Received: 23.07.2025; Revised: 21.10.2025; Accepted: 27.11.2025

UKRAINIAN JOURNAL OF FOREST AND WOOD SCIENCE

UKRAINIAN JOURNAL OF FOREST AND WOOD SCIENCE

Journal homepage: https://forestscience.com.ua/en
Ukrainian Journal of Forest and Wood Science, 16(4)

UDC 581.9:574(65)
DOI: 10.31548/forest/4.2025.31

Diversity and floristic analysis of *Pistacia lentiscus* L. (Anacardiaceae) groups in Tiaret region (West Algeria)

Belgacem Nouar*

PhD in Plant Ecology
Ahmed Zabana Relizane University
P.O. Box 48000, Bourmadiya Neighbourhood, Relizane, Algeria
https://orcid.org/0000-0002-3502-127X

Hicham Berrabah

PhD in Biology
Ibn Khaldoun Tiaret University
BP 78, Algiers Rd., Tiaret, Algeria
https://orcid.org/0000-0002-1416-145X

Benchohra Maamar

Professor
Ibn Khaldoun Tiaret University
BP 78, Algiers Rd., Tiaret, Algeria
https://orcid.org/0000-0002-6014-4837

Sid Ahmed Aouadj

PhD in Plant Ecology
Ahmed Zabana Relizane University
Bourmadiya Neighbourhood, Relizane, Algeria
Laboratory of Ecology and Management of Natural Ecosystems
Abou Bekr Belkaid University
BP 119, 22 Rue Abi Ayed Abdelkrim, Tlemcen, Algeria
https://orcid.org/0000-0002-5081-5844

Mohamed Amine Nouar

Master
Ibn Khaldoun Tiaret University
Algiers Road, BP 78, Tiaret, Algeria
https://orcid.org/0009-0000-7854-3249

Suggested Citation:

Nouar, B., Berrabah, H., Maamar, B., Aouadj, S.A., & Nouar, M.A. (2025). (2025). Diversity and floristic analysis of *Pistacia lentiscus* L. (Anacardiaceae) groups in Tiaret region (West Algeria). *Ukrainian Journal of Forest and Wood Science*, 16(4), 31-56. doi: 10.31548/forest/4.2025.31.

**Corresponding author*

Abstract. This study aimed essentially at the knowledge and analysis of associated *Pistacia lentiscus* L. groups in the Tiaret region. By an analytical and statistical approach of the floristic inventories made in this area, three stations (Saffalou, Plateau and Guertoufa) were selected during the optimal vegetation seasons March-June between 2015-2018. A total of 166 species was identified; these species grouped into 131 genera and 43 families highly dominated by Angiosperms (98.2%). The most represented families were *Asteraceae*, *Poaceae*, *Fabaceae*, *Cistaceae*, *Lamiaceae* and *Brassicaceae* with percentages (15.1%, 10.8%, 9%, 6%, 5.4% and 4.8%), respectively. The biological spectrum of the flora was dominated by Therophytes (51.2%), whereas Mediterranean species group was well presented (54, 8%) compared to the other groups. Ecological indexes calculation showed that, Shannon index revealed a high diversity (H = 4.6), Pielou Equitability (J = 0.9) indicated a regularity in species distribution whereas Simpson index (1 - D = 0.98) reflected a low diversity of stands. Meanwhile, the overall perturbation index (PI = 63%) reflected the openness of the environment. Moreover, Jaccard (S) similarity coefficient remained less than 50% in all the compositions between the stations, reflecting a heterogeneity in the floristic composition of these stations. The Agglomerative Hierarchical Classification (AHC), revealed a division of species into two main groups 91.56% and 8.43%. Subsequently, Factorial Analysis of Correspondence (FAC) reflects an opening of the environments in the studied groups and installation of species with short life cycle that adapt to local arid conditions. The results obtained provide a diagnosis of the condition of the plant cover in the face of ecological factors, and can be used by foresters to improve the management, protection and restoration of these natural areas

Keywords: mastic trees; floristic richness; ecological factors; thyrophetisation; aridity

Introduction

The Mediterranean region represents one of the world's most valuable centres of biodiversity and considered as one of the richest hotspots of the world with over 24,000 species distributed in the large territory of the Mediterranean Basin, where the interaction of climatic, geographical, and anthropogenic factors gives rise to unique plant communities. This hotspot has a long history of modification of natural ecosystems by human activities, and it is one of the regions that will face extensive changes in climate (Vargas, 2020).

The authors B. Gordo & S. Hadjadj-Aoul (2019) explored the floristic endemism in the Algerian-Moroccan mountain range of the Ksour (Naâma, Algeria), providing a comprehensive study on plant species unique to this area. Their research highlighted the distribution and significance of these endemic species, which are crucial for understanding regional biodiversity and ecosystem stability. A.D. Solomou (2025) examined the Mediterranean Basin within the broader context of terrestrial biomes, focusing on the impact of global warming on ecological and biodiversity patterns. His work provided an essential synthesis of the biome's vulnerability to climate change, emphasising the importance of conservation measures in this biodiverse region. Researchers A. Benkhettou *et al.* (2022), reported that regions of climatic transition between humid and arid are particularly susceptible to degradation due to the combination of climate change and human activities which leads to increased habitat fragmentation and land degradation and abandonment. Due to its well-known rich taxonomy, its strong plant endemism and growing human threats, the entire Mediterranean Maghreb belongs to priority global concerns in terms of conservation biology of which the North of Algeria is home to a diversity of rare and endemic flora.

In the western part of Algeria in general, a significant degradation of forest and pre-forest ecosystems has been observed and particularly in the mountainous areas of Tiaret by multiple human activities of which repeated forest fires remain the most serious and threatening phenomenon (Safa *et al.*, 2022), leading to changes in the floristic composition and structure of plant assemblages. N. Zemmar *et al.* (2020) focused on the floristic diversity in Bissa Forest, located in Chlef, Algeria. The authors analyzed the plant species present in this southern Mediterranean ecosystem, revealing the richness and ecological significance of the area's vegetation for understanding Mediterranean biodiversity. A. Saidi & A. Keifa (2024) examined the vascular plant diversity in the Mimouna Forest in north-western Algeria. Their research contributed to the knowledge of plant diversity in this forest, emphasising the importance of preserving its floristic heritage in the face of environmental challenges.

The study of spontaneous populations of *Pistacia lentiscus* L., a characteristic Mediterranean species, which is distributed in a wide range of habitats (forests, brush and scrubland) in both the Tell region and in forested areas with a very interesting richness of a wide range of bioactive compounds and multiple virtues for use in human medicine (Atmani *et al.*, 2025). W. Benchiha *et al.* (2024) investigated the antioxidant activity and the content of phenols and flavonoids in aqueous extracts from the leaves of *Pistacia lentiscus* L. Their study highlighted the potential of this plant as a source of natural antioxidants, with implications for both pharmacological and environmental applications. A. Bouchfara *et al.* (2025) evaluated the antibacterial and antioxidant properties of essential oils from *Pistacia lentiscus*, focusing on the impact of total phenolic content on antioxidant efficacy. Their findings provided insights into the potential medicinal applications of *Pistacia lentiscus* essential oils. The research by S. Moussaoui *et al.* (2025) evaluated the polyphenolic profile and various bioactivities (antioxidant, anti-cholinesterase, and anti-alpha-amylase) of *Pistacia lentiscus* L. leaves. The study highlighted the broad therapeutic potential of this plant, particularly in relation to metabolic and neurodegenerative diseases

Also, the plant plays a key role in the stabilisation of local biocoenoses, provides a deeper understanding of the mechanisms underpinning the conservation of plant diversity under ecological stress and climatic variability. Such analysis is essential for assessing the ecological potential of these formations and for developing strategies aimed at the restoration of natural ecosystems. M.N. Youcefi *et al.* (2020), confirm that one of the primary goals in community ecology is to determine the relative importance of processes and mechanisms that control biodiversity.

The insufficiency of the studies of these plant groups in Tiaret mountains, prompted to select this species, that grows spontaneously in this region and occupies an important area as a research model on this subject in order to inventory and identify their associated species and to determine the ecological factors that influence these plant groups through ecological indexes.

This study's aim was to investigate the ecological characteristics of *P. lentiscus* L. populations in the Tiaret region in order to assess their adaptive potential and environmental significance towards.

Materials and Methods

The study area was an integral part of the Tiaret Mountains, located in the north of the department (wilaya) and embracing in south the city of Tiaret, they are between 700 and over 1,200 m high (Fig. 1). The dominant bioclimate was of the type semi-arid in its cool winter variant mesomediterranean level (Miara *et al.*, 2020). Soil textures vary between silty-sandy, silty-clay-sandy and silty (Nouar *et al.*, 2020).

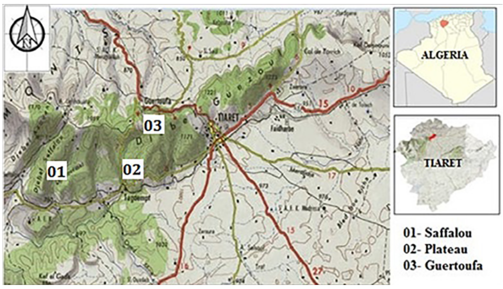

Figure 1. Geographical location of study stations

Source: developed by the authors

In order to obtain the maximum information on the studied groups and to cover the maximum of area by floristic surveys, it was preselected three (03) stations in the natural range of *P. lentiscus* L: Saffalou, Plateau and Guertoufa. A stratified sampling was conducted in three selected areas, which were relatively homogeneous, following the methodology outlined by M. Gounot (1969).

I. Benmehdi *et al.* (2013), have highlighted that a surface of 100m^2 seems to be sufficient for these mastic tress groups. Therefore, it was conducted 10 floristic surveys per station, 30 in total during the optimum period of vegetation (March to June) in the years 2015 to 2018 using the minimum area survey method adopted by J. Braun-Blanquet (1951) lists of all species present in the floristic cortege of the target species. Each species was accompanied by two indexes: abundance-dominance and sociability. Field material was as follow: a rope to determine surface area; a GPS to locate each survey and a station description was carried out citing altitude, soil characteristics and physiognomic recovery rate estimation.

The identification of taxa was made using the flora of P. Quézel & S. Santa (1962-1963) updated by the index of A. Dobignard & C. Chatelain (2010-2013). The different biological types were performed using the method of Raunkiaer. Collected specimens were pressed and dried and vouchered. Species identification was performed by local botanists. Then, they were conserved in the laboratory of Botany at the Faculty of Sciences of Nature and Life, Earth Sciences and Universe, University of Tlemcen (Algeria). In accordance with the Executive Decree No. 12-03 (2012), fixing the list of the non-cultivated protected plants throughout Algeria and by extension subject to the objectives and obligations of the Convention on Biological Diversity (1992).

The Table 1 of flora inventories by species was used as a database for systematic (families, biological and biogeographical types) and statistical analysis for ecological indexes (Table 2), Agglomerative Hierarchical Clustering (AHC) species and Factorial correspondence analysis (FAC). The restitution of the graphs was carried out by Microsoft Excel software and Minitab 18.1 software for statistical processing. AHC was used to determine the groups of species, allowing to individualize the groups of species and within each group, it was considered the floristic indicator as a guiding factor in the diagnosis of vegetation dynamics (Benmehdi, 2012). FAC was performed to show the ecological gradients that influence the vegetation studied. S. Ghezlaoui & N. Benabadji (2018), H. Khennouf *et al.* (2018) and M. Souddi & B.D. Ghezlaoui-Bendi-Djellou (2020) considered this method to be the most appropriate techniques for the discrimination of plant groups and the determination of ecological gradients.

Table 1. Phytosociological table of inventoried species

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Allium subvillosum Salzm. ex Schult. & Schult. f																	1.1	1.1							1.1	2.1	1.1	2.1	1.1	
Narcissus serotinus L.												1.1		2.1	1.1	+									+					
Pistacia lentiscus L.	2.2	2.3	1.1	1.2	2.3	1.2	2.3	1.1	1.1	2.3	1.1	1.1	1.1	2.1	1.1	2.1	+	+	1.1	1.1	2.3	2.1	3.3	3.3	2.1	2.1	2.1	2.3	2.1	2.1
Pistacia terebinthus L																	1.1			1.1										
Ammoides pusilla (Brot.) Breistr								1.1																						
Ferula communis L.								1.1																						
Ferula lutea (Poiret) Maire					2.2			1.2								+					+				2.1			+		
Nerium oleander L.																													+	
Chamaerops humilis L			2.2			1.2		2.3	2.2													+		+				+		
Asparagus acutifolius L.				2.2	1.2		1.1	1.1		1.1		+	1.1	1.1			1.1	1.1	1.1		+	1.1		1.1		1.1		1.1	1.1	
Asparagus albus L.								1.2																						
Dipcadi serotinum (L.) Medik															+	+											+			
Drimia maritima (L.) Stearn			1.1				1.1		1.1	1.1	+											1.1								
Muscari comosum L. Mill											+					+		+									1.1	1.1		
Ornithogalum baeticum Boiss.						1.1	2.1			2.1			+			1.1								+			+			
Anacyclus clavatus (Desf.) Pers						1.1		2.1								+	1.1	1.1		1.1			1.1		+	1.1		+		
Atractylis cancellata L.																													2.1	
Bellis annua L. *subsp. annua*													1.1		1.1				1.1											
Bellis sylvestris L.												2.1				1.1					1.1									
Bombycilaena discolor (Pers.) M.								+								+			2.1				+							1.1
Calendula arvensis (Vaill.) L.	+		2.1			1.1			2.1						+															

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Carduus pycnocephalus L. subsp. *pycnocephalus* L (M).																							+				1.1		1.1	
Cirsium echinatum (Desf.) DC.																							+							
Crepis vesicaria L			+						+				+												1.1		1.1			
Echinops spinosus. subsp eu.spinosus Greuter								1.2											1.1											
Glebionis segetum (L.) Fourr																1.1	2.1	3.1		+		1.1				1.1	1.1			
Glossopappus macrotus (Durieu) Briq. & Cavill		+									2.1		1.1															1.1		
Hedypnois rhagadioloides (L.) F. W. Schmidt												+		+	+								1.1							
Helichrysum stoechas (L.) Moench					1.2																1.1									
Helminthotheca glomerata (Pomel) Greuter														+										1.1					+	
Hyoseris radiata L.						1.1		2.1																						
Hyoseris scabra L.						+																								
Hypochaeris radicata L.												+																		
Leontodon tuberosus L., Hem											+																			
Micropus supinus L																						1.1								+
Pallenis spinosa (L.) Cass. subsp. *spinosa*								2.1																				+		
Senecio giganteus Desf	+	1.1			+	1.1					+	1.1	1.1								1.1	1.1			1.1					
Sonchus tenerrimus L. *subsp. tenerrimus*																								1.1						
Taraxacum obovatum (Willd.) DC.																								1.1		2.1				

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Tolpis barbata (L.) Gaertn.																								+	+	+				1.1
Borago officinalis L																									+					
Cynoglossum cheirifolium L														+																
Echium plalltagineum L.								+																						
Neatostema apulum (L.) I.M.Johnst																			1.1											
Alyssum alpestre L.																										+				
Alyssum simplex Rudolphi			+						+													+								
Biscutella didyma L.						+						1.1			2.1	1.1		2.1		2.1										+
Capsella bursa–pastoris (L.) Medik.	+																													
Eruca vesicaria L											1.1						+	+			+								+	
Lobularia maritima (L.) Desv .	1.2	1.1			1.2	2.2	1.1			1.1	2.2	2.1	2.1				+	1.1			3.3	2.1	2.1	1.1	+	+	1.1	2.1		+
Matthiola lunata DC.											2.3	1.1	+	1.1	+						1.1							2.1		
Sinapis arvensis L	1.1		1.1			2.1	1.1		1.1	1.1						+							1.1						1.1	
Lomelosia stellata L								2.1																		+				+
Lonicera implexa Aiton												1.1		1.1					1.1				1.1						+	
Paronychia argentea Lam.						+					1.2			1.1			1.2	1.2	2.2			1.2	1.2		+		1.1			
Silene colorata Poir. subsp. *colorata*															+															
Silene latifolia Poir. *subsp. Latifolia*															+															
Silene muscipula L.																													+	
Silene secundiflora Otth.																										+				
Cistus creticus subsp. eriocephalus (Viv.) Greuter & Burdet					2.2	1.2		1.2					2.1		2.2				1.1		1.1			1.1	2.1	2.1	2.1	1.1	1.1	

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Cistus halimifolius L		1.2		2.2	2.2						2.2	2.2	1.2	1.2											2.1		3.3	3.3		
Cistus ladanifer subsp. mauritianus Pau & Sennen	2.2	2.2			2.2																					1.1				
Cistus salvifolius L.	1.2	2.2	1.2	2.2			1.2	1.2	1.2	1.2	1.2	1.2	2.1	2.2	1.2	1.1		2.1	1.1			1.2	1.1	1.1	2.1	1.1	1.1	1.1	1.1	1.1
Fumana thymifolia (L.) . Verlot																+														
Helianthemum cinereum subsp. rotundifolium (Dunal) Greuter & Burdet			+						+																					
Helianthemum hirtum subsp. ruficonum (Viv.) Maire											+																			
Helianthemum pilosum L.							2.1	+		2.1																				
Helianthemum salicifolium (L.) Mill			2.1						2.1																					
Tuberaria guttata subsp. variabilis (Willk.) Litard		1.1	1.1			2.1			1.1													2.1								
Convolvulus cantabrica L.								2.1																						
Convolvulus siculus L. *subsp. siculus*			+						+																					
Sedum sediforme (Jacq.) Pau								1.2								2.2										1.2		+	1.2	
Juniperus oxycedrus L.		+									2.1	1.1	2.3	3.3	3.3	2.3		2.1	2.3	1.1	3.3	3.3		2.1	2.1	3.3	2.3	1.1	2.3	3.3
Tetraclinis articulata (Vahl) Mast																												+		+
Arbutus unedo L.	2.3	2.1			2.3							+	1.1	1.1									1.1		+	1.1	1.1	1.1	+	
Euphorbia falcata L																				+										
Astragalus edulis Bung																			2.1											
Bituminaria bituminosa (L.) C.H.Stirt																													1.2	

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Calicotome spinosa (L.) Link subsp. *spinosa*			1.2	2.2	2.2	1.2		2.1	1.2		+	1.1			1.1	+			1.1		2.1		2.1		1.1		1.1	1.1	2.1	2.1
Coronilla scorpioides (L.) W.D.J. Koch			+						+																					
Genista tricuspidata Desf. *subsp. tricuspidata*			2.2			1.2		2.2	2.2																					
Hedysarum pallidum Desf.							1.2	+		1.2																		1.1	1.1	
Lotus creticus subsp. cytisoides (L.) Arcang				1.2	1.2									1.1									+		1.1					
Lotus subbiflorus Lag						1.2																2.1								
Medicago italica (Mill.) Fiori														+	1.1															
Medicago orbicularis (L.) Bartal																+							1.1							
*Ornithopus compressus*L.												1.1				1.1														
Scorpiurus muricatus. subsp sulcatus (L.) TheIl.						+	+			+					+							1.1								
*Trifolium arvense*L.																										1.1	1.1			
Trifolium cherleri L.																			+					+						
Trifolium stellatum L.															+				+				1.1	2.1			1.1			
Quercus coccifera L. *subsp coccifera*	1.2	1.2				1.1	1.2			1.2																			+	
Quercus ilex subsp. ballota (Desf.) Samp		1.1	1.1	1.1	1.1			1.1	1.1		2.3	3.3		1.1	1.1	2.3	1.1	2.1	1.1	2.1	1.1	1.1	2.1	+	2.3	1.1		2.3	1.1	1.1
Quercus suber L.		+		1.1	1.1																									
Erodium chium (L.) Willd.			+						+																					

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Erodium cicutarium L'Her.																		+				+								
Erodium malachoides(L.) *L'Her*											+							+										3.1		
Erodium moschatum (Burm.) L'Her.	2.1	1.1	2.1	+		+	1.1		2.1	1.1	1.1	1.1		1.1							1.1	1.1	1.1	1.1			+	3.1	1.1	+
Geranium molle L.	+																					+								
Geranium purpureum Vill													1.2																	
Iris planifolia (Mill.) T. Durand & Schinz										+																				
Moraea sisyrinchium (L.) Ker Gawl																				+										
Romulea bulbocodium (L.) Seb.et Maur.																					+									
Cleonia lusitanica L.								1.1																						
Lavandula stoechas L.	2.2	2.2		1.2	1.2	1.2	2.2			2.2	1.1		2.1	1.1	2.1	1.1			1.1		1.1	2.1	1.1	1.1	2.1	1.1	1.1	2.1		2.1
Marrubium vulgare L.																						1.2								
Rosmarinus officinalis L.							3.3			3.3														2.3	2.1	2.1				
Salvia verbenaca (L.) Briq.																						1.1								
Stachys ocymastrum (L.) Briq.								1.1																						
Teucrium pseudochamaepitys L.												1.1			1.1	1.1	1.1		1.1				+		1.1	2.1	2.1			+
Teucrium thymoides Pomel,			1.2				1.2	1.2	1.2	1.2					+									1.1						
Thymus ciliatus (Desf.) Benth. subsp. *ciliatus*			1.2		1.2	2.3	2.2		1.2	2.2		1.2			1.2	1.2			1.2			2.2				1.2		1.2		1.2
Fritillaria oranensis Pomel							+			+																				
Gagea algeriensis Chabert																						+								
Jasminum fruticans L													1.1	1.1	1.1	2.1	+	1.1	+	1.1			1.1	1.1		2.1	1.1			

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Olea europea L. *subsp. europaea*		+	2.1						2.1																				+	+
Phillyrea angustifolia L.	2.3	2.3	1.1	3.3	2.3	3.3	2.3		1.1	2.3	2.1	3.3	3.1	2.1	2.1	2.1	3.3	2.3	2.3	2.3	1.1	2.1	2.3	2.3	2.3	2.1	2.3		2.3	
Ophrys fusca Link.																										+				
Ophrys speculum Link							1.2			1.2																				
Ophrys tenthredinifera Willd. p.p.					+		+			+																				
Orchis olbiensis Reut. ex Gren.				+																										
Orobanche gracilis Sm									+																					
Parentucellia latifolia (L.) Caruel						1.1																								
Phelipanche ramosa (L.) Pomel															+															
Papaver argemone L												+																		
Papaver hybridum L.																	+						2.1						1.1	
Papaver pinnatifidum Moris.														+																
Pinus halepensis Mill.	+												1.1	1.1										+						
Globularia alypum. Subsp alypum							1.2			1.2																				
Misopates orontium (L.) Raf.																												+		
Plantago afra L																												+		
Plantago albicans L.												2.1		2.1															1.2	
Plantago lagopus L.	1.1					2.3	1.2			1.2				2.1				1.1	2.1	2.1			+			1.1			2.1	
Aegilops geniculata Roth								2.3															1.1							

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Ampelodesmos mauritanicus (Poir.) Durand & Schinz	1.2	1.2	2.2		1.2	2.2	3.2	3.3	2.2	3.2	1.1		1.1	1.1	2.3	2.1			2.1		1.1	1.1	1.1		+	1.1			2.2	1.1
Anisantha rubens (L.) Nevski						1.2							+		1.1															
Avena barbata Pott ex Link												+					1.1		1.1						+	+		2.1	1.1	
Briza maxima L.							1.2	1.1		1.2																				
Bromus lanceolatus Roth.												1.1																		
Bromus madritensis L															1.1		2.1		2.1				2.1		2.1		2.1	2.1	2.1	3.1
Patzkea coerulescens (Desf.) H. Scholz						+																								
Cynosurus echinatus L																				2.1			2.1			2.1	+			
Echinaria capitata (L.) Desf.							1.1			1.1														1.1		1.1				
Hordeum murinum subsp. leporinum (Link) Arcang												1.1					2.1			2.3			1.1						2.1	
Lagurus ovatus L.								2.1									1.1	1.1		1.1										
Macrochloa tenacissima (L.) Kunth							3.2			3.2																		1.2	1.2	
Melica ciliata L.														1.1			1.1													
Phalaris canariensis L																			1.1											
Phleum pratense subsp. *bertolonii* (DC.) Bornm													1.1																	
Poa bulbosa L. *subsp. bulbosa*												1.1		1.1									1.1	+		2.1	2.1			
Stipa capensis Thunb												1.1														1.1				

Table 1, Continued

Taxa	Saffalou										Plateau										Guertoufa									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Rumex bucephalophorus L.						1.1	+			+	3.3	2.1	+	2.1	2.1		2.3	2.3		2.1	2.2	3.3	1.1		2.1		2.1	2.3		2.1
Lysimachia arvensis (L.) U. Manns & Anderb	+		2.2	1.1	+	2.1			2.2		+	+	+	+	1.1	1.1			+		+	1.1	1.1	1.1	+		+			
Lysimachia monelli (L.) U. Manns & Anderb																													+	
Cytinus hypocistis subsp. macranthus Wettst																											1.1			
Clematis flammula L																						1.1								
Ranunculus arvensis L.							+			+	1.1													+						
Reseda alba L. subsp. *alba*																						+								
Rhamnus lycioides. subsp. oleoides L.											1.1					1.1		1.1	1.1						+		1.1	1.1		
Sanguisorba minor subsp. *balearica* (Nyman) Muñoz Garm. & C. Navarro																													+	
Scrophularia canina L														+																
Smilax aspera L																						1.1								
*Tamarix gallica*L												+		+																
Thymelaea hirsuta Endl.				1.2		2.2		2.2						1.1								2.1	2.1						1.1	
Valerianella discoidea (L.) Loisel							1.1			1.1													+			+				
Asphodelus microcarpus Salzm et Viv.			2.1	2.1		1.1	2.1	1.1	2.1	2.1						1.1														

Source: developed by the authors

Table 1 of floristic records shows that *P. lentiscus* L. is often accompanied by shrubs and some very common herbaceous plants such as *Phillyrea angustifolia* L, *Cistus salvifolius* L., and *Quercus ilex subsp. ballota* (Desf.) Samp with frequencies over 80%. Other high frequency species which range between 60 to 80% include: *Lavandula stoechas* L., *Lobularia maritima* (L.) Desv., *Ampelodesmos mauritanicus* (Poir.) Durand & Schinz, *Juniperus oxycedrus* L., *Lysimachia arvensis* (L.) U. Manns & Anderb and *Calicotome spinosa* (L.) Link *subsp. Spinosa*. Both categories of these species are classified as faithful to *P. lentiscus* L. according to the definition established by I. Benmehdi *et al.* (2013). Species such as *Asparagus acutifolius* L., *Thymus ciliatus* (Desf.) Benth. *subsp. ciliatus*, *Cistus creticus subsp. eriocephalus* (Viv.) Greuter & Burdet, *Arbutus unedo* L. and *Jasminum fruticans* L. are medium frequency species, occurring between 40 and 60%, while the remaining species have frequencies of less than 40%.

The different index of floristic richness, Shannon-Wiener, Equitability of Pielou, Simpson and perturbation index were calculated for each station, while Jaccard index was used to compare between these three stations are presented in Table 2

Table 2. Formulas and objectives of the various ecological indexes used

Index	Formula
Shannon-Wiener	H' = -Σ ni/N log2 (ni/N) ni – the effective of species i, N – the total number of species
Equitability of Pielou	Eq = H'/log2N
Index of Simpson	D'= (ni/N)/2
The overall perturbation index (PI) Loisel & Gamila	PI = (Number of Chamaephytes + Number of Theophytes/ Total number of species) x 100
Jaccard index	S = (C/A + B – C) x 100, where A – all species of Group A, B – all species in Group B, C – the species common to both groups in comparison.

Source: developed by the authors

In order to better understand the different relations between the three studied sites it was performed the Shannon-Wiener index to assess the richness and relative abundance of species, followed by Equitability of Pielou to expresses the relationship between observed diversity and maximum diversity and accounts for species distribution in the sample. Simpson index was used measure the probability that two randomly selected individuals from an infinite population would belong to the same species. Then, the overall perturbation index (PI) to quantifies the thyrophetisation and finally, Jaccard index to reflect the similarity between plant groups.

Results and Discussion

166 taxa were inventoried from 30 floristic surveys, belonging to 131 genera and 43 botanical families in all stations. The distribution of these species in the large taxonomic groups indicates that Angiosperms largely dominate the flora (98.2%), specifically Dicotyledon (75.3%) followed by Monocotyledon (22.9%), whereas Gymnosperms only constitute (1.8%) (Table. 3).

Table 3. Distribution of taxa by taxonomic groups

Taxonomic groups	Saffalou				Plateau				Guertoufa				Study area			
	F	G	S	%	F	G	S	%	F	G	S	%	F	G	S	%
Gymnosperms	2	2	2	2.3	2	2	2	2.2	2	3	3	2.8	2	3	3	1.8
Monocotyledon	7	17	19	22.1	5	21	22	23.7	8	23	23	21.3	9	34	38	22.9
Dicotyledon	23	53	65	75.6	26	56	69	74.2	27	67	82	75.9	32	94	125	75.3
Total	**32**	**72**	**86**	**100**	**33**	**79**	**93**	**100**	**37**	**93**	**108**	**100**	**43**	**131**	**166**	**100**

Note: F – family, G – genera, S – species
Source: developed by the authors

It was noticed that the specific richness is irregularly distributed, the third station (Guertoufa) contains 108 species representing the maximum compared to the minimum of 86 species in the first station (Saffalou). Moreover, six richest families in terms of species, contain more than 50% of the total flora (Fig. 2). With *Asteraceae* (25 species; 15.1%), *Poaceae* (18 species; 10.8%), *Fabaceae* (15 species; 9%), *Cistaceae* (10 species; 6%), *Lamiaceae* (9 species; 5.4%) and *Brassicaceae* (8 species; 4.8%).

Species distribution in biological types for the total flora shows the dominance of Therophytes with (85 species; 51.2%), followed by the Hemicryptophytes (23 species; 13.9%), then the Chamæphytes (20 species; 12%) and in last position the Geophytes and Phanerophytes with the same percentage (11.4 %) each one. The total flora and of each study station by biological type is presented in Figure 3.

The analysis of the chorological spectrum of species shows the domination of the elements of the Mediterranean group on all other groups with (91 species; 54.8%) followed by the West Mediterranean (18 species; 10.8%), then the European-Mediterranean (9 species; 5.4%) for the entire study area and study stations (Fig. 4). The rest represents a low participation (less than 5%).

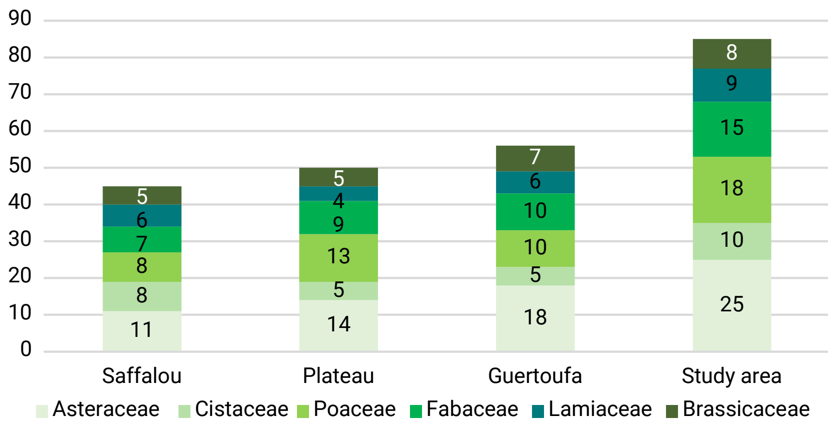

Figure 2. Species number of six dominant families in area and study stations
Source: developed by the authors

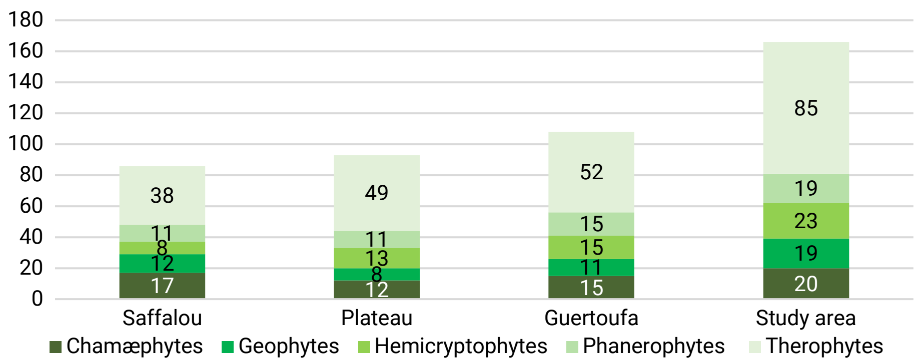

Figure 3. Species number of area and study stations by biological types
Source: developed by the authors

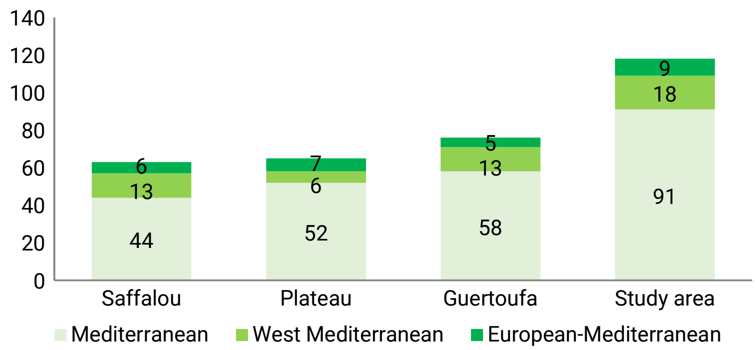

Figure 4. Species number of three dominant biogeographical types in area and study stations
Source: developed by the authors

The specific richness (S), the Shannon diversity (H), the Piélou equitability index (J), the Simpson index (1-D) and the Perturbation index (PI) of each station as well of the entire study area (Table 4) were calculated.

Table 4 presents the ecological indices for the three study stations and the overall area. The Shannon index (H), which measures species diversity, ranges from 4.2 to 4.37 at individual stations, reaching a value of 4.6 for the entire study area, indicating high biodiversity and healthy ecosystems that support a wide range of species. The Pielou equitability index (J) remains high at approximately 0.94 across all stations, suggesting a balanced distribution of species. However, for the overall area, this value decreases to 0.9, potentially indicating some unevenness in species distribution. The Simpson index (1-D), which measures the probability that two randomly selected individuals will belong to the same species, shows a low degree of species dominance (ranging from 0.98 to 0.9854), confirming the floristic diversity of the ecosystems. The perturbation index (PI), which assesses the level of ecological disturbance, varies from 62% at the Guertoufa station to 65.6% at the Plateau station. This suggests a moderate impact of anthropogenic factors, such as grazing and other ecological disturbances, which create conditions conducive to species with short life cycles.

Table 4. Comparison of indices of biological diversity

	Saffalou	Plateau	Guertoufa	Study area
Taxa S	86	93	108	166
Shannon H	4.202	4.246	4.372	4.602
Equitability J	0.9433	0.9368	0.9338	0.9001
Simpson 1-D	0.9816	0.9819	0.9837	0.9854
Perturbation PI	64%	65.6%	62%	63.3%

Source: developed by the authors

It is well documented that Jaccard similarity index is used for comparison between two sites by evaluating the resemblance, the more it exceeds fifty percent the more the sites are similar. Table 5 show this index performed between the different sites.

Table 5. Comparison of similarity coefficients between study stations

Jaccard (S)	Saffalou- Plateau	Saffalou- Guertoufa	Plateau- Guertoufa
	29%	37%	45%

Source: developed by the authors

Table 5 presents the results of the Jaccard similarity index (S) between the three study stations: Plateau, Guertoufa, and Saffalou. The Jaccard Index is used to measure the similarity between two sets, in this case, the floristic compositions of each station, where higher values indicate greater similarity. The results indicate a 45% similarity between the Plateau and Guertoufa stations, which suggests a moderate level of floristic overlap. This relatively higher similarity could imply that these two stations share several species and may have comparable ecological conditions or disturbances that allow similar species to thrive. The similarity between Saffalou and Guertoufa is slightly lower at 37%, indicating that while there is still a considerable overlap in species, the floristic composition of Saffalou and Guertoufa is less similar compared to the Plateau-Guertoufa pair. This difference could be attributed to variations in microclimates, soil types, or other ecological factors influencing species distribution. The lowest similarity is observed between Saffalou and Plateau, with a 29% similarity. This significant difference in floristic composition suggests that these two stations are ecologically more distinct, with fewer species in common. The variation in plant communities between these two stations may be influenced by differences in altitude, climate, or other environmental factors, leading to a greater divergence in species composition.

The determination of species groups through descending hierarchical classification are presented in (Table. 6; Fig. 5). According to the dendrogram of the AHC of the 166 species in the study area, it was distinguished two groups which are well individualized.

Table 6. Comparison of similarity coefficients between study stations

	Species number	%
Group 1	152	91.56
Group 2	14	8.43

Source: developed by the authors

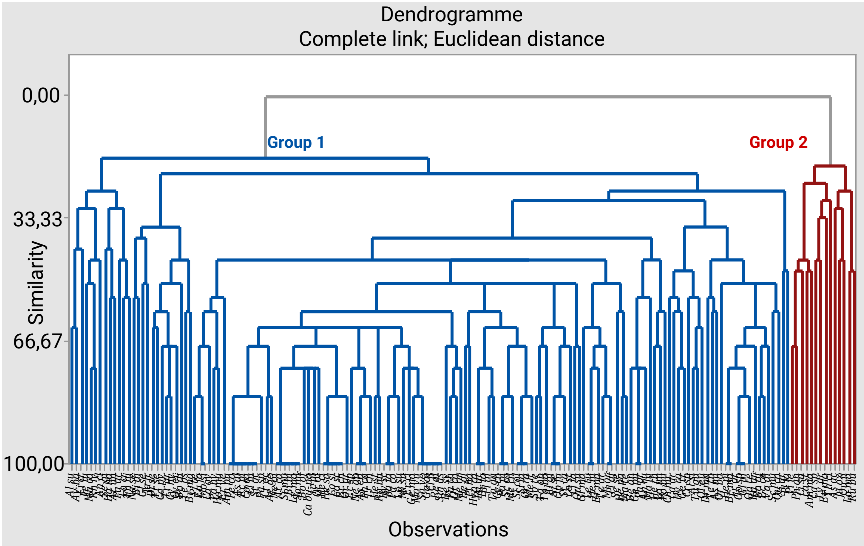

Figure 5. Dendrogram of groups species in the study area

Source: developed by the authors

Table 6 presents the results of a hierarchical classification of species observations in the study area, dividing the species into two distinct groups. The first group comprises 91.56% of the species (152 species), while the second group contains only 8.43% (14 species). This clear division highlights the dominance of a large number of species in the study area, with a smaller subset representing a less frequent or secondary group of species. Such a classification suggests that the plant communities in the region are structured in a way that a majority of species belong to one primary ecological group, while a smaller group of species might be more specialized or occur under specific environmental conditions.

Figure 5, which is a dendrogram of the species groups, visually represents this hierarchical classification. It helps to further illustrate the relationship and clustering of species, showing how closely related or distinct the different species are based on their ecological observations. The analysis reveals that the flora of the study area is dominated by a majority of common species, while a minority of species make up a secondary cluster, potentially indicating different ecological niches or environmental conditions. This finding underscores the variability and complexity of the region's plant communities.

The inertia rates of the first three axes are respectively 28.8%, 8.5% and 5.8% (Table. 7).

Table 7. Eigenvalues and percentage of inertia for the first three axes of the FAC

Variable	Factor 1	Factor 2	Factor 3	Communality
Variance	8.632	2.5647	1.7457	12.9425
% variance	0.288	0.085	0.058	0.431

Source: developed by the authors

The first axis summarizes the maximum information with an inertia rate of 28.8%, therefore the interpretation has been carried on the first factorial axis because the inertia rates of the other axes (02 and 03) are lower than 10% and the clouds are therefore very poorly structured in the factorial plane. The species having a strong contribution relative to the eigenvalues of this axis are mentioned in (Table. 8; Fig. 6).

Table 8. High contribution taxa for axis 1 of the FAC

Positive side of axis 01	Negative side of axis 01
Pistacia lentiscus 4.3023	*Stachys ocymastrum* -0.7325
Phillyrea angustifolia 3.8834	*Cleonia lusitanica* -0.7325
Cistus salvifolius 3.3987	*Convolvulus cantabrica* -0.7325
Quercus ilex 3.3201	*Echium plalltagineum* -0.7325
Lavandula stoechas 3.2365	*Asparagus albus* -0.7325
Ampelodesmos mauritanicus 2.9167	*Ferula communis* -0.7325
Lobularia maritima 2.8202	*Ammoides pusilla* -0.7325
Lysimachia arvensis 2.6625	*Sanguisorba minor* -0.6706
Juniperus oxycedrus 2.6009	*Lysimachia monelli* -0.6706
Erodium moschatum 2.4924	*Bituminaria bituminosa* -0.6706
Rumex bucephalophorus 2.3063	*Silene muscipula* -0.6706
Calicotome spinosa 2.3030	*Atractylis cancellata* -0.6706
Asparagus acutifolius 2.00301	*Nerium oleander* -0.6706

Source: developed by the authors

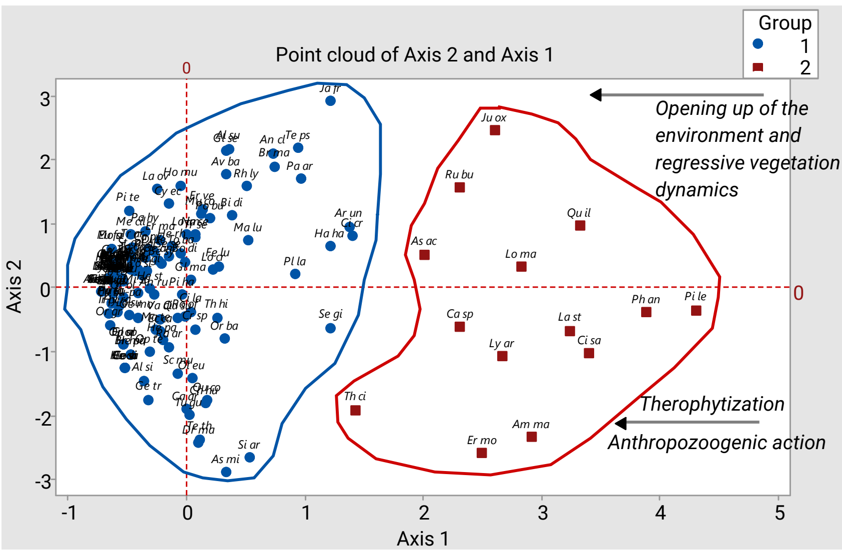

Figure 6. Factorial plan of the species in the study area (Axis1-2)
Source: developed by the authors

The floristic indicator of species around this axis (positive and negative side) is considered as a guiding factor in the diagnosis of vegetation dynamics. For this, the distribution of species helps to determine the ecological factors influencing the vegetation studied. The majority of group 1 species settle around the intersection of the two axes (close to zero) in the negative side of axe 1 with a low relative contribution to the values specific to this axis. The rest of the species of group 1 and the totality of the group 2 species are individualized in the positive side of axis 1 with an average and strong relative contribution to the values specific to this axis.

In terms of specific richness, it was found that the study area (03 stations) is very rich in species (166 taxa). Whereas in Tlemcen for instance in Western Algeria recorded by I. Benmehdi *et al.* (2013), for a sampling effort five times larger (150 surveys), there was a smaller richness (109 taxa). The dominance of families of *Asteraceae*, *Poaceae*, *Fabaceae*, *Cistaceae*, *Lamiaceae* and *Brassicaceae* go in the same direction with those of M.D. Miara *et al*. (2018), B. Nouar *et al.* (2020), in which these families dominate the vegetation cover of the Western Tellien Atlas of Tiaret. Biologically, the flora studied is composed of more than half of Therophytes with (51.2%), according to M. Barbero *et al*. (1990), thyrophetisation is considered as the ultimate stage of degradation of the different ecosystems with the dominance of sub-nitratophilic species linked to overgrazing.

The dominance of the Mediterranean biogeographic type is a well-established characteristic of the Algerian flora, a phenomenon that was first highlighted by P. Quézel (2002) for all North African countries. This dominance has been further supported by several studies in various regions and biotopes of Algeria. Notably, N. Yahi *et al.* (2008) and A. Boughani *et al.* (2009) demonstrated the prevalence of Mediterranean species in different Algerian ecosystems. Similar findings were reported by B. Guit & B. Nedjimi (2019), who studied Mediterranean flora in the steppes and the Saharan Atlas, and more recently by B. Taibaoui *et al.* (2020) and R. Larbi *et al.* (2021), who conducted research in forests and other biotopes across Algeria. These studies consistently show that Mediterranean species play a dominant role in shaping the floristic composition of Algeria, confirming the widespread distribution and ecological significance of Mediterranean plant types in the country.

Based on the results obtained, the Shannon index (S) is 4.6 for the study area (4.2, 4.24 and 4.37) for Saffalou, Plateau and Guertoufa respectively, according to I. Yabi *et al*. (2013), this means a high diversity within the plant group, indicating that the site conditions are very favourable to the installation of a large number of species in almost equal proportions. However, Pielou equitability (J) is 0.9 for the study area (0.94) for Saffalou, Plateau and Guertoufa with the same value (0.93), these values indicate a regularity in species distribution, thus inducing a relatively uniform spatial structure (Hachemi, 2015), while the Simpson index (1-D) is 0.98 for the entire study area and for the three sites, this reflects a low diversity of stands.

The perturbation index (PI) is in the order of 63.3% for the whole study area, it varies from a minimum of 62% (Guertoufa) to a maximum of 65.6% (Plateau). N. Hachemi (2015) signals that the importance of this index is proportional to the dominance of chamaephytes and especially of the therophytes who find their environment favourable to their development (sandy substrate, organic matter poverty); this also reflects a more open environment (Nouar *et al.*, 2020). The Jaccard index (S) values shows that the similarity between Plateau-Guertoufa stations is 45% and between Saffalou-Guertoufa is 37%, while the lowest rate is between Saffalou-Plateau. In general, this index is less than 50%, it is concluded that the three stations are different and do not share many common species (Yabi *et al*., 2013).

The majority of species are individualized in group 1 (152; 91.56%), these species are annual and perennial herbs and are located in the centre (intersection of the axes). The group 2 reunited 14 species (8.43%), it was found *P. lentiscus* L. (*Pi Le*) where it is very characteristic of the order Pistacio-*Rhamnetalia alaterni* (Rivas-Martinez, 1974), this order brings together the pre-forest structures resulting from an intense degradation of forest formations in which the mastic tree is often associated with *Quercus ilex* (*Qu il*), *Juniperus oxycedrus* (*Ju ox*), *Phillyrea angustifolia* (*Ph an*), *Calicotome spinosa* (*Ca sp*), *Ampelodesmos mauritanicus* (*Am ma*), *Asparagus acutifolius* (*As ac*) and *Lavandula stoechas* (*La st*).

The positive side brings together 50 species or 30.12% of the total, essentially a pre-forest structure species dominated by the tree and shrub layer composed of *P. lentiscus*, *P. angustifolia*, *Q. ilex*, *J. oxycedrus*, *C. spinosa*, L. *stoechas*, *A. mauritanicus*, *Cistus salvifolius*, and the herbaceous layer of *Lobularia maritima*, *Lysimachia arvensis*, *Erodium moschatum*, etc.

The current study examined the floristic diversity and ecological factors influencing *Pistacia lentiscus* plant groups in western Algeria. The results obtained were compared with those of other studies on similar topics, providing a broader understanding of the ecological dynamics and anthropogenic impacts on local ecosystems.

According to the findings of this study, 116 species, accounting for 69.87% of the negative side of the floristic spectrum, were identified, predominantly consisting of annual and perennial herbaceous species such as *Stachys ocymastrum*, *Cleonia lusitanica*, *Convolvulus cantabrica*, *Echium plalltagineum*, *Ammoides pusilla*, *Sanguisorba minor*, *Lysimachia monelli*, and *Atractylis cancellata*. It was also noted that species indicative of environmental degradation, including *Asparagus albus*, *Ferula communis*, *Macrochloa tenacissima*, and *Carduus pycnocephalus*, were present (Babali, 2014). These findings are consistent with those of other researchers who have observed the dominance of short-lived species in areas affected by intense anthropogenic activity.

The dynamic gradient of vegetation in this study revealed a clear distinction between the positive and negative axes. The positive axis was primarily occupied by species typical of pre-forest vegetation structures, while the negative axis showed a dominance of species with short life cycles, a result of significant anthropogenic disturbances. This phenomenon aligns with observations made in earlier studies on *P. lentiscus* populations (Benmehdi, 2012; Benmehdi *et al.*, 2013), which also highlighted the influence of human activities on the vegetation composition. Similar findings were reported by K. Cherifi *et al.* (2011) and S.M. Merioua *et al.* (2013), who attributed the degradation of plant formations in western Algeria to intense anthropozoogenic actions.

Moreover, the results of the present study corroborate the broader trend observed in western Algeria, where anthropogenic pressures have significantly impacted plant communities, leading to the predominance of species adapted to disturbed environments. N. Benabadji *et al.* (2014) emphasised the role of such disturbances in shaping the floristic structure of the region, and similar patterns were observed across various plant formations in the area. Thus, the observed dominance of short-lived species in disturbed areas is a consistent finding in the literature, underlining the broader ecological implications of human activity on Mediterranean ecosystems.

Conclusions

This study provided an overview of the current knowledge on groups of *Pistacia lentiscus L.* and their dynamics in the Tiaret Mountains through an analytical and statistical approach. The vegetation sampling carried out at the three study stations based on 30 floristic surveys allowed to identify 166 species belongs to 43 families of which *Asteraceae*, *Poaceae*, *Fabaceae*, *Cistaceae*, *Lamiaceae* and *Brassicaceae* constitute more than half of the flora studied with 51.1% in total. The life forms of species reveal the dominance of species with a short life cycle with a large presence of therophytes with 51.2%, which reflects slightly high rate of disturbance estimated to 63% overall. The majority of inventoried species are individualised in the first group with 91.56%, while the second group includes the rest of the species with only 8.43.

The eigenvalues and percentage of inertia for the first three axes of the FAC show that first axis (01) represents 28.8% of the majority of the information of which 50 species of the total represented mainly by trees and shrubs are on the positive side of this axis, while 116 species dominated by annual and perennial herbaceous plants are grouped on the negative side of the same axis. This distribution is the result of ecological factors influencing these plant groups in particular the opening of the environment through human practices.

In view of these results, the installation of short-life cycle plants and pyrophytic shrubs promotes the outbreak and spread of forest fires during the summer period, which have become increasingly frequent in recent years in Algeria. Therefore, findings shed light on the therophytic influence of the *P. lentiscus* L. plant community, thus necessitating the adoption of more appropriate firefighting strategies within reforestation and forest fire prevention programs.

Acknowledgements

The authors thank Babali Brahim. PhD in plant ecology from the Laboratory of Ecology and Management of Natural Ecosystems, Tlemcen, Algeria for the confirmation of the identified taxa.

Funding

None.

Conflict of Interest

None.

References

[1] Atmani, D., Saidene, N., Kilani, D., Bouguellid, G., & Richard, T. (2025). Pistacia lentiscus: A plant with multiple virtues for use in human medicine as palliative in the treatment of inflammatory-related disorders. *Phytochemistry Letters*, 69, article number 103519. doi: 10.1016/j.phytol.2025.103519.

[2] Barbero, M., Bonin, G., Loisel, R., & Quézel, P. (1990). Changes and disturbances of forest ecosystems caused by human activities in the western part of the Mediterranean basin. *Vegetatio*, 87(2), 151-173. doi: 10.1007/BF00042952.

[3] Benabadji, N., Benabadji Bouchenak-Khelladi, A., Regagba, Z., & Medarbal, K. (2014). Some Anthropic Aspects in Meridional Region of Sebdou (Oran-Algeria). *Open Journal of Ecology,* 11(4), 678-692. doi: 10.4236/oje.2014.411058.

[4] Benchiha, W., Aouadj S.A., Megharbi, A., Tamert, A., Lazreg, K., Lazreug N.E.H., & Belkhadem, A.B. (2024). Antioxidant activity and content of total phenols and flavonoids of aqueous extracts from leaves of *Pistacia lentiscus* L. *Brazilian Journal of Animal and Environmental Research*, 7(4), e74374-e74374. doi: 10.34188/bjaerv7n4-051.

[5] Benkhettou, A., Taibi, K., Benkhettou, M., Azouzi, B., & Djili, K. (2022). Assessment of floristic diversity in the arid steppe region of Tiaret, Algeria. *Tropical Ecology*, 63(3), 463-479. doi: 10.1007/s42965-022-00226-0.

[6] Benmehdi, I. (2012). *Contribution à une étude phyto-écologique des groupements à Pistacia lentiscus du littoral de Honaine (Tlemcen, Algérie occidentale)*. (Master's Thesis, University of Tlemcen, Tlemcen, Algeria).

[7] Benmehdi, I., Hasnaoui, O., Hachemi, N., & Bouazza, M. (2013). Species faithful to *Pistacia lentiscus* along the coastline of the Honaine region, Tlemcen Province (Western Algeria). *Mediterranea Series of Biological Studies,* 2(24). doi: 10.14198/MDTRRA2013.24.04.

[8] Bouchfara, A., Zerrad, H., Ez-zari, A., Laglaoui, A., Nechar, M., & Souhail, B. (2025). Antibacterial and antioxidant activities of Pistacia lentiscus essential oils: Impact of total phenolic content on antioxidant efficacy. *Biocatalysis and Agricultural Biotechnology*, 64, article number 103532. doi: 10.1016/j.bcab.2025.103532.

[9] Boughani, A., Sadki, N., Médail, F., Nedjraoui, D., & Salamani, M. (2009). Floristic and phytogeographic analysis of a region in the Saharan Atlas of Constantine, the Ghouffi gorges (Algeria). *Acta Botanica Gallica*, 156(3), 399-414. doi: 10.1080/12538078.2009.10516166.

[10] Braun Blanquet, J. (1951). *The plant associations of Mediterranean France*. Paris: C.N.R.S.

[11] Cherifi, K., Mehdadi, Z., Latreche, A., & Bouiadjara, S.E.B. (2011). Impact of anthropozoogenic action on the forest ecosystem of Mount Tessala (Western Algeria). *Science and Planetary Changes/Drought*, 22(3), 197-206. doi: 10.1684/sec.2011.0310.

[12] Convention on Biological Diversity. (1992, June). Retrieved from https://www.cbd.int/convention/text.

[13] Dobignard, A., & Chatelain, C. (2010-2013). *Synonymic index of the flora of North Africa* (Vols. 1-5). Genève: Conservatoire et Jardin botaniques de la Ville de Genève.

[14] Executive Decree No. 12-03 "On Establishing the List of Protected Non-cultivated Plant Species". (2012, January). Retrieved from https://surl.li/uhwcsa.

[15] Ghezlaoui, S.M.B.E., & Benabadji, N. (2018). Vegetation of the Tlemcen Mountains (Algeria): Phytoecological aspects. *Botanica Complutensis*, 42, 101-124. doi: 10.5209/BOCM.61372.

[16] Gordo, B., & Hadjadj-Aoul, S. (2019). Algero-Moroccan floristic endemism in the Ksour Mountains (Naâma, Algeria). *Flora Mediterranea*, 29, 129-142. doi: 10.7320/FlMedit29.129.

[17] Gounot, M. (1969). *Quantitative methods for vegetation study*. Paris: Masson.

[18] Guit, B., & Nedjimi, B. (2019). Floristic diversity of Mount Guerouaou (Sehary Guebli, Djelfa region, Algeria) in relation to site parameters. *Ecologia Mediterranea*, 45(2), 45-61. doi: 10.3406/ecmed.2019.2088.

[19] Hachemi, N. (2015). *Contribution to the study of therophytisation of the matorrals of the Tlemcen Mountains: Ecological and cartographic aspects (Tlemcen, Western Algeria)*. (Doctoral dissertation, Abou Bakr Belkaid University of Tlemcen, Tlemcen, Algeria).

[20] Khennouf, H., Chefrour, A., Corcket, E., Alard, D., & Véla, E. (2018). Dune vegetation of the Jijel coastline (Algeria): Proposal of a new important plant area. *Revue d'Ecologie (Terre et Vie)*, 73(3), 345-362.

[21] Larbi, R., Meddour, O. S., Bouxin, G., & Meddour, R. (2021). Floristic and phytogeographical diversity of the cedar forest of the Ait Ouabane massif (north-eastern slope of Djurdjura National Park, Algeria). *Lejeunia, Revue de Botanique*. doi: 10.25518/0457-4184.2384.

[22] Maamar, B., Nouar, B., Soudani, L., Maatoug, M., Azzaoui, M., Kharytonov, M., Wiche, O., & Zhukov, O. (2018). Biodiversity and dynamics of plant groups of the Chebket El Melhassa region (Algeria). *Biosystems Diversity*, 26(1), 62-70. doi: 10.15421/011810.

[23] Merioua, S.M., Seladji, A., & Benabadji, N. (2013). Anthropozoic impact on the floristic biodiversity in the area of Beni Saf (Algeria). *Open Journal of Ecology*, 3(3), 254-264. doi: 10.4236/oje.2013.33029.

[24] Miara, M.D., Ait Hammou, M., Rebbas, K., & Hamdi, B. (2018). Floristic diversity of forest and pre-forest environments of the western Tellian Atlas of Tiaret (NW Algeria). *Evaxiana: Annual Electronic Journal of the Botanical Society of the Centre-West*, 4, 34-58.

[25] Miara, M.D., Hadjadj-Aoul, S., & Decocq, G. (2020). Phytosociological diversity and dynamic series of the vegetation in the Western Tell Atlas of Tiaret (NW Algeria). *Ecologia Mediterranea*, 46(1), 97-116. doi: 10.3406/ecmed.2020.2102.

[26] Moussaoui, S., Mokrani, E.S., Kabouche, Z., Guendouze, A., Laribi, A., Bradai, N., Bensouici, C., Yilmaz, M.A., Cakir, O., & Tarhan, A. (2025). Evaluation of polyphenolic profile, antioxidant, anti-cholinesterase, and anti-alpha-amylase activities of *Pistacia lentiscus* L. leaves. *Natural Product Research*. doi: 10.1080/14786419.2025.2471836.

[27] Nouar, B., Hasnaoui, O., Maamar, B., Soudani, L., & Oliver, W. (2020). Edaphic characterization of maquis bio-resources of the Tiaret Mountains (West Algeria). *PONTE International Journal of Sciences and Research,* 76(2). doi: 10.21506/j.ponte.2020.2.8.

[28] Quézel, P. (2002). *Reflections on the evolution of the flora and vegetation of the Mediterranean Maghreb*. Paris: Ibis Press.

[29] Quézel, P., & Santa, S. (1962-1963). *New flora of Algeria and the southern desert regions* (Vols. I-II). Paris: Centre National de la Recherche Scientifique.

[30] Safa, O., Bouacha, M.I., Soudani, L., Azzaoui, M.S., & Chafaa, M. (2022). Fire risk mapping in the Sdamas Chergui forest in Tiaret region, Algeria. *International Journal of Ecosystems & Ecology Sciences,* 12(2). doi: 10.31407/ijees12.246.

[31] Saidi, A., & Keifa, A. (2024). Floristic diversity of vascular plants in the Mimouna Forest (North-western Algeria). *Biodiversity: Research and Conservation,* 73, 13-22. doi: 10.14746/biorc.2024.73.2.

[32] Solomou, A.D. (2025). Mediterranean Basin. In *Terrestrial biomes*. *Global biome conservation and global warming impacts on ecology and biodiversity: Volume 2* (pp. 147-154). Amsterdam: Elsevier. doi: 10.1016/B978-0-443-36569-0.00009-4.

[33] Souddi, M., & Ghezlaoui-Bendi-Djelloul, B.D. (2020). Bioclimate and diversity of Tamaricaceae in Oranie, West Algeria. *Environmental and Experimental Biology*, 18(3), 193-205. doi: 10.22364/eeb.18.20.

[34] Taibaoui, B., Douaoui, A., & Bouxin, G. (2020). Floristic diversity of the southern Algiers steppe: The case of the Djelfa region (Algeria). *Lejeunia, Journal of Botany*, 203. doi: 10.25518/0457-4184.2265.

[35] Vargas, P. (2020). The Mediterranean floristic region: High diversity of plants and vegetation types. In *Encyclopedia of the world's biomes* (pp. 602-616). Amsterdam: Elsevier. doi: 10.1016/B978-0-12-409548-9.12097-4.

[36] Yabi, I., Biaou, F.Y., & Dadegnon, S. (2013). Plant species diversity within agroforests based on cashew trees in the commune of Savalou, Benin. *International Journal of Biological and Chemical Sciences,* 7(2), 696-706.

[37] Yahi, N., Djellouli, Y., & de Foucault, B. (2008). Floristic and biogeographical diversity of cedar forests in Algeria. *Acta Botanica Gallica,* 155(3), 389-402. doi: 10.1080/12538078.2008.10516119.

[38] Youcefi, M.N., Bouhoun, M.D., Kemassi, A., & El-Hadj, M.D.O. (2020). Relationship between topography and the distribution of matorral plant species in the Saharan Atlas: Case of Djebel Amour, Algeria. *Acta Ecologica Sinica,* 40(3), 237-246. doi: 10.1016/j.chnaes.2019.05.010.
[39] Zemmar, N., M'hammedi Bouzina, M., Ababou, A., Belhacini, F., & Hadidi, D. (2020). Analysis of the floristic diversity of an ecosystem in the southern Mediterranean. The case of the Bissa forest, Chlef (Algeria). *Botanica Complutensis*, 44, 19-28. doi: 10.5209/bocm.64447.

Диверсифікація та флористичний аналіз груп *Pistacia lentiscus* L. (Anacardiaceae) у регіоні Тіарет (Західний Алжир)

Бельгасем Нуар

Кандидат наук з екології рослин
Університет Ахмеда Забани
P.O. Box 48000, Район Бурмадія, м. Релітан, Алжир
https://orcid.org/0000-0002-3502-127X

Хічам Берраба

Кандидат наук з біології
Університет Ібн Халдуна
BP 78, Алжирська дорога, м. Тіарет, Алжир
https://orcid.org/0000-0002-1416-145X

Бенчохра Маамар

Професор
Університет Ібн Халдуна
BP 78, Алжирська дорога, м. Тіарет, Алжир
https://orcid.org/0000-0002-6014-4837

Сід Ахмед Ауаж

Кандидат наук з екології рослин
Університет Ахмеда Забани
Район Бурмадія, м. Релітан, Алжир
Лабораторія екології та управління природними екосистемами
Університет Абу Бекр Белкаїд
BP 119, вул. Абі Аєд Абделькрім, 22, м. Тлемсен, Алжир
https://orcid.org/0000-0002-5081-5844

Мохамед Амін Нуар

Магістр
Університет Ібн Халдуна
Алжирська дорога, BP 78, м. Тіарет, Алжир
https://orcid.org/0009-0000-7854-3249

Анотація. Метою цього дослідження було вивчення та аналіз груп *Pistacia lentiscus* L., які зустрічаються в регіоні Тіарет. Використовуючи аналітичний і статистичний підходи до флористичних інвентаризацій, проведених у цій місцевості, були вибрані три станції (Саффалу, Плато та Гертуфа) протягом оптимальних вегетаційних сезонів з березня по червень між 2015 та 2018 роками. Було ідентифіковано 166 видів, які належать до 131 роду та 43 родин, з яких переважають ангросперми (98,2 %). Найбільш представленими родинами були Asteraceae, Poaceae, Fabaceae, Cistaceae, Lamiaceae та Brassicaceae, з такими відсотковими співвідношеннями: (15,1 %, 10,8 %, 9 %, 6 %, 5,4 % і 4,8 %) відповідно. Біологічний спектр флори переважно складали терофіти (51,2 %), в той час як група середземноморських видів була добре представлена (54,8 %) порівняно з іншими групами. Розрахунки екологічних індексів показали, що індекс Шеннона вказує на високу різноманітність (H = 4,6), індекс рівномірності Пієлу (J = 0,9) вказує на регулярність у розподілі видів, а індекс Сімпсона (1-D = 0,98) відображає низьку різноманітність стоянок. Загальний індекс порушення (PI = 63 %) вказує на відкритість середовища. Крім того, коефіцієнт подібності Яккарда (S) залишався менше 50 % у всіх композиціях між станціями, що свідчить про гетерогенність флористичного складу цих станцій. Агломеративна ієрархічна класифікація виявила поділ видів на дві основні групи: 91,56 % і 8,43 %. Далі факторний аналіз відповідності відобразив відкриття середовищ на досліджених територіях та поселення видів з коротким життєвим циклом, що адаптуються до місцевих посушливих умов. Отримані результати надають діагноз стану рослинного покриву під впливом екологічних факторів і можуть бути використані лісівниками для покращення управління, захисту та відновлення цих природних територій

Ключові слова: мастикові дерева; флористичне багатство; екологічні фактори; терофітізація; посушливість