch	SA, SH, H	S	LC		MA, Man, LM, R
<i>Cistus monspeliensis</i>	Ph	SA, SH	S	LC		HA, MA, Mam, Man, Om, LM, R
<i>Cistus salvifolius</i>	Ch	SA, SH, H	S	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Fumana laevis</i>	Ch	A, SA, SH	S	LC		Mam, Man, LM, R
<i>Fumana thymifolia</i>	Ch	A, SA, SH	S	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Helianthemum salicifolium</i>	Th	A, SA, SH	S	LC		HA, MA, Mam, Man, Op, Om, LM, R
<i>Pomelina fontanesii</i>	Ph	SA	S	LC		HA, MA, Mam, Man, R
<i>Tuberaria guttata</i>	Th	SA, SH, H	S	LC		AA, HA, MA, Mam, Man, Om, LM, R
CONVOLVULACEAE						
<i>Convolvulus althaeoides</i>	Hem	(S), SA, SH, H	S, Su	LC		All geographic divisions, rare in arid and desert regions
<i>Convolvulus tricolor</i>	Th	S, SA, SH	S	LC		Ms, AA?, Mam, Man, Op (Lower Moulouya), Om, R
<i>Cuscuta planiflora</i>	Th	A, SA, SH, H, HM	S	LC		All geographic divisions except Ms
CORIARIACEAE						
<i>Cortaria myrtifolia</i>	Ph	SH	S	NT	R	
CRASSULACEAE						
<i>Sedum forsterianum</i>	Ch	SH, H	S, Su	LC		MA, Man, R
<i>Sedum rubens</i>	Th	A, SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Op, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Umbilicus horizontalis</i>	G	S, A, SA, SH, H	S, Su	NA		Ms, AA, HA, MA, Mam, Man, Om, LM, R
CUCURBITACEAE						
<i>Bryonia dioica</i>	G	A, SA, SH, H	S	LC		All geographic divisions
CYTINACEAE						
<i>Cytinus hypocistis</i>	G	SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Om, LM, R
ERICACEAE						
<i>Arbutus unedo</i>	Ph	SA, SH, H	F, W	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Erica arborea</i>	Ph	SH, H	S	LC		MA (Tazekka), Man, Op (j. Kerker south of Tistoutine), Om, LM, R
EUPHORBIACEAE						
<i>Chrozophora tinctoria</i>	Th	A, SA, SH, H	(F), S, Su	LC		HA?, MA, Mam, Man, LM, R
<i>Euphorbia exigua</i>	Th	A, SA, SH, H	S, Su	LC		Non-Saharan Morocco
<i>Euphorbia falcata</i>	Th	A, SA, SH, H	S, Su	LC		All geographic divisions except Ms
<i>Mercurialis ambigua</i>	Th	S, A, SA, SH, H	(F), W, S, Su	LC		All geographic divisions
FABACEAE						
<i>Adenocarpus telonensis</i>	Ph	SH, H	S	LC		MA, Man, R
<i>Anagyris foetida</i>	Ph	A, SA, SH, H	W, S	LC		AA, HA, MA, Mam, Man, LM (Bokkoya), R
<i>Anthyllis vulneraria</i>	Hem	A, SA, SH, H, HM	S, Su	LC		Non-Saharan Morocco
<i>Astragalus depressus</i>	Hem	SA, SH, HM	S, Su	VU	R?	HA (j. Takreda; Ourika; Tachdirt), MA (Békrit; j. Hayyan; j. Moussaou-Salah), western R
<i>Astragalus echinatus</i>	Th	A, SA, SH, H	(W), S	LC		AA (Tiguermine), HA, MA, Mam, Man, Om ?, LM, R
<i>Bituminaria bituminosa</i>	Hem	A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Calicotome infesta</i>	Ph	SA, SH	S	LC		MA, Man (Prérif; Moyen Sebou), OM, LM, R
<i>Ceratonia siliqua</i>	Ph	SA, SH	F, W	LC		As, AA, HA, MA, Mam, Man, Op?, Om, LM, R
<i>Coronilla scorpioides</i>	Th	S, A, SA, SH	S, Su	LC		All geographic divisions
<i>Coronilla valentina</i>	Ph	A, SA, SH, H	S, Su	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Cytisus arboreus</i> subsp. <i>baeticus</i>	Ph	SA, SH, H	W, S	LC	EIA	AA, HA, MA, Mam, Man, Om, LM, R
<i>Cytisus villosus</i>	Ph	SH, H	S	LC		HA, MA, Man, LM, R
<i>Glycyrrhiza foetida</i>	G	SA, SH	S, Su	NT		Man, Central-Western R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Lathyrus tingitanus</i>	Th	SH, H	S, Su	NT		Man, R
<i>Lotus parviflorus</i>	Th	SA, SH	S	LC		MA (Bab Azhar; Bab Frej), Man, LM?, R
<i>Lupinus micranthus</i>	Th	SA, SH, H	S	LC		Western AA, MA, Mam, Man, R
<i>Medicago polymorpha</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Melilotus speciosus</i>	Th	A, SA, SH	S	LC	EIA	Mam, Man, Op, Om, LM, R
<i>Ononis mitissima</i>	Th	A, SA, SH	S, (Su)	LC		Man, Om, LM, R
<i>Ononis natrix</i>	Ch	S, A, SA, SH	S	LC		All geographic divisions
<i>Ononis viscosa</i>	Th	SA, SH	S, (Su)	LC		HA, MA, Mam, Man, Om, LM
<i>Ornithopus compressus</i>	Th	A, SA, SH, H	S	LC		AA, HA, MA, Mam, Man, R
<i>Scorpiurus muricatus</i>	Th	(S), A, SA, SH	S	LC		(Ms), AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Scorpiurus vermiculatus</i>	Th	A, SA, SH, H	S	LC		MA, Mam, Man, Om (Bni Snassène), LM, R
<i>Tetragonolobus conjugatus</i>	Th	SA, SH	S	LC		MA, Man, Om, LM?, R
<i>Trifolium angustifolium</i>	Th	A, SA, SH, H	S, (Su)	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Trifolium stellatum</i>	Th	SA, SH, H	S, (Su)	LC		Western AA, HA, MA, Mam, Man, Om, LM, R
<i>Trifolium tomentosum</i>	Th	A, SA, SH, H	S, (Su)	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Tripodion tetraphyllum</i>	Th	(S), A, SA, SH	W, S, Su	LC		Ms (Guelmim), AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Vicia benghalensis subsp. heterocalyx</i>	Th	A, SA, SH, H	S	LC		All geographic divisions
<i>Vicia pubescens</i>	Th	SA, SH, H	S	LC		MA, Man, LM, R
FAGACEAE						
<i>Quercus coccifera</i>	Ph	SA, SH, H	S	LC		Om, LM, R
<i>Quercus faginea</i>	Ph	SH, H	S, Su	LC		HA, MA, Man, R
<i>Quercus rotundifolia</i>	Ph	SA, SH, H	S, Su	LC		All geographic divisions except Ms and Op
<i>Quercus suber</i>	Ph	SA, SH, H	W, S, (Su)	LC		HA, MA, Man, Om, LM, R
GENTIANACEAE						
<i>Blackstonia perfoliata</i>	Th	SA, SH, H	S, Su	LC		HA, MA, Man, Om, LM, R
<i>Centaurium erythraea</i>	Th	SA, SH, H	S, Su	DD		Western AA, HA, MA, Mam, Man, Om, LM, R
<i>Centaurium maritimum</i>	Th	SA, SH	S	NT		MA, Mam, Man, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Centaurium pulchellum</i>	Th	SA, SH, H	S, Su	DD		Ms oceanic, As, AA (Ida-ou-Gnidi), MA, Man (High Ouergha Fourat; Salé), Om, LM, R
<i>Cicendia filiformis</i>	Th	SA, SH, H	S	LC		Man, R
GERANIACEAE						
<i>Erodium moschatum</i>	Th	A, SA, SH, H	W, S	LC		HA, MA, Mam, Man, Om, LM, R
<i>Geranium molle</i>	Th	A, SA, SH, H	W, S, (Su)	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Geranium purpureum</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Geranium rotundifolium</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		All divisions except Ms
HYPERICACEAE						
<i>Hypericum perforatum</i>	Ch	SA, SH, H	S, Su	LC		Mam, Man, Om, LM, R
<i>Hypericum tomentosum</i>	Hem	S, SA, SH	S, Su	NT		HA (Rich), MA (Ifrane), Mam, Man, Op, LM, R
LAMIACEAE						
<i>Ajuga reptans</i>	Hem	A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Cleonia lusitanica</i>	Th	A, SA, SH	S	LC		HA, MA, Mam, Man, Op (Bni Snassène), LM, R
<i>Clinopodium nepeta</i>	Ch	SA, SH, H	W, S, Su	LC		HA, MA, Mam, Om, LM, R
<i>Lavandula stoechas</i>	Ch	SA, SH	S	LC		Mam, Man, LM, Om, R
<i>Marrubium vulgare</i>	Ch	A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Mentha pulegium</i>	Hem	SA, SH, H	S, Su	DD		Non-Saharan Morocco
<i>Mentha suaveolens</i>	Hem	S, A, SA, SH, H	S, Su	LC		All geographic divisions
<i>Origanum compactum</i>	Ch	A, SA, SH	Su	VU	EI	MA, Mam, Man, R
<i>Prasium majus</i>	Ph	SA, SH, H	S	LC		AA, HA, MA, Mam, Man, Op, Om, LM, R
<i>Stachys arvensis</i>	Th	SA, SH, H	W, S	LC		Non-Saharan Morocco
<i>Stachys circinata</i> subsp. <i>zaiana</i>	Ch	SH, H	W, S	LC	E ; RR	MA, Man, Op?, LM, R
<i>Teucrium decipiens</i>	Th	SA, SH	S	LC	E ; RR	HA, MA, Mam, Man, Om (Bni Snassène), LM, R
<i>Teucrium fruticans</i>	Ph	SA, SH, H	W, S, Su	LC		(Ms), AA, HA, MA, Mam, Man, Om, LM, R
<i>Vitex agnus-castus</i>	Ph	S, A, SA, SH, H	Su	LC		All geographic divisions

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
LAURACEAE						
<i>Laurus nobilis</i>	Ph	SH, H	(W), S	VU	R	MA (El Ksiba), R
LINACEAE						
<i>Linum tenue</i>	Th	A, SA, SH, H	S, Su	LC	EIA	AA coastline?, HA, MA, Mamn Man, Om, LM, R
<i>Linum usitatissimum</i>	Th	SH	S, Su	NA		Cultivated and spontaneous especially in Mam, Man, LM, R
LYTHRACEAE						
<i>Lythrum junceum</i>	Hem	A, SA, SH, H	S, Su	LC		All geographic divisions
MALVACEAE						
<i>Lavatera olbia</i>	Ph	SA, SH, H	S, (Su)	LC		MA, Mam, Man, LM, R
<i>Malva hispanica</i>	Th	A, SA, SH, H	(W), S	LC	EIA	AA?, HA, MA, Mam, Man, LM, Om, R
<i>Malva parviflora</i>	Th	S, A, SA, SH	W, S	LC		All geographic divisions
MORACEAE						
<i>Ficus carica</i>	Ph	A, SA, SH, H	S, Su	NA		Non-Saharan Morocco
MYRTACEAE						
<i>Myrtus communis</i>	Ph	SA, SH	S	NT		Man, Om (Bni Snassène), LM, R
OLEACEAE						
<i>Fraxinus angustifolia</i>	Ph	SA, SH, H	W, S	LC		HA, MA, Mam, Man, Om, LM, R
<i>Olea europaea</i> subsp. <i>oleaster</i>	Ph	A, SA, SH, H	S	LC		Non-Saharan Morocco
<i>Phillyrea latifolia</i>	Ph	SA, SH	W, S	LC		As, AA, HA, MA, Mam, Man, Om, LM, R
OROBANCHACEAE						
<i>Orobancha crenata</i>	Th	A, SA, SH, H	S	LC		As, AA littoral?, HA, Mam, Man, Op, Om, LM, R
<i>Parentucellia viscosa</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		HA, MA, Mam, Man, Om, LM, R
OXALIDACEAE						
<i>Oxalis pes-caprae</i>	G	A, SA, SH	W, S	LC		Mam, Man, Op, Om, LM, R
PAPAVERACEAE						
<i>Fumaria ouezzanensis</i>	Th	SH	S	NT	E ; R	Man, R (Préfif)
<i>Papaver rhoeas</i>	Th	A, SA, SH, H	S, Su	LC		All geographic divisions

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
PLANTAGINACEAE						
<i>Plantago afra</i>	Th	A, SA, SH, H	S	LC		All geographic divisions
<i>Plantago coronopus</i> subsp. <i>commutata</i>	Th	A, SA, SH	S, Su	LC		All geographic divisions
<i>Plantago lagopus</i>	Th	S, A, SA, SH, H	W, S	LC		All geographic divisions
POLYGONACEAE						
<i>Persicaria hydropiper</i>	Th	SA	Su, F	DD		MA, Man, R
<i>Rumex bucephalophorus</i>	Th	A, SA, SH, H	W, S	LC		HA, MA, Mam, Man, Op, Om, LM, R
<i>Rumex conglomeratus</i>	Hem	A, SA, SH, H	S, Su	LC		HA, MA, Mam, Man, Op, Om, LM, R
POTAMOGETONACEAE						
<i>Potamogeton natans</i>	HyF	SH, H	S, Su	LC		Man, Western R
PRIMULACEAE						
<i>Anagallis arvensis</i>	Th	A, SA, SH, H	Flowering possible all year	LC		All geographic divisions except Ms & AA
<i>Anagallis arvensis</i> subsp. <i>parviflora</i>	Th	A, SA, SH, H	Flowering possible all year	LC		As, HA, MA, Mam, Man, Op, R
<i>Anagallis monelli</i>	Ch	A, SA, SH, H, HM	S, Su	LC		Ms (Around Errachidia), AA (Tazeroualt), HA, MA, Mam, Man (Ouezzane; Bni Aros; Brikcha; O. Mkikes; around Rabat), Op (Midelt), LM (Melilia), R (Around Tanger)
<i>Asterolimon linum-stellatum</i>	Th	A, SA, SH, H	S	LC		All geographic divisions except Sahara
RANUNCULACEAE						
<i>Anemone palmata</i>	G	SA, SH, H	W	LC		Mam, Man, LM, R
<i>Clematis cirrhosa</i>	Ph	SA, SH, H	F, W	LC		MA, Mam, Man, Op, LM, R
<i>Clematis flammula</i>	Ph	SA, SH, H, HM	S, Su	LC		MA, Mam, Man, Op, Om, LM, R
<i>Delphinium nanum</i>	Th	SH, H	S	LC		HA, MA, Mam, Man, Op, LM, R
<i>Ficaria verna</i> subsp. <i>ficariiformis</i>	Hem	SA, SH, H	F, S	LC		HA, MA, Man, R
<i>Ranunculus macrophyllus</i>	Hem	A, SA, SH, H	S	LC		Mam, Man, Op, LM, R
<i>Ranunculus paludosus</i>	Hem	SA, SH	W, S	LC		AA, HA, MA, Mam, Man, Op, LM, R
<i>Ranunculus parviflorus</i>	Th	SA, SH, H	S	LC		HA, MA, Man, R

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
RESEDACEAE						
<i>Reseda lutea</i>	Th	S, A, SA, SH	W, S, Su	LC		All geographic divisions except As
RHAMNACEAE						
<i>Rhamnus alaternus</i>	Ph	SA, SH, H	W, S	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Ziziphus lotus</i>	Ph	S, A, SA, SH	S, Su	LC		All geographic divisions
ROSACEAE						
<i>Crataegus monogyna</i>	Ph	SA, SH, H	W, S	LC		All geographic divisions except Ms and As
<i>Rosa sempervirens</i>	Ph	SA, SH, H	W, S	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Rubus ulmifolius</i>	Ph	A, SA, SH, H	S, Su	LC		All geographic divisions except Ms and As
<i>Sanguisorba minor</i>	G	A, SA, SH, H	S, Su	LC		Everywhere except in Ms, LM
RUBIACEAE						
<i>Galium parisiense</i>	Th	A, SA, SH, H	(W), S, Su	LC		AA, HA, MA, Mam, Man, Om, LM, R
<i>Rubia peregrina</i>	Ch	A, SA, SH, H	S, Su	LC		HA, MA, Mam, Man, Om, LM, R
<i>Sherardia arvensis</i>	Th	A, SA, SH, H	W, S, (Su)	LC		All geographic divisions
<i>Theligonum cynocrambe</i>	Th	SH, H	W, S	LC		Mam, Man, LM, Om?, R
RUTACEAE						
<i>Ruta montana</i>	Ch	A, SA, SH	S, Su	LC		HA, MA, Mam, Man, Om (Bni Snassène), LM, R
SALICACEAE						
<i>Salix pedicellata</i>	Ph	SA, SH, H	W, S	LC		All geographic divisions except Ms
SANTALACEAE						
<i>Osyris alba</i>	Ch	SA, SH, H	S, Su	LC		Ms?, As?, AA?, HA, MA, Mam, Man, Om, LM, R
SAXIFRAGACEAE						
<i>Saxifraga granulata</i>	Hem	SA, SH, H	S	LC		HA, MA, Mam, Om (Bni Snassène), R
SCROPHULARIACEAE						
<i>Anarrhinum pedatum</i>	Hem	A, SA, SH, H	(W), S, (Su)	LC		HA, MA, Mam, Man, Om, LM, R
<i>Kickxia spuria</i>	Th	S, A, SA, SH, H	S, Su	LC		Ms (Around Tinfouche; N of Hassi Beida; O. Oum el-Assel), Mam, Man, Om, LM, R
<i>Scrophularia canina</i>	Ch	A, SA, SH, H	(W), S, Su	LC		All geographic divisions

Divisions, Families and Species	Life from spectrum	Bioclimatic stage	Flowering period	Assessment Criteria	Endemism / Rarity	Geographic distribution in Morocco
<i>Verbascum sinuatum</i>	Th	A, SA, SH, H	S, Su	LC		All geographic divisions except Ms
<i>Veronica anagallis aquatica</i>	Th	A, SA, SH, H	(W), S, Su	LC		All geographic divisions
<i>Veronica arvensis</i>	Th	A, SA, SH, H	W, S, (Su)	LC		As, AA, HA, MA, Mam, Man, Op, Om, LM, R
SOLANACEAE						
<i>Mandragora autumnalis</i>	G	SA, SH	S, Su	LC		Mam, Man, LM, R
<i>Solanum nigrum</i>	Th	S, A, SA, SH, H	S, Su	LC		Oceanic Ms, AA, HA, MA, Mam, Man, Op, Om, LM, R
TAMARICACEAE						
<i>Tamarix canariensis</i>	Ph	A, SA, SH	S, Su	NA		Ms, Mam (Ait Amer ; Essaouira ; O. Massa), R (Tetouan)
THYMELAEACEAE						
<i>Daphne gnidium</i>	Ch	SA, SH	S	LC		All geographic divisions except Ms
URTICACEAE						
<i>Urtica membranacea</i>	Th	A, SA, SH, H, HM	S	LC		HA, MA, Mam, Man, Op, Om, LM, R
VALERIANACEAE						
<i>Centranthus calcitrapae</i>	Th	A, SA, SH, H	(W), S, (Su)	LC		AA, HA, MA, Mam, Man, Om (Bni Snassène), LM, R
<i>Fedia cornucopiae</i>	Th	A, SA, SH, H	(W), S	LC	EI	MA (Tazekka), Mam (Chaouia-Doukkala; medium Oum Rbia), Man, western LM, R
<i>Valerianella dentata</i>	Th	A, SA	S	LC	RR	Central HA, MA (Tezekka), Man (Prérif-Middle Sebou), Op (Lower Moulouya), LM, R
VERBENACEAE						
<i>Verbena supina</i>	Th	A, SA, SH	S, Su	LC		Ms, AA, Mam, Man, LM, R
VITACEAE						
<i>Vitis vinifera</i>	Ph	SA, SH, H	S	LC		HA, MA, Mam, Man, Om, LM, R