FLORISTIC STUDY OF FOREST BASED ON *TETRACLINIS ARTICULATA* (VAHL) MAST. IN WESTERN ALGERIA

Omar El MECHRI[1]*, Benamar BELGHERBI[2], Abdelkrim BENARADJ[1], Bachir MAHI[3] & Ibrahim BERKANE[3]

[1]Research Laboratory of Sustainable Management of Natural Resources in Arid and Semi-AridAreas, Salhi Ahmed University Center of Naâma, Algeria; ORCID OE: 0009-0008-6793-6491; ORCID AB:0000-0001-6555-6008
[2]Research Laboratory in Geo-Environment and Spaces Development, Faculty of Science of Nature and Life, University of Mascara, Algeria. ORCID:0000-0002-4472-3572
[3]Environment and sustainabledevelopmentlaboratory (ESDL), Department of biologicalscience, University of Ahmed Zabana. Relizane. Algeria
* Corresponding author: elmechri@cuniv-naama.dz

ABSTRACT: The species richness of the Oued Fergoug forest is estimated at 155 species, divided into 44 families and 134 genera. The dominant morphological type is annual and perennial herbaceous species, with 42.58% and 41.3% respectively, while the biological type characterizing this forest formation is therophytic, with a rate of 38.06%, and the biogeographical type is determined by the presence of Mediterranean species (53.54%). Calculation of the disturbance index and the thermophilisation index indicates that the Oued Fergoug forest is in a state of advanced degradation due to adverse climatic conditions, negative anthropozoic impacts and, above all, repeated destructive fires. The overall floristic composition is determined by the presence of rare species, with the exception of *Tetraclinis articulata* in the form of coppice with the species making up its floristic composition (*Pistacia lentiscus* L., *Globularia alypum* L., *Phillyrea latifolia* L. ...). **Keywords**: Species richness; Flora; Degradation; Western Algeria; North Africa.

RESUMEN: **Estudio florístico de la formación forestal de *Tetraclinis articulata* (Vahl) Mast. en el oeste de Argelia**. La riqueza de especies del bosque de Oued Fergoug se evalúa en 155 especies divididas en 44 familias y 134 géneros. El tipo morfológico dominante son las plantas herbáceas anuales y perennes (42,58% y el 41,3% respectivamente); el tipo biológico que caracteriza esta formación forestal son los terófitos con un índice del 38,06%, mientras que el tipo biogeográfico está determinado por la presencia de especies mediterráneas (53,54%). El cálculo de los índices de perturbación y de terófitos indican que el bosque de Oued Fergoug se encuentra en un estado de degradación avanzado debido a las condiciones climáticas adversas, a los impactos antropozoicos negativos y, sobre todo, a los incendios destructivos repetidos. La flora en su conjunto está determinada por la presencia de especies raras, a excepción de *Tetraclinis articulata* en forma de monte bajo con las especies que componen su flora (*Pistacia lentiscus* L., *Globularia alypum* L., *Phillyrea latifolia* L. ...). **Palabras clave**: riqueza de especies; flora; degradación; Argelia occidental; Norte de África.

RÉSUMÉ: Étude floristique de la formation forestière à base de *Tetraclinis articulata* en Algérie occidentale. La richesse spécifique de la forêt d'Oued Fergoug est évaluée à 155 espèces réparties en 44 familles et 134 genres. Le type morphologique dominant est représenté par les herbacées annuelles et vivaces avec respectivement 42,58 % et 41,3 %. Le type biologique caractérisant cette formation forestière est celui des thérophytes avec un taux de 38,06%, tandis que le type biogéographique est marqué par la présence d'espèces méditerranéennes (53,54 %). Le calcul de l'indice de perturbation et de l'indice de thérophytisation indique que la forêt d'Oued Fergoug est en état de dégradation avancée, suite aux conditions climatiques défavorables, aux impacts anthropozoogènes négatifs et surtout aux incendies répétés et destructeurs. Le cortège floristique, dans son ensemble, est dominé par la présence d'espèces rares, à l'exception de *Tetraclinis articulata* (Vahl) qui se présente sous forme de taillis, accompagnée des espèces constituant son cortège floristique (*Pistacia lentiscus* L., *Globularia alypum* L., *Phillyrea latifolia* L., etc.). **Mots-clés** : richesse spécifique; flore; dégradation; Algérie occidentale; Afrique du Nord.

INTRODUCTION

In the global context of preserving biodiversity, the study of the flora and vegetation of the Mediterranean basin is of great interest because of its richness linked to the heterogeneity of historical, paleogeographic, paleoclimatic, ecological and geological factors and the secular impact of anthropogenic pressure (QUÉZEL & al., 1980).

The biodiversity of the Mediterranean basin is exceptional. In the case of tree and shrub species, for example, the Mediterranean region, which accounts for no more than 1,8% of the world's wooded area, is home to 290 forest species compared with just 135 for the rest of Europe (GAUQUELIN & al., 2016).

With its biological diversity, the Algerian forest is characterized by a remarkable wealth of flora and fauna, and certain landscapes are of worldwide interest. It is an essential element in the ecological, climatic and socio-economic balance of various regions of the country. Its current situation is considered one of the most critical in the Mediterranean region (IKERMOUD, 2000).

Due to its geographical situation, its relief and the great diversity of its climates and soils, Algeria has an extremely rich and varied flora in its coastal regions, mountain massifs, high plateaux, steppe and Saharan oases (QUÉZEL& SANTA, 1962-1963); This country, whose natural resources (fauna, soil, vegetation) were the subject of early demands (LOUNI, 1994), is home to highly diversified forest and pre-forest ecosystems that remain relatively unknown, particularly in certain areas of the country. These forest ecosystems are characterized by a remarkable wealth of flora, some of which represent landscapes of worldwide interest (BENABADJI & al., 2007).

Algeria's flora includes 3139 species in nearly 150 families, of which 653 species are endemic, representing a 12,6% endemism rate (MANSOURI *&*al.*,* 2018).

Considering only the Oran area, this conserves around 1780 plant species of the total Algerian flora, i.e. around 57%, as well as 95% of the Maghrebian Mediterranean flora, with 1865 species (QUÉZEL, 2000).

According to VÉLA & BENHOUHOU (2007), the Oran region, in particular the coastal areas, is one of the most endemic regions in Algeria. Thanks to its favorable climatic conditions, this part of the country is home to a characteristic, endemic species: The Barbary Thuja [*Tetraclinis articulata* (Vahl) Mast.], a monoecious species that rarely exceeds 6 to 8 m in height and 0,30 m in diameter on average. There are, however, a few hard-to-reach stands where dimensions can be even greater (12 m by 0,50 m). The tree flowers in autumn (October) and bears fruit the following summer (June-July). This fruiting starts at around 15 years of age and is repeated every two or three years until a very advanced age; *Tetraclinis* is one of the few conifers to reject stumps until a very advanced age, around 400 years (BOUDY, 1952).

Tetraclinis is a thermophilous and xerophilous light species characterized by its low water requirements of 300 to 500 mm / year. Its ecological optimum is linked to the semi-arid bioclimatic stage with mild, hot and very hot temperate variants. It also thrives in subhumid stages with hot, mild and temperate variants on filtering soil (limestone); it fears damp cold and prefers warm exposures (QUÉZEL, 2000). This species is endemic to the three Maghreb countries (Morocco, Algeria and Tunisia). According to the study by ESTEVE & MIÑANO (2010), it is also found in Spain, in the Murcia region, with an occupied area of 595 hectares. And a few more feet are scattered on the Island of Malta, where it is considered the national tree species.

Algeria's climatic diversity gives it one of the most diverse and original floras in the Mediterranean basin. Knowledge of the floristic composition and distribution of weed communities enables the preservation and proper management of these areas.

Vegetation can be used to characterize the state of an ecosystem and highlight its natural or induced modifications (BLANDIN, 1986). The study of vegetation involves the description of groups and their situational conditions. The floristic and ecological characteristics of the vegetation, and the study of the dynamic aspects of the groupings in the field, is essentially carried out using the phytoecological survey method is "the classical phytosociological method" (BRAUN BLANQUET, 1951). In this work, we set out to quantify and analyze the floristic richness and diversity of the *Tetraclinis articulata* (ecosystem from a biological type and biogeographical point of view, and to identify the species loyal to this taxon in the Oued Fergoug forest.

MATERIALS AND METHODS. PRESENTATION OF THE STUDY AREA

The Oued Fergoug forest, located in north-western Algeria, is one of the mountain forests that make up the forest heritage of the wilaya of Mascara; it is part of the "Béni-Chougrane" mountain range. The forest covers an area of 6000 ha of meadows. It is surrounded on all sides by farmland and rangelands. Altitudes vary from 100 to 600 m. This forest is characterized by a very accentuated relief, with the largest surface area exceeding 25% slope. It is drained by several watercourses, including: Oued Fergoug, Oued Tarzout and Oued el Hammam, which flow into the Oued Fergoug dam outlet (Fig. 1).

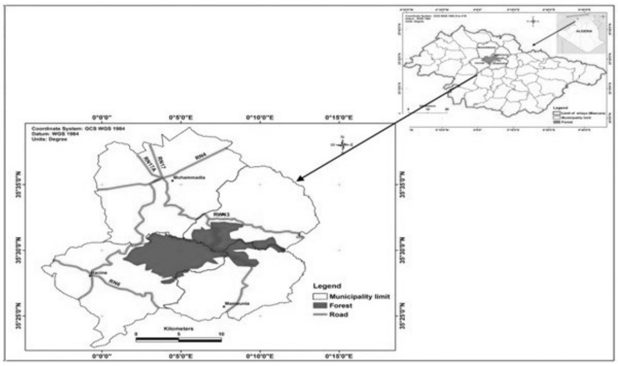

Fig. 1. Map showing the location of the study area.

The region's climate is semi-arid Mediterranean, with temperate to cool winters and average annual rainfall of around 300-350 mm. The average maximum temperature in the hottest month is 35,5°C, while the average minimum in the coldest month is 2,69°C (BELGHERBI & BENABDELI, 2010, 2016; BELGHERBI & al., 2018).

The lithology is characterized by a diversity of surface formations, with a predominance of marl and clay soils sensitive to water erosion (DALLONI, 1940- 1953). The soil types encountered are: Grey or black vertisols occupying low-lying areas, flats and slopes; brown calcareous soils occupying sizeable areas on the hills and less evolved soils occupying the upper slopes (BOUKHARI & al., 2016).

In terms of vegetation, the Oued Fergoug forest is characterized by the dominance of a single species endemic to Algeria, the *Tetraclinis articulata*. The large area is highly vulnerable to erosion. The resulting relief is rugged, with a predominance of steep slopes (20%). The dominant vegetation is represented by *Artemisia herba-alba* Asso and *Ampelodesmos mauritanicus* (Poir.) T. Durand & Schinz. Vast areas based on *Tetraclinis articulata* formations that have been used for grazing. The geographical location, bioclimatic conditions and various types of habitat provide an interesting flora to study in these mountains (RADJA & al., 2024).

It is a forest that shows a positive evolutionary pattern from a very degraded or almost exterminated forest formation, mainly due to successive fires, to a paraclimacic formation, following the protection measures established by the forestry services concerned; This protection has made it possible, on the one hand, to minimize any negative human impact, including fires, and on the other hand, to ensure biological recovery of the floristic composition accompanying *T. articulata* as well as the particularity of sexual and asexual regeneration of this species (EL MECHRI & al., 2024).

METHODOLOGY AND APPLIED MODEL

For a study of the vegetation and in order to draw up a list of plant species found in the Oued Fergoug forest, we applied the simple random sampling method (ZINGER, 1963; DANIEL & al., 2008).

The floristic inventory was carried out using the phytosociological method (BRAUN-BLANQUET, 1951; GUINOCHET, 1973). 100 surveys were carried out with a sampling area of 100 m^2, considered sufficiently representative for Mediterranean formations (DJEBAILI, 1984; AIME & al., 1986; FENNANE, 2003). The species census was carried out in the years 2022 and 2023. Each species is assigned a number of qualitative and/or quantitative indices or coefficients. These are the abundance-dominance and sociability coefficients according to the Braun-Blanquet scale (BRAUN-BLANQUET, 1952; GOUNOT, 1969).

Taxa were identified using various databases and floras: QUÉZEL& SANTA (1962-1963), MAIRE (1952-1987), *Flora Vascular de Andalucía Oriental* (LÓPEZ &al.,2011), and the *Index synonymique de la flore d'Afrique du nord* (DOBIGNARD & CHATELAIN, 2010) and some internet sites through digital flora in this case *Tela Botanica*, *PlantNet*, *Plante Méditerranéenne*.

Taxonomic decisions concerning the organization of families derive from GREUTER & al., (1984-1989) for gymnosperms. For angiosperms, we based ourselves on the APGIII phylogenetic classification (Angiosperm Phylogeny Group, 2016).

Indices have been applied to characterize vegetation: the biological index, the phytochoric index and the morphological index. In addition to these indices, others were applied: the relative frequency for each species; according to DURIETZ (1920), this is expressed by the following formula: **F(%)** (Frequency) = **100× n** (The number of surveys in which the species exists)/**N** (The total number of surveys carried out) and the disturbance index (PI) was used to assess and quantify the impact of anthropozoic action on floristic diversity. This index is defined by HÉBRARD & al. (1995) as follows: **IP** disturbance index = (chamephytes + therophytes)/total number of species x 100.

RESULTS AND INTERPRETATION

Based on **100** vegetation surveys, the species richness of the Oued Fergoug forest is estimated at **155** species grouped into **134**genera and **44** families (Fig. 2). The list is made up of remarkable and fairly important species displaying diversity despite the fact that the two years of the present study (2022-2023) were characterized by severe drought due to the virtual absence of rainfall, which had a negative impact on vegetation. The *Asteraceae* family is the most represented in our surveys, with 31 species or 20%, followed by the *Lamiaceae* family with 18 species or 11.61%, then the *Poaceae* and *Fabaceae* families represent 14 species (9.03%) and 13 species (8.38%) respectively. The *Brassicaceae* with 9 species or 5.8%, the *Asparagaceae* with 7 species or 4.51%, then the *Plantaginaceae*, *Cistaceae* and *Apiaceae* families with 5 species or 3.22%, the rest of the families do not exceed 3 species.

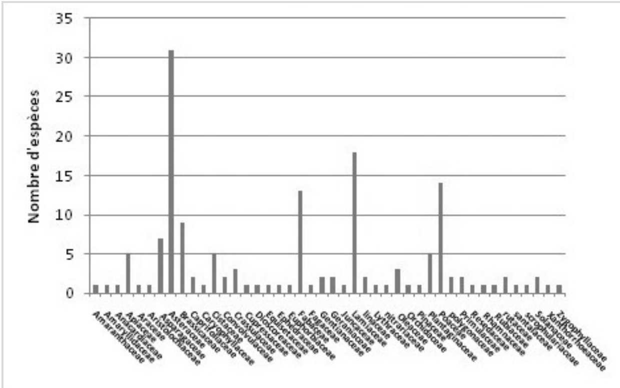

Fig. 2. Representation of species families in the study area.

ANALYSIS OF BIOLOGICAL TYPES

Classification of the species recorded by biological type (Fig. 3) shows a clear dominance of the types best adapted to the various environmental constraints, i.e. therophytes with 59 species (38,06%), followed by hemicryptophytes 35 species (22,58%), chamephytes with 31 species (20%), geophytes 16 species (10,32%) and lastly phanerophytes with 14 species (9,03%).

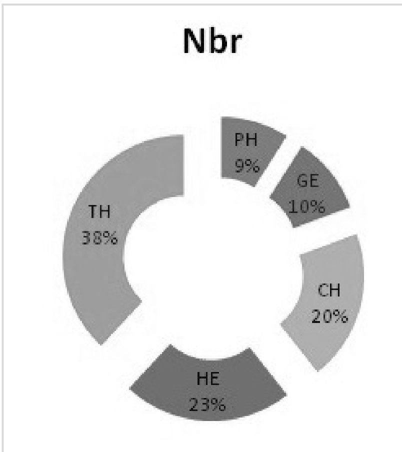

Fig. 3. Representation of biological types in study area.

The high rate of therophytes is evidence of the strong pressure on the forest ecosystem, due to drought and, above all, grazing. According to BARBERO &al. (1990), the presence of therophytes is favored by grazing, which enriches the soil with nitrates and allows the development of ruderal plants, particularly annuals.

This high presence of therophytes is explained by the fact that they are heliophilous species that colonize open spaces and especially cultivated areas (WENDPANGA & al., 2023).

Other researchers, such as MEDAIL& MYERS (2004), consider therophytes to be a form that characterizes Mediterranean and arid zones where high water stress prevails.

Chamephytes are particularly prominent in the study area. This rather remarkable representation is explained by their good adaptation to environmental conditions. According to LE-HOUEROU (1992), overgrazing by sheep and cattle leads to the development of chamephytes, a biological type that is better adapted to summer drought and light than phanerophytes (BENABADJI et al., 2007).

According to FLORET & al. (1990); ORSHAN & al. (1984), chamephytes are well adapted to the phenomenon of soil aridification, as they can develop various forms of adaptation to drought.

Therophytes and chamephytes are biological types found in the southern, western and less eastern parts of the forest. These areas are generally the poorest sites, with skeletal soils that are less rich in organic matter. These forms are found mainly in the most accessible areas, at the ends of forests and at the margins of tracks and certain clearings. These areas are subject to severe degradation as a result of human pressure, leading to intensive, random grazing and consequent degradation of the vegetation and trampling of the soil. It is in these areas that water erosion can be seen in its various forms.

Hemicryptophytes, on the other hand, are found to the north of the forest in the wettest locations and on the most stable soils, which are more or less rich in organic matter. The spread of this form is induced by favorable conditions in these locations. BARBERO & al. (1988) report the presence of hemicryptophytes in the Maghreb countries, due to the presence of organic matter and humidity.

Phanerophytes are less represented than other forms in our study zone, but they are the most present in almost all the plots; we note the presence of a species endemic to Algeria, a species that is essentially localized in north-western Algeria with both ecological and socio-economic virtues: *Tetraclinis articulata*. Accompanied by other species: *Quercus coccifera* L., *Olea europea* L., *Phillyrea latifolia* L.

MORPHOLOGICAL TYPES

From a morphological point of view, the plant formations in our study area are marked by the presence of annual and perennial herbaceous species, with the latter slightly outnumbering the former at 66 species (42,58%) and 64 species (41,3%) respectively. The morphological type of perennial ligneous plants is the least dominant, with 25 species or 16,13% (Fig. 4). Perennial vegetation is mostly confined to the north of the forest, providing permanent ground cover and protecting the soil from erosion.

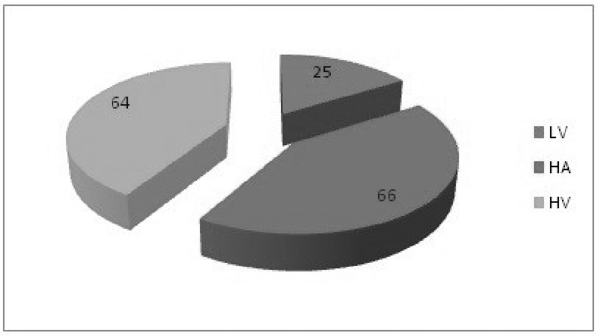

Fig. 4. Morphological shapes of the study area.

Bearing in mind that the Oued Fergoug forest is a protection forest, this herbaceous vegetation makes it possible to: (i) reduce the energy of rain erosion by intercepting raindrops, thanks to the aerial parts of the plants (COSANDEY & al., 2000); (ii) combat runoff, by increasing water infiltration (CERDA, 1998); (iii) maintain the soil thanks to the root systems. In fact, plants improve soil cohesion and thus strengthen its mechanical properties (O'LOUGHLIN & XINBAO, 1986).

BIOGEOGRAPHICAL TYPES

The biogeographical characterization of the species inventoried shows the floristic richness of the existing formations. The biogeographical characterization of species is based on the indications proposed by the floras of QUÉZEL& SANTA (1962-1963) and OZENDA (1991).

Floristic status is dominated by Mediterranean species with 83 species or 53.54%, followed by Euro-Mediterranean species with 9.03% (14 species). Eurasian and Ibero-Mauritanian species account for 3.87% (6 species); the remaining species are Macaronesian-Mediterranean with 4 species (2.58%), Atlantic-Mediterranean with 4 species (2.58%), Mediterranean-Iranian-Turanic with 1 species and Endemic-North African with 5 species (3.22%) and a single species endemic to Algeria (Fig.5).

This situation is common to most natural ecosystems in Algeria (QUÉZEL, 1964-2002) and the rest of the Mediterranean basin (QUÉZEL & BARBERO, 1990; QUÉZEL & MÉDAIL, 2003).

The inventory revealed that 90% of the species encountered have medicinal properties.

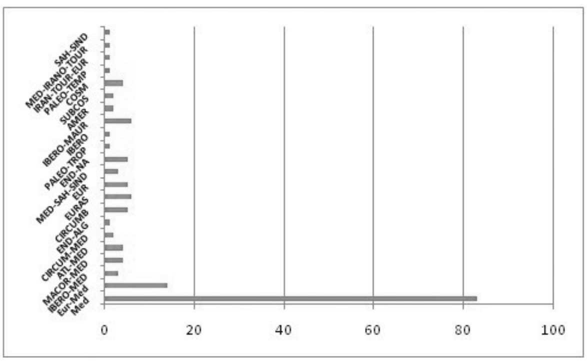

Fig. 5. Representation of biogeographical types in the study area.

DISTURBANCE INDEX

The value of the disturbance index depends largely on the dominance of therophytes, which is directly linked to the degree of openness of the plant formations (LOISEL & GAMILA, 1993; HEBRARD & al., 1995).

The disturbance index calculated reveals a rate of 58.06%. This indicates that the study area is subject to significant disturbance due to climate change in recent years, but mainly of anthropogenic origin. According to QUÉZEL& BARBERO (1990) In the Maghreb, this opening-up of vegetation is currently due to disturbances of anthropogenic origin.

Table (1) shows that the most constant species are *Tetraclinis articulata* present in all plots (100%) *and Pistacia lentiscus* with a rate of 84%: *Globularia alypum* (72%), *Phillyrea latifolia* (70%), *Quercus coccifera* (70%) and *Olea europea* (68%). 16 species are common, with rates varying between 48 and 58%. "Rare" species number 35, with a percentage not exceeding 33%. The "very rare" species account for the remainder of the species, and do not exceed 19%, but they represent the majority of the species recorded in our surveys, with 88 species (55,7%).

These results show that the most abundant species marking the floristic status of the Oued Fergoug forest are mostly phanerophytes, with the perfect dominance of *Tetraclinis*, the objective species of this forest, followed mainly by species that make up its floristic cortège. It's also worth noting the presence of a forest species that manages to maintain itself despite the adverse ecological conditions, namely *Quercus coccifera*.

These results clearly show that the most abundant and frequent species are those that are native to the study area. On the other hand, the presence of a large number of rare and very rare species can be explained by the fact that these are species of low ecological value "stenopecious species" as confirmed by GEGOUT (1995), where this is explained by the fact that the forest is at risk of degradation due to deterioration of the vegetation cover as a result of anthropic impact and a long duration of very disturbing climatic factors, requiring special attention and the urgent implementation of a protection program to ensure biological recovery.

CONCLUSION

Following this study, it appears that the Oued Fergoug forest, with a status of 155 species and 44 families, remains a rich and diversified forest formation despite the fact that the area has experienced a period of fairly pronounced drought in recent years, the strong pressure exerted by intensive grazing and the destructive impact of repeated fires.

The main species of this forest (*Tetraclinis articulata* is 100% present in all vegetation surveys carried out, and manages to maintain itself despite adverse environmental and social conditions. It manages to develop as a coppice, oscillating between dense coppice on the northern, north western and north eastern slopes of the forest, and open coppice mainly on the southern slopes.

The Oued Fergoug forest is a protection forest, located on the Bénichougrane mountains. Its role is to protect the soil and the slope against erosion, to protect the dam against sediment transport and to protect infrastructure (roads, neighboring towns, etc.).

Faced with this situation of forest degradation and in view of the protection function assigned to this formation housing an endemic species, it is very important, even urgent, to set up a management plan enabling environmental, social and economic attributes to be reconciled. Several actions need to beundertaken:

- As a matter of urgency, stop replanting Aleppo pine in this area, as it has suffered fatal dieback and entomological and/or cryptogamic contamination of barbarian Thuja is possible.
- Set up a schedule of silvicultural work to ensure the development of this species.
- Calculate the regeneration effort and guarantee the regeneration of the species and study the absence of regeneration by seedlings.
- Reforest empty spaces, especially those exposed to water erosion;
- Try to involve the local population in the various forestry activities that ensure the protection and preservation of the forest and a direct and/or indirect benefit for the population.

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Table 1. List of species recorded in the study area.

Rarety class (Durietz, 1920) / **Species**	**Frequency (%)**
Class V: very constant	
Tetraclinis articulata (Vahl) Mast.	100
Pistacia lentiscus L.	84
Class IV: Abundant	
Globularia alypum L.	72
Phillyrea latifolia L.	70
Quercus coccifera L.	70
Olea europea L.	68
Class III: Frequent	
Artemisia californica Less.	48
Ruta angustifolia Pers.	58
Thymus vulgaris L.	57
Cistus creticus L.	56
Cistus clusii dunal	50
Ampelodesmos mauritanicus (Poir.) T. Durand & Schinz	51
Calicotome spinosa (L.) Link	50
Teucrium pseudochamaepity L.	49
Bromus diandrus Roth	49
Hordeum murinum L.	41
Lavandula dentata L.	43
Class II: Rare	
Teucrium polium L.	39
Marrubium vulgare L.	38
Salvia verbenaca L.	35
Anisantha diandra (Roth) Tutin ex Tzvelev	34
Foeniculum vulgare Mill.	28
Aethusa cynapium L.	29
Eryngium campestre L.	37
Asteriscus aquaticus (L.) Less.	34
Arisarum simorrhinum Durieu	29
Macrochloa tenacissima (L.) Kunth	29
Aristolochia baetica L.	23
Asparagus horridus L.	25
Asparagus acutifolius L.	37
Drimia maritima (L.) Stearn	33
Perityle microglossa Benth.	32
Cistus albidus L.	31
Agrostis capillaris L.	31
Elytrigia repens (L.) Nevski	26
Asparagus verticillatus L.	25
Pallenis maritima (L.) Greuter	24
Fagonia cretica L.	23
Ruta chalepensis L.	22
Pallenis spinosa (L.) Cass.	22
Artemisia campestris L.	30
Carduus pycnocephalus L.	21
Crepis micrantha Czerep	21
Dioscorea communis (L.) Caddick & Wilkin	29
Ballota hirsuta Benth.	29
Sonchus oleraceus L.	29
Stachys ocymastrum (L.)Briq.	28
Phagnalon saxatile (L.)Cass.	28
Paronychia argentea Lam.	27
Crepis albida Vill.	26
Rumex verticillatus L.	25
Scolymus hispanicus L.	24
Sedum sediforme (Jacq.)Pau	24
Lobularia maritima (L.) Desv.	21
Chondrilla juncea L.	27
Hedysarum boveanum Bunge ex Basiner	22
Peganum harmala L.	24
Plantago lagopus L.	39
Plantago ciliata Desf.	22
Convolvulus althaeoides L.	22
Calicotome villosa(Poir.) Link	22
Salvia rosmarinus Spenn.	21
Globularia arabica Jaub. & Spach	21
Aegilops geniculata Roth	20
Brassica napus L.	20
Asphodelus ramosus L.	20
Lagurus ovatus L.	20
Class I: Verry rare	
Lapiedra martinezii Lag.	19
Helianthemum violaceum (Cav.) Pers.	19
Sedum rubens L.	19
Centaurium erythraea Rafn.	19
Sisymbrium officinale (L.) Scop.	19
Hieracium cerdanum Arv.-Touv.	19
Lysimachia monelli (L.) U. Manns. & Anderb	19
Trifolium arvense L.	19
Apera spica-venti (L.) P.Beauv.	19
Hypochaeris glabra L.	18
Drimia numidica (Jord. & Fourr.) J.C. Manning & Goldblatt	18
Anthemis arvensis L.	18
Onopordum illyricum L.	17
Lomelosia stellata (L.)Raf.	17
Erodium malacoides (L.) L'Hér	17
Visnaga daucoides Gaertn.	16
Anisantha sterilis (L.) Nevski	15
Calendula arvensis L.	15
Calendula suffruticosa Vahl	14
Phalaris paradoxa L.	15
Eruca vesicaria (L.) Cav.	14
Avenula bromoides (Gouan) H. Scholz	14
Catananche caerulea L.	14
Ajuga iva (L.)Schreb	14
Centaurea pullata L.	14
Ziziphora capitata L.	13
Moricandia foetida Bourg. ex Coss	13
Chrysojasminum fruticans (L.) Banfi	13
Anacyclus clavatus (Dest.) Pers.	13
Linum suffruticosum L.	12
Linum strictum L.	12
Medicago sativa L.	12
Ipomoea sagittata Poir.	12
Moricandia arvensis (L.) DC.	12
Plantago albicans L.	12
Hirschfeldia incana (L.) Lagr.-Foss	12
Rosmarinus eriocalyx Jord. & Fourr.	12
Hieraciumpallidum Biv.	12
Cytisus villosus Pourr.	11
Erodium botrys (Cav.) Bertol.	11
Sedum hispanicum L.	10
Thymus zygis L.	11
Euphorbia peplis L.	11
Osyris lanceolata Hochst. & Steud.	10
Genista scorpius(L.) DC.	10
Juncus acutiflorus Ehrh. ex Hoffm.	9
Equisetum ramosissimum Desf.	9
Lythrum borysthenicum (M. Bieb. ex Schrank) Litv.	9
Bombycilaenaerecta(L.) Smoljan	9
Centaurium pulchellum (Sw.) Hayek ex Hand.-Mazz., Stadlm., Janch. & Faltis	9

Ceratonia siliqua L.	9
*Atriplex halimus*L.	9
Lotus ornithopodioides L.	9
Cladanthus arabicus (L.) Cass.	9
Daucus muricatus L.	9
Himantoglossumrobertianum (Loisel.) P. Delforge	9
Polygonum arenarium Waldst. & Kit.	9
Centaurea melitensis L.	9
Sherardia arvensis L.	8
Crepis foetida L.	8
Asparagus albus L.	8
Fumana laevipes (L.) Spach.	8
*Prasium majus*L.	7
Ephedra fragilis Desf.	7
Verbascum sinuatum L.	7
Pinus halepensis Mill.	6
Ornithopus pinnatus (Mill.) Druce	6
Matthiola longipetala (Vent.) DC.	6
Pseudodictamnus acetabulosus (L.) Salmaki & Siadati	6
Rhamnus alaternus L.	6
Bellis sylvestris Cirillo	5
Coronilla scorpioides (L.) W.D.J.Koch	5
Coris monspeliensis L.	5
Reseda alba L.	5
Ornithogalum orthophyllum Ten.	5
Thymbra capitata (L).Cav.	5
Sideritis montana L.	5
Stachys arvensis L.	5
Hymenopappus filifolius Hook.	5
Sulla spinosissima (L.) B.H.Choi & H.Ohashi	5
Rapistrum rugosum (L.) All.	4
Bromus madritensis L.	4
Withania frutescens (L.) Pauquy	3
Scabiosa atropurpurea L.	3
Solanum nigrum L.	3
Cirsium undulatum Spreng.	3
Colutea arborescens L.	2
Dittrichia viscosa (L.) Greuter	2

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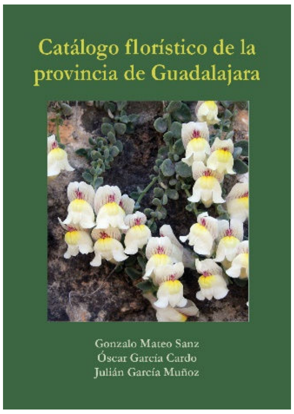

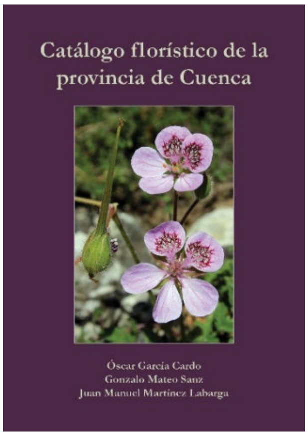

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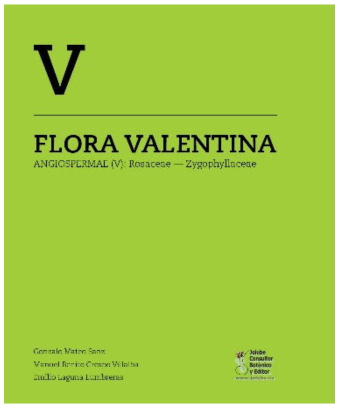

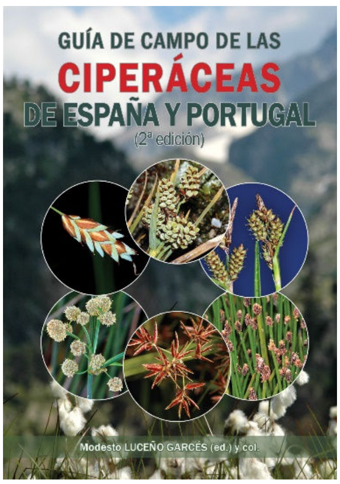

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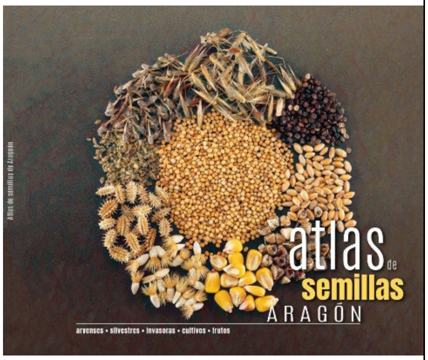

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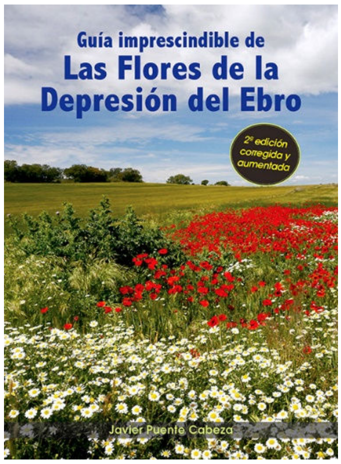

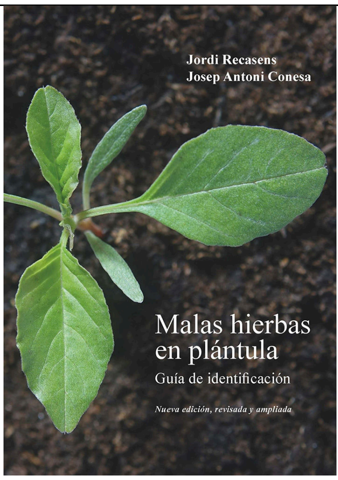

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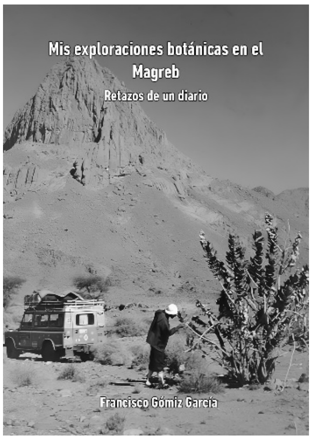

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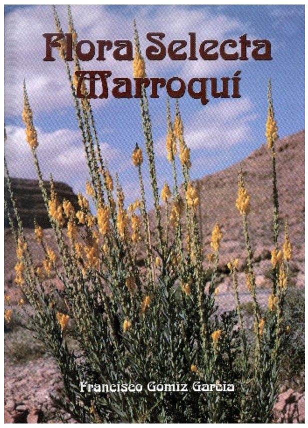

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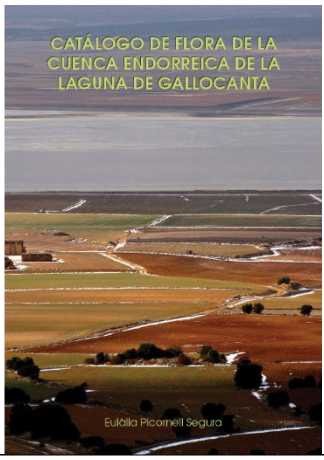

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