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Floristic and phytogeographic analysis of Moulay Driss Zerhoun massif (Prerif), Morocco

Abstract

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The region of Moulay Driss Zerhoun, located north of the city of Meknes, hosts a remarkable plant diversity. The sampling conducted in 2022, resulted in the inventory of 407 taxa belonging to 257 genera and 67 families. The objective of the present work is to proceed to the floristic analysis of the species list elaborated to facilitate the implementation of conservation strategy of natural heritage. Thus, the overall biological spectrum shows a dominance of therophytes (49.38%) over other life forms. The endemic element is well represented (8.6%). Also, the rare or threatened flora is estimated at 6.63%. The chorological spectrum indicates a significant dominance of Mediterranean species (60%).

Key words: Fes Meknes region, N Africa, flora, endemism, rarity, chorology, conservation.

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Introduction

By its geographical position, between the two seas, Morocco offers, compared to other circum-Mediterranean countries, an original orography and climate, to which respond an original flora and vegetation. Indeed, the high mountain ranges that can exceed 4,000 m in altitude have a complex and highly compartmentalized structure, and the plateaus and plains are extensive (Benabid 1985). Morocco is the richest country in the southern Mediterranean region in terms of biodiversity, due to its different ecological systems, ranging from humid mountains to a Saharan environment (Benabid 2000; Benzyane & al. 2010). Indeed, the Moroccan flora currently includes nearly 4500 species and subspecies belonging to 940 genera and 135 families (Benabid 2000). More recent statistics established by Fennane & al. (2023), speak instead of 3800 species, 80 hybrids and 1400 of subspecies, divided into 140 families and 979 genera. These authors explain these differences by taxonomic rearrangements since at the family level, only that of *Dracaenaceae* is new

for Morocco (Benabid & Cuzin 1997). Also, there are taxa of doubtful presence or whose chorology remains to be clarified (Fennane & al. 1999-2014). The flora of Morocco is still poorly estimated and requires further study. In this context, we are interested in the study of the flora of the Moulay Driss Zerhoun massif located in the north of Morocco, in the region of Fes-Meknes, Province of Meknes. The city, bearing the same name, located in the center of the massif, was built around the tomb of My Driss the First, founder of the dynasty of Idrissides. The area is therefore of great historical interest. That's why it has been registered by Morocco in the tentative list of the UNESCO world heritage. The scientific interest that we have in this region comes after preliminary surveys that have revealed a little polluted area, with a rich and remarkable biodiversity and not yet deeply explored. Indeed, Studies carried out in the region include Sauvage (1933), Emberger (1939), Montserrat & al. (2006) and Valdés & al. (2002) and an ethnobotanical study (Slimani & al. 2016) that identified 111 medicinal plants used by the natives in phytotherapy. In addition, the frequency and the important coverings of lichens show the originality of the region whose plant heritage still seems well preserved. Thus, the objective of this study is a floristic analysis and to evaluate the rate of endemism, threatened taxa, geographical distribution in Morocco and chorology. of the Moulay Driss Zerhoun massif.

Materials and Methods

Study area

The Zerhoun region covers a total area of 55,800 ha (Dpam 2010) north of the city of Meknes. It is part of the Wilaya of Meknes and is bordered to the north by the provinces of Sidi Kassem and Taounate, to the south by the Dkhissa area, to the east by the province of Zouagha Moulay Yaakoub and to the west by the area of Ain Jemaâ (Fig. 1). The climate is Mediterranean, characterized by mild, wet winters and very hot, dry summers. The average annual precipitation of the area is estimated at 580 mm and is characterized by high interannual variability (CCA 2018). Indeed, the year 2021 had a low rainfall not exceeding 345.5 mm (Table 1), while the year 2018 was very rainy with a rate of 770 mm (Infoclimat 2022), this in the city of Meknes, which is the closest point to the study area (18 km) and for which climatic data are available. The difference between maximum and minimum temperatures during the same year is significant (Tab. 1).

Already in 1930, Dresch had described the My Driss Zerhoun massif as an entity formed essentially by two folds that extend southward. The southern bundle includes, on the one hand, the Kannoufa and Takerma djebels and, on the other hand, the Nosrani and Takouch djebels, constituted by domerian limestones and extended towards the West by the Zerhoun djebel, constituted by sandstones undoubtedly Jurassic.

Methodology

The sampling adopted is stratified. The division into homogeneous strata was made according to three criteria: geological substratum (sandstone, marl, or limestone), exposure (north or south) and vegetation facies (*Calycotome intermedia* facies and *Zizyphus lotus* facies of the *Oleo-lentiscetum*, *Pistacia Terebinthus* facies and

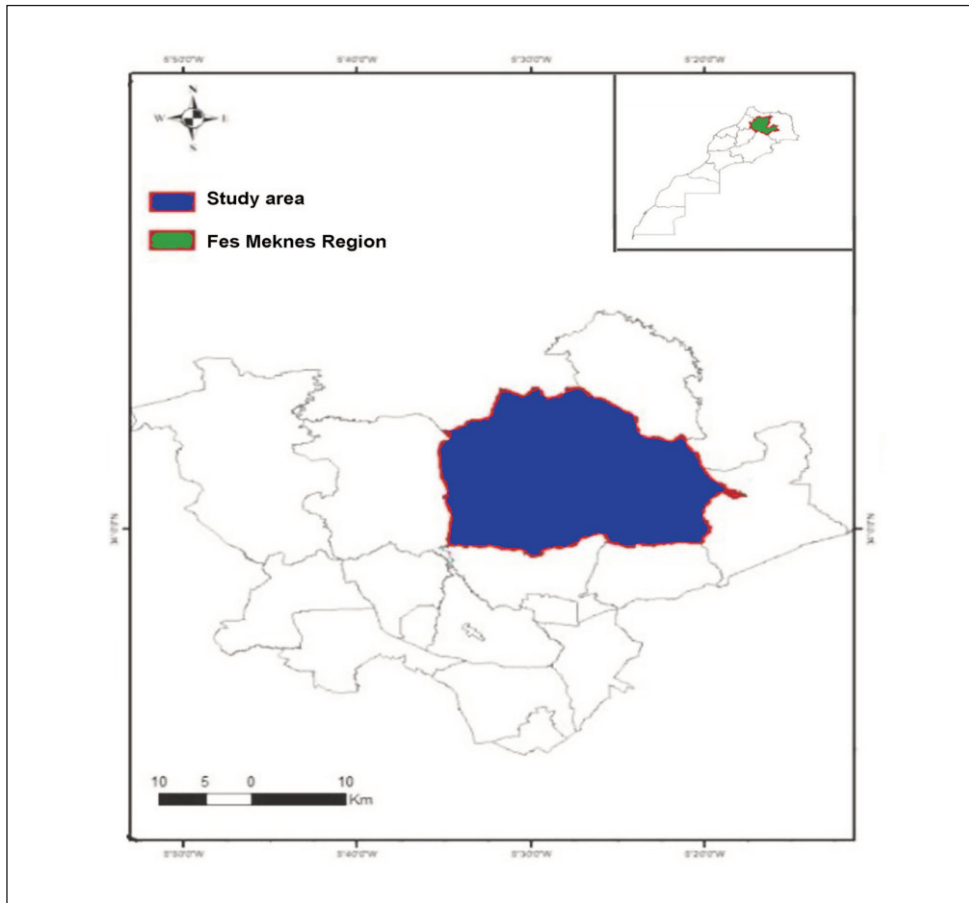


Fig.1. Location of Moulay Driss Zerhoun Region.

Adenocarpus-telonensis facies of the holm oak grove) Sauvage (1933-1934), Benabid (2000). Without forgetting special habitats such as cliffs (ex. Cliff Limestone El Kifane Jbel Abdelkarim, Cliff Karmos).

Data collection on the chorological types of the various taxa is based on (Quézel & Santa 1962-1963; Valdés & al 2002; Fennane 2021; Fennane & Ibn Tatou 2005, 2008) when data are available and then completed from Telabotanica (2022), threatened and endemic species are indicated after consultation of the red book (Fennane 2021). The practical flora of Morocco (Fennane & al. 1999, 2007, 2014) is used to determine the flowering season, bioclimate and range in the geographical divisions of Morocco. The data collected is recorded on cards for analysis and study at the end. These data were then entered and analyzed using Microsoft Excel 2016.

Table 1. Temperatures and precipitations of the city of Meknes for the year 2022 (Infoclimat 2022).

Average maximum temperature	25.1°C
Average minimum temperature	11.1°C
Average temperature	18.1°C
Extreme maximum temperature	46.8°C recorded on July 10
Extreme minimum temperature	-1.2°C recorded on January 4
Précipitation annuelle	345.5 mm

Results and discussions

Floristic composition

Taxonomic analysis yields 407 plant species, 257 genera and 67 families (Boudik & al. 2024), or 7% of the Flora of Morocco estimated by Fennane & Ibn Tattou (2012) to be 5211 species and subspecies, 26% of the total genera (981; Fennane 2012) and 42% of the total families recorded in Morocco (155 families) Fennane (2012). The observed species belong to 50 Dicotyledons, 12 Monocotyledons, 4 Pteridophytes and 1 Gymnosperm. *Asteraceae* is the most represented family (50 species) followed by *Fabaceae* (47 species), *Poaceae* (39 species) and *Lamiaceae* (25 species). The other families are represented by only one taxon (Tab. 2). The three families specifically with the highest diversity are also the most diverse on the Moroccan territory and occur in the same order established by Fennane (2012).

Life form spectrum

Raunkier (1905), defines the life form according to the position of of the survival organs (persistent buds) in relation to the ground, during the unfavorable period; the life forms considered in the present work are: Phanerophytes, Chamephytes, Hemicryptophytes, Geophytes and Therophytes. For each taxon presented in the catalog, is assigned a biological type.

Analysis of the life form (Fig. 3) shows the specific dominance of Therophytes (Th) with a percentage of 49.38%. Then come the Hemicryptophytes (Hem) with 16.21%, followed by the Phanerophyte (Ph) with 12.53% and finally the Geophytes and Chamephytes with respectively 11.30% and 10.56%. At the scale of the Mediterranean basin and particularly in Morocco, the dominance of therophytes (Aafi 2005; Bammi 2004) is thought to be linked to the climate characterized by a dry and hot summer period (Daget 1980; Barbero & al.1990) and the opening of vegetation (Daget 1980). Thus, these authors agree to present Therophytes as a form of resistance to drought and high temperatures of arid environments.

Table 2. Generic and specific richness of the families recorded in Moulay Driss Zerhoun (**NbG**: Number of genera; **Nbsp**: Number of species and subspecies).

Family	NbG	Nbsp	Family	NbG	Nbsp
<i>Aspleniaceae</i>	1	3	<i>Convolvulaceae</i>	2	5
<i>Polypodiaceae</i>	1	1	<i>Crassulaceae</i>	4	7
<i>Pteridaceae</i>	1	1	<i>Cucurbitaceae</i>	1	1
			<i>Ericaceae</i>	1	1
<i>Selaginellaceae</i>	1	1	<i>Euphorbiaceae</i>	2	5
<i>Cupressaceae</i>	1	1	<i>Fabaceae</i>	20	47
<i>Amaryllidaceae</i>	2	4	<i>Fagaceae</i>	1	2
<i>Araceae</i>	1	1	<i>Gentianaceae</i>	3	3
<i>Arecaceae</i>	1	1	<i>Geraniaceae</i>	2	10
<i>Ericaceae</i>	1	1	<i>Hypericaceae</i>	1	4
<i>Asparagaceae</i>	6	10	<i>Lamiaceae</i>	15	25
<i>Asphodelaceae</i>	1	1	<i>Linaceae</i>	1	3
<i>Cyperaceae</i>	1	1	<i>Lythraceae</i>	1	1
<i>Dioscoreaceae</i>	1	1	<i>Malvaceae</i>	1	2
<i>Iridaceae</i>	1	1	<i>Moraceae</i>	1	1
<i>Liliaceae</i>	1	2	<i>Oleaceae</i>	4	4
<i>Orchidaceae</i>	2	4	<i>Oxalidaceae</i>	1	1
<i>Poaceae</i>	30	39	<i>Papaveraceae</i>	4	4
<i>Smilacaceae</i>	1	1	<i>Plantaginaceae</i>	7	9
<i>Acanthaceae</i>	1	1	<i>Plumbaginaceae</i>	2	2
<i>Adoxaceae</i>	1	1	<i>Polygonaceae</i>	1	3
<i>Amaranthaceae</i>	1	1	<i>Primulaceae</i>	2	2
<i>Anacardiaceae</i>	2	5	<i>Ranunculaceae</i>	4	8
<i>Apiaceae</i>	16	23	<i>Resedaceae</i>	1	2
<i>Apocyanaceae</i>	1	1	<i>Rhamnaceae</i>	2	3
<i>Aristolochiaceae</i>	1	2	<i>Rosaceae</i>	7	7
<i>Asteraceae</i>	35	50	<i>Rubiaceae</i>	9	13
<i>Boraginaceae</i>	7	9	<i>Rutaceae</i>	1	2
<i>Brassicaceae</i>	7	12	<i>Santalaceae</i>	1	1
<i>Campanulaceae</i>	3	5	<i>Scrophulariaceae</i>	1	1
<i>Capparaceae</i>	1	1	<i>Solanaceae</i>	3	4
<i>Caprifoliaceae</i>	3	5	<i>Tamaricaceae</i>	1	1
<i>Caryophyllaceae</i>	9	19	<i>Thymelaeaceae</i>	2	2
<i>Cistaceae</i>	4	8	<i>Urticaceae</i>	2	4
<i>Convolvulaceae</i>	2	5	<i>Verbenaceae</i>	1	1
Total : 67 families ; 257 genres et 407 species					

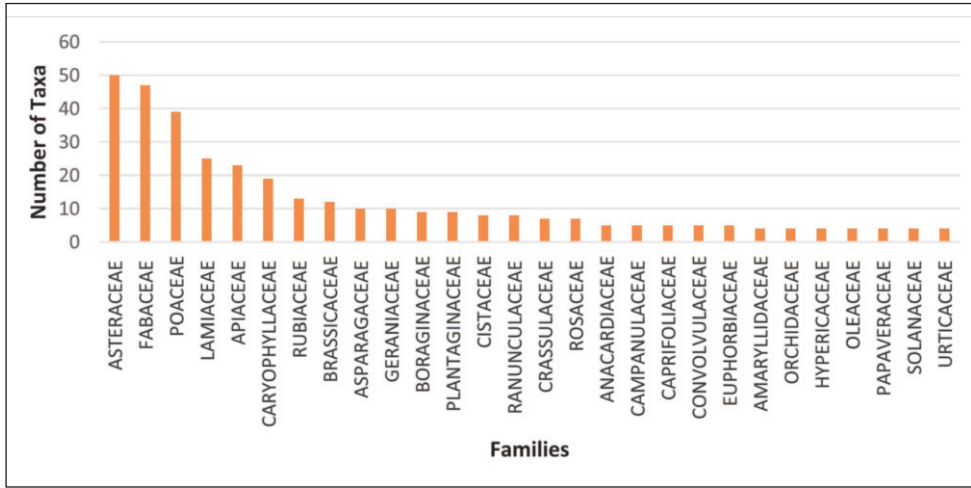


Fig. 2. Specific richness of botanical families in Moulay Driss Zerhoun.

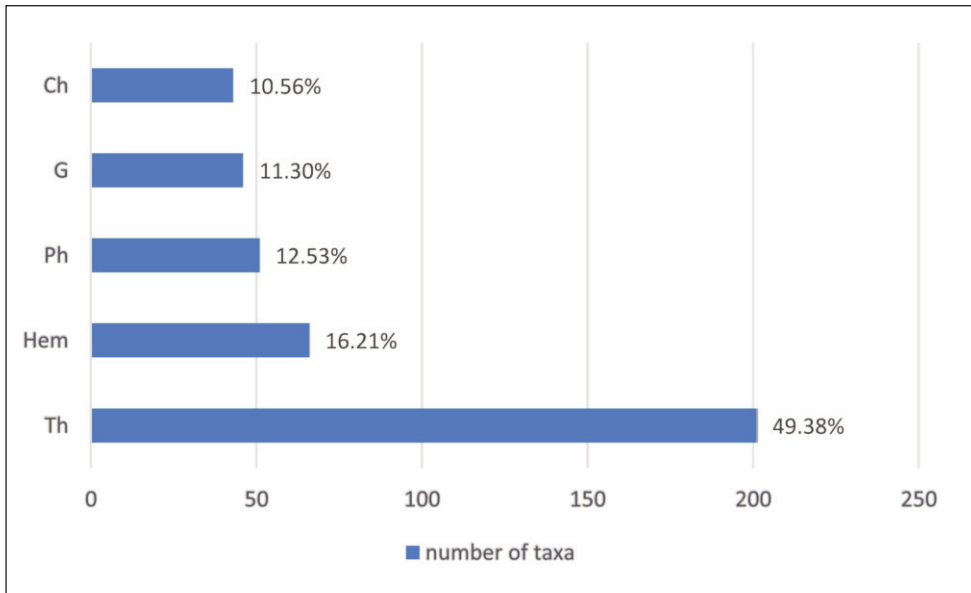


Fig. 3. Life form spectrum of the vegetation of the Zerhoun region.

Flowering period

The majority of species inventoried in the region flower in spring (46%) followed by 34% in summer, 15% in winter and 5% in autumn (Fig. 4). The latter are mainly therophytes such as *Bromus rubens* L., *Brachypodium distachyon* (L.) P. Beauv., *Briza minor*

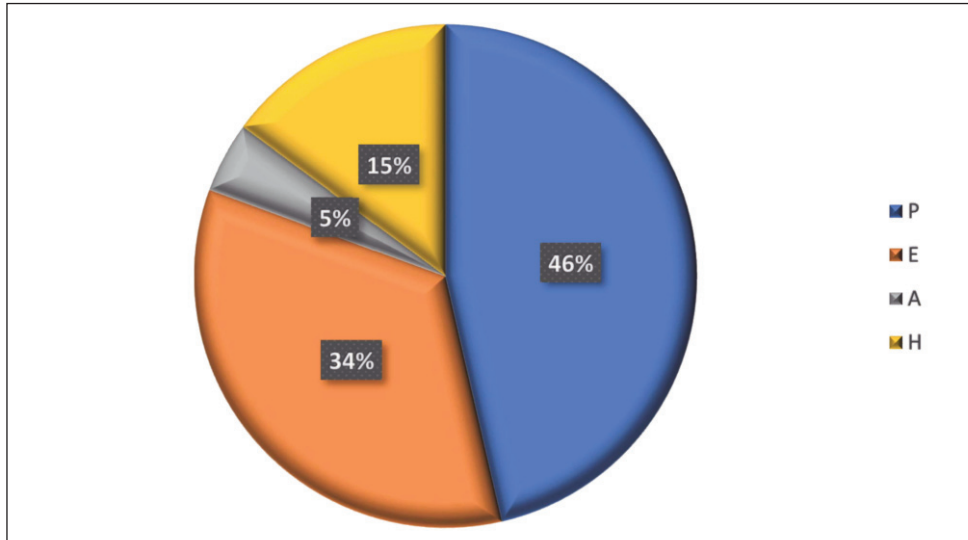


Fig. 4. Distribution of plant species in the Moulay Driss Zerhoun region according to their flowering period. P: Spring; E: Summer; A: Autumn; H: Winter.

L., *Bellis annua* L., *Scorzoneroïdes muelleri* (Sch.Bip.) Greuter, *Alyssum alyssoides* (L.) L., etc. The landscape in the region is characterized by this flowering whose quantification can be characteristic of the types of vegetation encountered.

Endemic species

The development of endemic species from a biogeographic point of view can be of great importance. Indeed, the territory of each of these species should be carefully circumscribed and its range specified. This would facilitate the preservation of this remarkable biodiversity. In this context, the present study has identified 36 endemic taxa among the 407 that make up the catalog of the Moulay Driss Zerhoun region (Boudik & al. 2024). These species are endemic to Morocco or shared with neighboring countries such as Algeria, the Iberian Peninsula, or the Canary Islands.

The endemic flora encountered in the area belongs to 19 families. *Asteraceae* and *Lamiaceae* hold the largest numbers with 5 species each, followed by *Brassicaceae*, *Crassulaceae* and *Fabaceae* with 3 species each.

The analysis carried out on the endemic encountered in the study area shows that of the 36 species found, 15 are specific to Morocco with a number (E) of about 44%, 5 are shared with Algeria (EA) or about 15%, 10 are shared with Morocco, Algeria, and the Iberian Peninsula (EIA) or 26%. There are also species common to Morocco and the Iberian Peninsula (EI) which are 4 or 9% and only one species common to Morocco, Algeria, the Iberian Peninsula, and the Canary Islands, or 3%. The latter species remains doubtful in both Algeria and the Canary Islands (Fennane & al. 2014). Finally, only one endemic of Morocco and the Canary Islands (EC) is recorded, or 3%.

We identified 36 taxa, a rate of 8.8% ($36/407 \times 100\%$) compared to the total species of the massif. This rate of endemism is much lower than that of the entire Moroccan vascular flora (16.3 % according to Fennane 2023), while it is relatively high than that recorded in other parts of Morocco such as of the Achach forest where 15 species have been noted (Bammi & Douira 2004), the average Moulouya with 18 endemic taxa (Douiri & al. 2007) and Izarene massif with 20 endemic taxa (Orch 2013).

Among the endemic species encountered in the study area, two are Critically endangered (CR): *Cirsium ducellieri* Maire, *Ononis jahandiezii* Maire & Weiller. Two are Endangered (EN): *Thymus bleicherianus* Pomel, *Teucrium barbarum* Jahand. & Maire. Five are Least concern (LC): *Stachys saxicola* subsp. *villosissima* (Ball) Maire, *Sedum wilczekianum* Font Quer, *Filago duriaei* Lange, *Dianthus sylvestris* subsp. *longibracteatus* (Maire) Greuter & Burdet and *Linaria tristis* subsp. *pectinata* (Pau & Font Quer) Maire and one vulnerable (Vu): *Ceratocnemum aphanoneurum* (Maire & Weiller) Al-Shehbaz. These taxa, in addition to their endemism, are vulnerable, critically endangered, or Endangered. Their confinement in the area would be beneficial to them insofar as some localities difficult to access because of the rugged relief and therefore little anthropized would be a precious refuge for these plants.

Considering all the endemic species recorded in the area, their presence in the phytogeographic divisions of Morocco is mainly noted in North Atlantic Morocco (36 taxa), the Middle Atlas (26 taxa), the Rif (24 taxa), Middle Atlantic Morocco (22 taxa) and the High Atlas (22 taxa) (Fig. 6). The other phytogeographical divisions come after with the Mediterranean coast (17 taxa), the Anti-atlas (14 taxa), the eastern Moroccan mountains (13 taxa), the eastern Moroccan plateaus (9 taxa), Saharan Morocco (4 taxa) and the Saharan Atlas (2 taxa) (Fig. 5). The species from our area encountered in Saharan Morocco are: *Coronilla viminalis* Salisb., *Pulicaria paludosa* Link, *Modescidium involucreatum* (Maire) P. Vargas & Jim. Mejías, *Asparagus latissimus* Munby. Those encountered in the Saharan atlas are: *Chaenorhinum villosum* (L.) Lange, *Dianthus lusitanus* Brot. The endemic species of Morocco and the Canary Islands are found in all the phytogeographic divisions except the Saharan Atlas, the mountains of eastern Morocco, the Mediterranean coast, and the Rif, those shared with the Iberian Peninsula are found in HA, MA, Mam, Man, R. Those shared with Algeria are found in AA, HA, Mam, Man, R.

Rare or threatened species

The examination of the species list of the Moulay Driss Zerhoun region allowed us to note many species considered by previous work (Fennane 2021) as vulnerable, critically endangered, endangered, near threatened, least concern or with doubtful presence. Indeed, among the 407 taxa, 25 are threatened, or 6.39% of which 10 are least concern (LC) (Fig. 6).

These species should be the subject of safeguard strategies at the scale of Morocco and the region such as the creation of seed banks and the installation of protected areas. Awareness campaigns and training should be conducted with local residents for a better exploitation of these other resources. Thus, this heritage would be preserved and would also benefit future generations in a spirit of sustainable development (Kahouadji 2022).

All this brings us to an analysis of the geographical distribution of these threatened species (Fig 7). This analysis shows that North Atlantic Morocco has 26 species threatened. The other phytogeographical regions come next with the Middle Atlas (18 species),

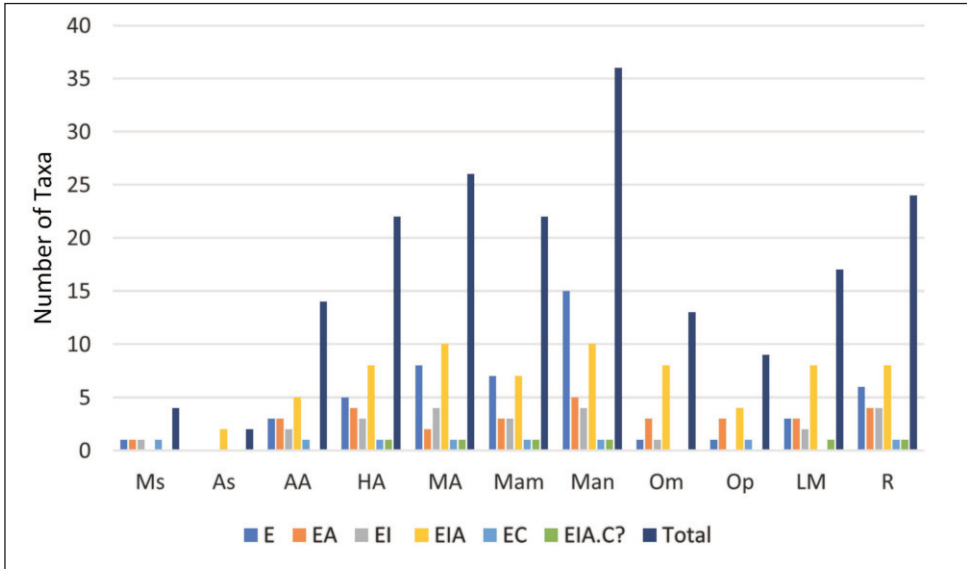


Fig. 5. Distribution of endemic species recorded in Moulay Driss Zerhoun according to phytogeographical division. E: endemic to Morocco; EA: endemic to Morocco and Algeria; EI: endemic to Morocco and Iberian Peninsula; EIA: Endemic to Morocco, Algeria, and the Iberian Peninsula; EC: Endemic to Morocco and Canary Islands; EIA.C?: As: Saharan Atlas, AA: Anti-Atlas; HA: High Atals, MA: Middle Aatlas; Mam: Middl Atlantic Morocco; OP: Plains and Plateau of Morocco; OM: Eastern Morocco Mountains; LM: Mediterranean Littoral; R: Rif.

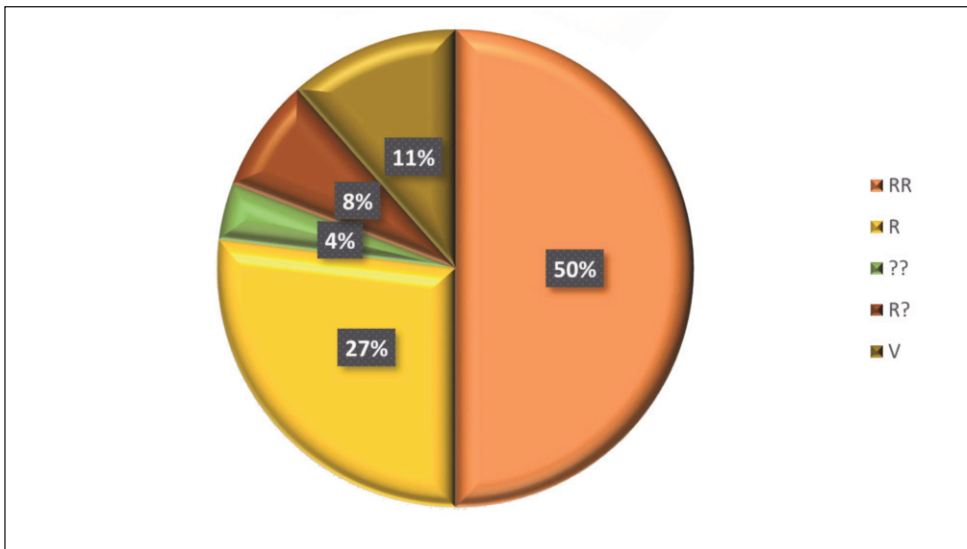


Fig. 6. The rare and endangered species of the Zerhoun region. RR: Extremely rare; R: Rare ; ??: Extinct or doubtful taxon; R?: suspected rare; V: vulnerable.

the Rif (13), the Mediterranean Coastline (10), the Middle Atlantic Morocco (9), the Eastern Moroccan Mountains and the High Atlas (7 species), Eastern Morocco Plateau (6 species), Anti-Atlas (4 species) and Saharan Atlas (1 species). The number of species in common with the other geographical divisions is all the lower as these divisions are distant from the area, example with the Saharan atlas a single species in commune.

Geographical distribution in Morocco

The distribution of the 407 taxa recorded in the Moulay Driss Zerhoun region in the phytogeographic divisions that make up the national territory would provide valuable information on the range of the taxa, their ecology, and their status.

North Atlantic Morocco (Man) occupies the first place with 407 taxa (Boudik & al. 2023). The species found in the region and shared with the Rif (R) are 378 species, those shared with the Middle Atlas (MA) are 352 species and those in common with the Mediterranean Littoral (LM) are 341 species. In fifth place, the Middle Atlantic Morocco (Mam) has 333 species, followed by the High Atlas (HA) with 331 species, the Eastern Moroccan Mountains (Om) with 308 species, the Anti-Atlas (AA) with 255 species, then the Plains and Plateau of Eastern Morocco (Op) with 212 species, and finally the Saharan Atlas (As) and Saharan Morocco (Ms) with 130 and 107 species respectively.

Chorology

The biogeographical origin or chorology is one of the main parameters that reflect the originality of the flora. Several works deal with the biogeography of the North African flora among others (Quézel 1957, 1995, 2000; Pignatti 1978; Galàn de Mera & al. 2003), complemented by documents that contain lists of plants with their biogeographic distributions (Quézel & Santa 1962, 1963; Mateo Sanz & Crespo 2001; Valdés & al. 2002; Fennane 2021; Fennane & Ibn Tatou 2005, 2008). The flora of Morocco, like that of the entire Mediterranean basin, has diverse origins. Several elements contribute to its development (Quézel 1964, 1978, 2002; Valdés & al. 2002): the southern origin, the native plants with Mediterranean origin and the northern origin. The flora of the region of Zerhoun includes the main phytogeographical elements which are at the origin of the establishment of the flora of the Maghreb (Tab. 3).

The Mediterranean elements in the large sense count 232 taxa, 57% of the counted flora. This element includes several subsets, the most represented of which is formed by taxa originating from the Mediterranean region in the strict sense (134 species) which occupies a share of nearly 33% of the total number of species. Then come the West-Mediterranean species with 26 species and the Macaronesian-Mediterranean taxa with 21 representatives. The other subsets are only weakly represented.

The northern element is the second set represented by 114 species, or nearly 28%. It includes European, Eurasian, paleo-temperate and circumboreal species. Other species correspond to transitional elements between the Mediterranean group and this chorological group. The most important lot corresponds to the European with 40 species, followed by the Euro-Mediterranean with 18 species, the Eurasian with 17 species, Paleo-temperate with 14 species and Atlantic-Mediterranean with 6 species. The other categories are poorly represented.

The endemic set occupies the third place with 36 taxa or 8.84% of the flora inventoried in the Zerhoun region. This rate corresponds to 3.91% of the total species and subspecies,

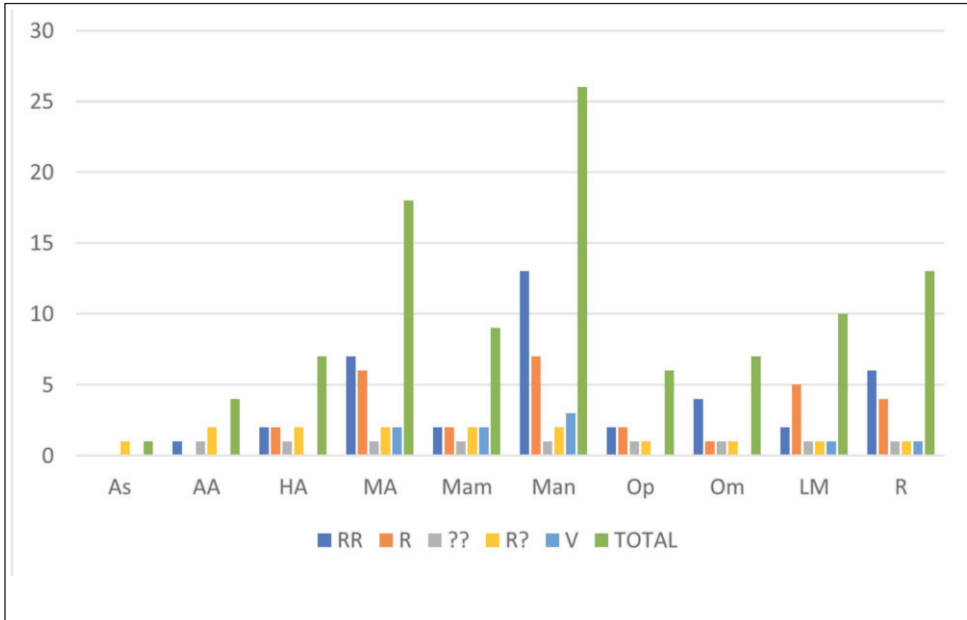


Fig. 7. Distribution of rare or vulnerable species according to the phytogeographic division. As: Saharan Atlas, AA: Anti-Atlas; HA: High Atals, MA: Middle Atlas; Mam: Middl Atlantic Morocco; Op: Plains and Plateau of Morocco; Om: Eastern Morocco Mountains; LM: Mediterranean Littoral; R: Rif; RR: Extremely rare; R: Rare; ??: Extinct or doubtful taxon; R?: suspected rare; V: vulnerable.

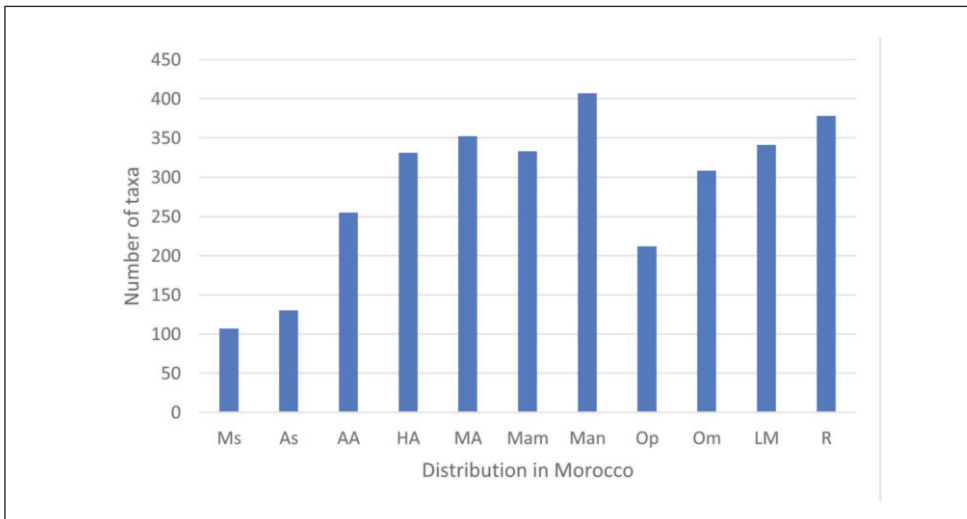


Fig. 8. Distribution of the flora of Moulay Driss Zerhoun according to the phytogeographical divisions of Morocco. Abbreviations as in Fig.7.

Table 3. Chorological types of the Zerhoun region (Galàn de Mera & al. 2003 ; Quézel & Santa 1962, 1963; Mateo Sanz & Crespo 2001; Valdés & al. 2002; Fennane 2021; Fennane & Ibn Tatou 2005, 2008).

Chorological types	Number of taxa	%	Chorological types	Nombre de taxa	%
-Mediterranean (large sense).	232	57	-Septentrional	114	28
Mediterranean (strict sense).	134	32.9	Euro-Mediterranean	18	4,42
Western Mediterranean	26	6.38	Eurasian	17	4,17
Central Mediterranean	3	0.73	Paleo-temperate	14	3,43
Sub-Mediterranean	3	0.73	Atlantic-Mediterranean	6	1,47
Ibero-Mauretanian	13	3.19	Circumboreal	5	1,22
Macaronesian-Mediterranean	21	5.15	Eurasian-Mediterranean	1	0,24
Mediterranean-Atlantic	6	1.47	Macaronésien-eurasiatique	4	0,98
North Africa-Sicily	1	0.24	North American	1	0,24
Iranian-Turanian Mediterranean	5	1.22	Eurasian-North Africa	2	0,49
Canary-Mediterranean	4	0.98	Eurasian-temperate	1	0,24
Mediterranean-European	1	0.24	European	40	9,82
North Africa- Italian	1	0.24	Temperate	2	0,49
Mediterranean-Asian	2	0.49	Atlantic	3	0,73
Circum-Mediterranean	15	3.68	-Wide distribution and cosmopolitan	25	6,14
Southern Mediterranean	1	0.24	Cosmopolitan	10	2,45
-Endemic	36	8.84	Sub-cosmopolitan	9	2,21
1 Endemic to Morocco	15	3.68	Paleo-subtropical	4	0,98
2 Endemic Morocco-Iberian Peninsula	10	2.46	Paleo-tropical	1	0,24
3 Algerian - Moroccan endemic	5	1.23	Tropical	1	0,24
4 Endemic Morocco-Algerian-iberian	4	0.98			
5 Endemic Morocco and Canary Islands	1	0.24			
6 Endemic to Morocco, Algeria, Canary Islands, and Iberian Peninsula.	1	0.24			
Total				407	100

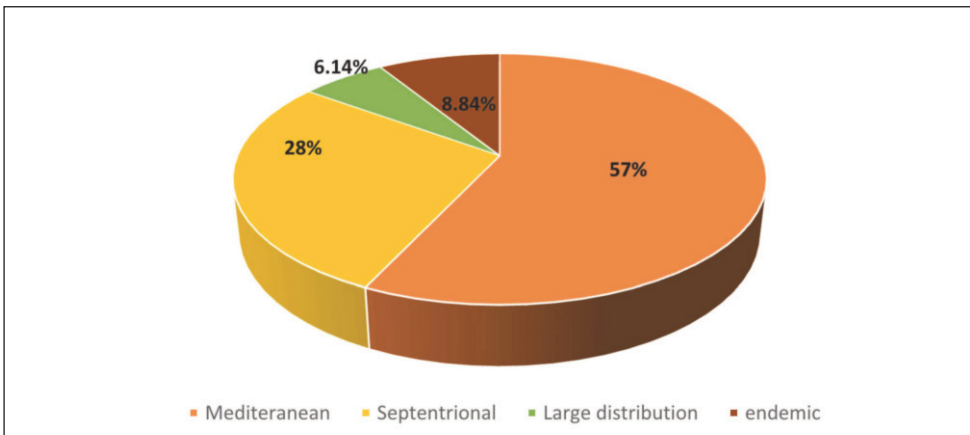


Fig. 9. Chorology of the plant species of the Moulay Driss Zerhoun region.

endemic to Morocco estimated at 920 Fennane & Ibn Tattou (2012). Among these 36 taxa, 32 are strictly species or a rate of 5.16% of endemic species of Morocco estimated at 620 Fennane & al. (2023). This category will be the subject of a future publication.

Wide-ranging species total 25 species or nearly 6.14% of the flora counted in the area. Cosmopolitans and sub-cosmopolitans have 10 and 9 species respectively. The paleo-subtropical element is very weakly represented, with only 4 species.

Conclusion

The study of the flora of the study area has shown a considerable richness of plant biodiversity, especially in the families of *Asteraceae*, *Fabaceae*, *Poaceae*, *Lamiaceae*, and *Apiaceae* which dominate the area. The dominance of therophytes followed by hemicryptophytes in the biological spectrum (Th>Hem> Ph >G>Ch), testifies to the dryness of the summer season and a strong anthropic pressure. It is the image of Mediterranean vegetation. The present work has also made it possible to present a list of rare or threatened species that deserve to be considered for safeguarding and preservation.

The Mediterranean element is important, estimated at more than half of the total number of taxa recorded, followed by the septentrional element which occupies more than a quarter of the total number. Similarly, we were able to inventory 36 taxa endemic to Morocco and shared with neighboring regions. All these data deserve to be capitalized for the benefit of the Moulay Driss Zerhoun region which has a very varied vegetation that can qualify it as a biodiversity hot spot at the regional scale. Thus, the region could be proposed as a new important area for plants.

This would surely contribute to the safeguarding of all threatened, and endemic species present as well as the development of the region.

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