

Floral Diversity of the Tlemcen Mountains (Western Algeria)

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Abstract. Mountains of Tlemcen offer a very interesting model for studying the evolution of the flora in the region, since their landscapes variety remains very remarkable and the vegetation distribution is conditioned by a significant number of ecological factors. Although there were registered manyfires in the area during the 1990s, the coexistence of some species, such as *Quercus faginea* subsp. *tlemcenensis* (DC.) M., *Pinus halepensis* Miller., *Calicotome intermedia* (Salzm.) C. Presl., *Lonicera implexa* L., *Ruscus aculeatus* L., indicates a dominant ecological atmosphere of the forest. In this study, a phytocological and syntaxonomical analysis was made. More than 300 species were identified and indexed, belonging to more than 50 families, which shows the importance of the phyto-diversity of the studied area. Based on the analysis of the phytoecological parameters, we could note a decline of the ground vegetation in its diversity.

Key words: biodiversity, floristic inventory, phytocology, Tlemcen Mts.

Introduction

In the Mediterranean regions, evolved a portion of forest area estimated at 2,145,000 ha. The latter has suffered in his life cycle of very difficult times: a forest in perfect balance toward a forest very degraded; there is sometimes a matorralisation of this portion, such as the Algerian forest.

Because of its geographical position, Algeria has a great diversity of biotopes occupied by important floristic richness. Its forest ecosystems are characterized by a noteworthy flora; some represent regions of global interest. According to DAHMANI (1997, Algeria, pers. com.) the knowledge of the biological and ecological characteristics of the species, just as the identification of the historical and current factors at the origin of

the fluctuations of the flora are essential to any action of the biodiversity conservation.

The contemporary forests of the mountains of Tlemcen are result from the interaction of much diversified factors, concerning in particular topography, geology, climatology and especially by a long and deep anthropogenic action. Under this permanent pressure, the forests tend to be transformed into matorral. Sparse are destroyed consequently and their place is taken by thorny species and thermophytes (QUÉZEL, 2000).

This vegetation is subsequently a favorable environment to fires very often volunteers.

In addition, the drought that has known in the region of Tlemcen, has disrupted deeply

the nature resulting in plants of important phenomena of water stress and adaptation.

This introduction is quite dark, but agrees to this sad reality. That is what thus remains at the level of these forest ecosystems mediterranean. A presentation of the current stage of forests of the mountains of Tlemcen of point of view of the species that constitute will allow us to be located along a path ecological. Also this will help us to better carry out an action conservatoire (GHEZLAOUI *et al.*, 2011). The studies of the flora and its diversity in Western Algeria interested a certain number of researchers (BENABADJI *et al.*, 2010; QUÉZEL, 1956, 1957, 2000; KADI-HANIFI, 2003; GHEZLAOUI *et al.*, 2011; MESLI *et al.*, 2008; LETREUCH-BELAROUCI *et al.*, 2009; MEDJAHDI *et al.*, 2009; BOUAZZA & BENABADJI, 1998).

Materials and Methods

Study area. The Tlemcen Mts. are located in the Western part of Algeria, between the latitudes north of 34°30' and 35° and western longitudes of 0°30' and 2°. It is a mountain range which appears starting from 600 m and which culminates at certain points with more than 1800 m. It is connected to the Tellian Atlas (Fig. 1).

The forests of Tlemcen Mts. stand on a mountainous mass dating from the upper Jurassic made up mainly of sequanien sandstone and quaternary alluvia. The soils are in general more or less deep and of brown forest type. The herbaceous layer is rather rich, leading to the existence of a strong biological activity. The texture is clay-limestone and silt-clay with some concretions on the horizon A1. The humus is quite abundant and the organic matters are important. The brown fersialitic soils also are very developed (GAOUAR, 1980).

From the bioclimatic point of view, the recent period (1980-2013) varies clearly compared to the old one (1913-1938), with a reduction in precipitations and an increase in the temperatures.

Tlemcen Mts. are characterized with semi-arid and sub-wet Mediterranean climate characterized by two seasons: a short and cold winter and a long and dry

summer. The maximum average temperature of the hottest month is of 32.67°C, which of the minimum of the coldest month is of 3.22 °C.

The pluviometric index of Emberger is of 42.10, which confirms an upper semi-arid climate with temperate variant. Current precipitations vary between 350 mm and 485 mm, (Fig. 2) which explains the rusticity of the plant species: *Pinus halepensis* Miller, *Olea europaea* L. subsp. *europaea*, *Ziziphus lotus* (L.) Desf, *Juniperus ocycedrus* subsp. *rufescens* L. of the area. The forests of the mountain appear among the habitats indexed like key issues (Hotspots) in the Mediterranean basin, where the vegetation east persists on the level of ecosystems refuges (MÉDAIL & DIADEMA, 2009) (Fig. 3).

Sampling procedures. The choice of the samples is based on a selection which takes account of the structure of the vegetation where the floristic and ecological criterion of homogeneity was privileged. We used the surface sampling method (minimal surface) which consists in choosing sites as typical as possible by noting down the environmental conditions (GOUNOT, 1969). Each floristic surface sample was elaborated according to the BRAUN-BLANQUET (1951) method.

The main literature used for the identification of the collected species in the field is starting from the studies carried out by BATTANDIER & TRABUT (1888-1889); QUÉZEL & SANTA (1962-1963); MAIRE (1952-1987); VALDÉS *et al.* (2002); DOBIGNARD & CHATELAIN (2010-2012); BLANCA *et al.* (2009).

Taxonomy. The taxonomy of the species follows "Index synonymique et bibliographique de la flore d'Afrique du Nord" (DOBIGNARD & CHATELAIN, 2010-2012) and the synonymes are given after "Nouvelle flore d'Algérie et des Régions désertiques méridionales" (QUEZEL & SANTA, 1962-1963).

Results and Discussion

Physiognomic description of the forests

As a whole, the forests of Tlemcen Mts. depend on the soil and climate conditions and the anthropogenic pressure. The various forests which the mountains constitute offer a great floristic diversity; it is interesting to tackle their description.

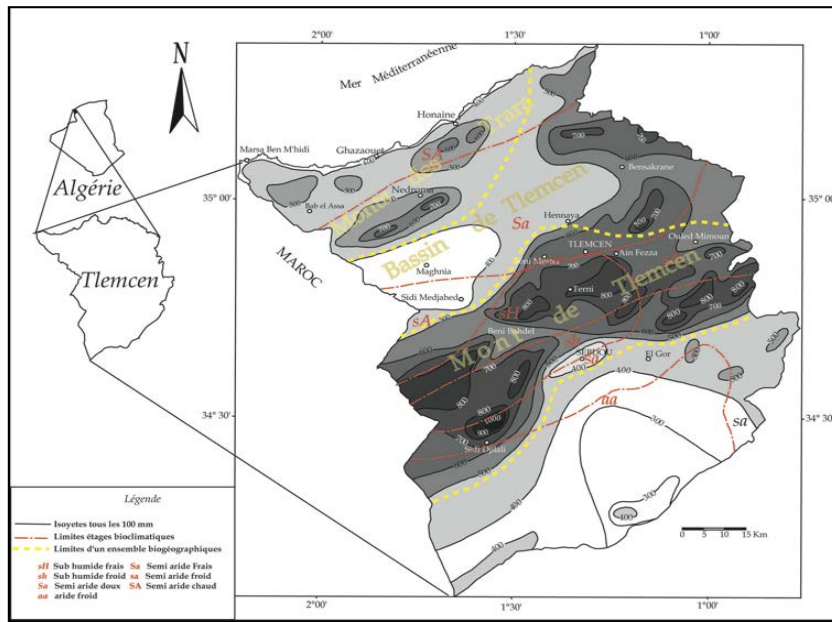


Fig. 1. Map of the study area.

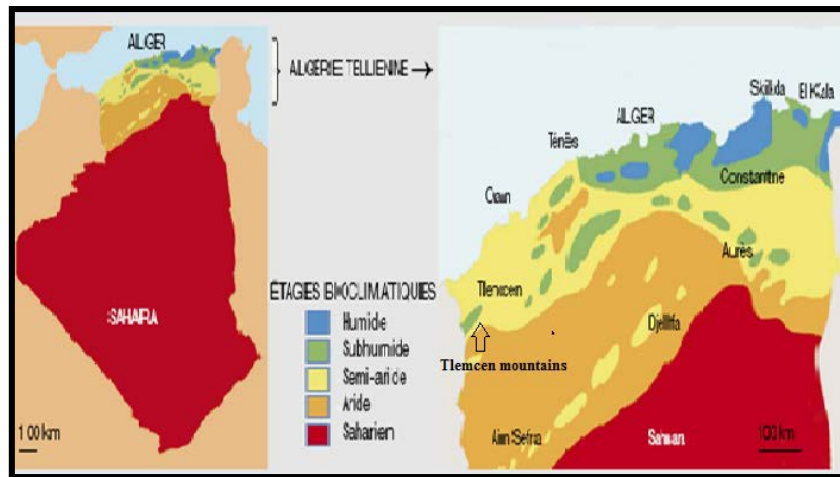


Fig. 2. Bioclimatic stage of Tlemcen Mts.



Fig. 3. Hotspots in the Mediterranean basin.

The forest of Hafir

It is a mature forest of Cork oak. This forest, formerly, produced the best cork of Algeria (BOUDY, 1955). It covers a surface of 9870 ha. The shrubby layer is composed primarily of: *Juniperus oxycedrus* subsp. *rufescens* L., *Quercus ilex* subsp. *ballota* (Desf.) Samp., *Quercus suber* L. and the oak Zeen (*Quercus faginea* Lamk). The last one is an oak with deciduous leaves of types meso- and supra-Mediterranean (QUÉZEL & MEDAIL, 2003; MESSAOUDÈNE *et al.*, 2008) endemic of the Western Mediterranean (Iberian peninsula, Morocco, Algeria and Tunisia) (ZINE EL ABIDINE, 1988). It would be represented in the Tlemcen Mts. by a subspecies: *Quercus faginea* subsp. *tlemcenensis* (CD.) M (Fig.4).



Fig. 4. Locality of cork oak (the forest of Hafir). Photo: F.Z. Chemouri, January 2015.

The matorral of Zarifet

On a surface of 944 ha, it is based mainly on the old settlements of Cork oak and Holm oak. Their growth is generally less strong after a fire. These species are typical of low intensity fires but common in the study zone (PRODON *et al.*, 1984; SCHAFFHAUSER *et al.*, 2012). The vegetation associated with these oaks cork is: *Genista tricuspidata* subsp. *duriaei* (Spach.) Beats., *Ampelodesmos mauritanicus* (Poiret) Dur. & Schinz., *Daphne gnidium* L., *Cistus salvifolius* L., *Cistus villosus* L., *Asparagus acutifolius* L., *Asphodelus microcarpus* Sal. & Viv., *Arbutus unedo* L., *Cytisus villosus* Pour. (Fig. 5). These plants prefer siliceous substrates.



Fig. 5. The matorral of Zarifet. Photo: F.Z. Chemouri, January 2015.

The forest of Beni Boussaid

It covers a surface of 11.350 ha, it acts of a vegetal formation in mixture with Holm Oak, Thuya and of Juniper, often of the matorrals containing *Quercus ilex* subsp. *ballota* (Desf.) Samp. Al one or mixed with *Tetraclinis articulata* (Vahl) Link. Endemic in North Africa (HADJADJ-AOUL *et al.*, 2009), it colonizes the zones with weak pluviometry (from 300 to 500 mm) (QUÉZEL, 2000) and of *Juniperus oxycedrus* subsp. *rufescens* L (Fig. 6). On the whole, it represents a rather advanced stage of degradation of a climactic forest of oak cork and of holm oak. The coppice of intensely exploited holm oak is able to be maintained while being regenerated remarkably and easily in spite of the strong anthropogenic pressure.



Fig. 6. The coppice of intensely exploited holm oak (the forest of Beni Boussaid). Photo: F.Z. Chemouri, January 2015.

The forest of El Khemis

Always in the series of the holm oak (11.655 ha), but in the presence of climatic and soil conditions and of the different human activities and especially less favorable than the preceding ones, this forest offers thanks to its old coppice of holm oak accompanied by *Juniperus ocycedrus* subsp. *rufescens* L., *Pinus halepensis* Miller, *Pinus pinea* L., *Cedrus atlantica* (Endl.) Career and *Cupressus sempervirens* L. Some of the species are in the ultimate stages of degradation (Fig. 7).



Fig. 7. The forest of El Khemis (Pine of Alep, Thuja, Genevrie). Photo: F.Z. Chemouri, December. 2014.

The forest of Azails

It consists of high matorral and of clear forest of Pin d'Alep and average matorral of Holm oak and prickly juniper. It is distributed on approximately 7.990 hectares and is dominated by the annual species (thermophytes) caused by the high anthropogenic pressure and an additional degradation (fires). This forest is characterized by its weakness since even *Pinus halepensis* Miller., *Juniperus ocycedrus* subsp. *rufescens* L., *Stipa tenacissima* L., which entirely invaded the underwood (Fig. 8). The holm oak is the dominant species and testifies to its adaptation to the ecological and anthropic conditions most difficult.

List of the species indexed by family in the mountains of Tlemcen.

The list includes 340 species belonging to 57 families, dominating by Asteraceae, Fabaceae, Lamiaceae, and Cistaceae.



Fig. 8. The forest of Azail (average matorral of Holm oak). Photo: F.Z.Chemouri, January 2015.

ANACARDIACEAE

Pistacia atlantica Desf.

Pistacia lentiscus L.

Pistacia terebinthus L.

APIACEAE

Ammoides pusilla (Brot.) Breistr.

Ammoides verticillata (Desf.) Briq.

Balansae glaberrimae (Desf.) Lange

Bunium alpinum W. & Kit.

Bupleurum balansae var. *balansae* B. & R.

Bupleurum rigidum L.

Daucus carota L.

Daucus muricatus Lamk.

Eryngium campesire L.

Eryngium maritimum L.

Eryngium tricuspdatum L.

Ferula communis L.

Foeniculum vulgare (Millet.) Gaertn.

Thapsia garganica L.

ARACEAE

Arisarum vulgare Targ.Tozz.

ARALIACEAE

Hedera helix L.

ARISTOLOCHIACEAE

Aristolochia longa L.

Lamium amplexicaule L.

ASTERACEAE

Anthemis punctata Vahl.

Artemisia alba ESA.

Asteriscus maritimus (L.) Less.

Asteriscus pygmaeus Coss & Kral.

Asterolinum linum-stellatum (L.) Duby.

Atractylis cancellata L.

Atractylis humilis L.

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- Bellis annua* L.
Bellis silverstris L.
Calendula arvensis L.
Carduus pycnocephalus L.
Carlina lanata L.
Carthamus caeruleus L.
Carthamus lanatus L.
Carthamus pectinatus Desf.
Catananche caerulea L.
Catananche lutea L.
Centaurea acaulis L.
Centaurea incana Desf. non Lag. nec Ten.
Centaurea involucrata Desf.
Centaurea paviflora Desf.
Centaurea pullata L.
Centaurea solstitialis L.
Centaurea tenuifolia Duf.
Chrysanthemum coronarium L.
Chrysanthemum grandiflorum (L.) Beats
Chrysanthemum paludosum Poiret.
Cichorium intybus L.
Cirsium vulgare Ten.
Globe-thistle spinosus L.
Elichrysum stoechas (L.) DC.
Evax argentea Pomel.
Hypochoeris achyrophorus L.
Hypochoeris radicata L.
Inula montana L.
Leontodon hispidulus Poiret.
Leuzea conifer (L.) DC.
Micropus bombycinus Lag.
Pallenis spinosa (L.) Case.
Phagnalon saxatile (L.) Case.
Pulicaria odora (L.) Rchb.
Reichardia picroides (L.) Roth.
Scolymus grandiflorus Desf.
Scolymus hispanicus L.
Scolymus maculatus L.
Scorzonera undulata Beats. non Vahl.
Senecio vulgaris L.
Xanthium spinosum L.
Xeranthemum inapertum (L.) Millet
- BORRAGINACEAE**
Echium parviflorum Moench.
Echium flavum Desf.
Echium parviflorum Moench.
Echium vulgare L.
Lithospermum apulum (L.) Vahl.
Lithospermum arvensis L.
- BRASSICACEAE**
Alyssum campestre L.
Alyssum granatense (B. & R)
Alyssum serpyllifolium Desf.
Alyssum spinosum L.
Arabis alpina L.
Arabis auriculata Lamk.
Arabis verna (L.) R. Br.
- Biscutella didyma* L.
Brassica nigra (L.) Koch.
Maximum Briza L.
Lobularia maritima (L.) Desv.
Raphanus raphanistrum L.
Sinapis alba L.
Sinapis arvensis L.
Thlapsi perfoliatum L.
Vella annua L.
- CAMPANULACEAE**
Campanula dichotoma L.
- CAPRIFOLIACEAE**
Lonicera etrusca Santi.
Lonicera implexa L.
Virbumum tinus L.
- CARYOPHYLLACEAE**
Arenaria aggregata Laws.
Arenaria grandiflora L.
Arenaria serpyllifolia L.
Cerastium pentandrum L.
Dianthus caryophyllus L.
Herniaria hirsuta L.
Gay Herniaria fontanesii J.
Minuartia campestris L.
Paronychia argentea (Pourr.) Lamk.
Silene tridentata Desf.
Vaccaria pyramidala Medik
- CHENOPODIACEAE**
Atriplex halimus L.
- CISTACEAE**
Cistus albidus L.
Cistus creticus L.
Cistus ladaniferus Lada.
Cistus monspeliensis L.
Cistus salvifolius L.
Cistus villosus L.
Fumana fontanesii Pomel.
Fumana thymifolia (L.) Verlot.
Halimium halimifolium (L.) Willk.
Helianthemum cinereum (Cav.) Sea-green.
Helianthemum cinereum subsp. *rubellum* (Presl.)
Helianthemum croceum (Desf.) Sea-green.
Helianthemum helinthemoides (Desf.) Grosser.
Helianthemum hirtum E. and Mr.
Helianthemum origanifolium (Lamk.) Sea-green.
Helianthemum pilosum (L.) Sea-green.
Helianthemum virgatum (Desf.) Sea-green.
Helianthemum racemosum (L.) Pau.
Triticum sativum B. Attic
Tuberaria guttata (L.) Sleeve
Tuberaria vulgaris Willk.
- CONVOLVULACEAE**
Convolvulus althaeoides L.
- CRASSULACEAE**
Sedum acre L.
Sedum sediforme (Jacq.) Pau.
Sideritis montana L.

CUPRESSACEAE

Callitris articulata (Vaht.) Link.
Cupressus sempervirens L.
Juniperus oxycedrus L. subsp. *rufescens*

CYPERACEAE

Carex halleriana ESA.

DIPSACACEAE

Cephalaria leucantha (L.) Schard.

DYPSACACEES

Scabiosa stellata L.

EPHEDRACEAE

Ephedra fragilis Desf.

ERICACEAE

Arbutus unedo L.

Erica arborea L.

EUPHORBIACEAE

Euphorbia exigua L.

Euphorbia falcata L.

Euphorbia nicaeensis All.

Euphorbia sulcata de Lens.

FABACEAE

Adenocarpus decorticans Wood.

Adenocarpus bacquei (B. & T)

Anagyris foetida L.

Anthyllis montana L.

Anthyllis tetraphylla L.

Anthyllis vulneraria L.

Astragalus armatus Willd.

Astragalus incanus L.

Calicotome intermedia (Salzm.) C. Presl =

Calycotome villosa subsp. *intermedia* (Salzm.) Mr.

Capsella bursa-pastoris L.

Ceratonia siliqua L.

Cerintho major L.

Colutea arborescens L.

Coronilla juncea L.

Coronilla minimum L.

Coronilla scorpiodes Koch.

Cynoglossum cheirifolium L.

Cytisus villosus Pourret. = *Cytisus triflorus* Herit.

Erinacea anthyllis Link.

Genista erioclada subsp. *atlantica* (Spach.) Mr.

Genista ramosissima (Desf.) Poiret. = *Genista*

cinerea subsp. *ramosissima*

Genista erioclada Spach.

Genista spartioides Spach.

Genista tricuspidata subsp. *duriaei* (Spach.) Beats.

Hedysarum coronarium L.

Hedysarum flexuosum L.

Hippocrepis multisiliquosa L.

Hippocrepis multisiliquosa subsp. *ciliata* (Willd.)

Hornungia petraea (L.) R.Br.

Lagurus ovatus L.

Lathyrus sphaericus Retz.

Lotus edulis L.

Medicago minima Grufb.

Medicago rugosa Desr.

Melilotus sulcata Desf.

Odontites purpurea Gift.

Onobrychis alba (W.et K) Desv.

Ononis natrix L.

Scorpiurus muricatus L.

Solenanthus lanatus cd.

Tetragonolobus purpureus Moench.

Trifolium angustifolium L.

Trifolium campestre Schrad

Trifolium scabrum L.

Trifolium stellatum L.

Trifolium tomentosum L.

Stauracanthus boivinii (Webb) Samp = *Ulex boivinii*

Webb var. *webbianus* (Cosson) Mayor

Vitis sativa L.

FAGACEAE

Quercus coccifera L. subsp. *coccifera*

Quercus faginea subsp. *ilemecenensis* (cd.) Mr. =

Quercus faginea subsp. *broteroi* (Coutinho) A.

Camus

Quercus ilex subsp. *ballota* (Desf.) A. cd.

Quercus suber L.

FUMARIACEAE

Fumaria capreolata L.

GERANIACEAE

Erodium guttatum (Desf.) Willd.

Erodium moschatum (Burm.) Her.

Geranium molle L.

Geranium robertianum L.

GLOBULARIACEAE

Globularia alypum L.

IRIDACEAE

Iris tingitana (B. & R.) B. & T.

LAMIACEAE

Ajuga chamaepytis (L.) Schreber. = *Ajuga*

chamaepytis Schreb.

Ajuga iova subsp. *iova* (L.) Schreber.

Ballota hirsuta Benth.

Lavandula dentata L.

Lavandula multifida L.

Lavandula stoechas L.

Marrubium vulgare L.

Micromeria inodora Benth.

Nepeta multibracteata Desf.

Origanum glandulosum Desf.

Origanum hirtum Beats. non Link.

Phlomis herba venti L.

Prasium majus L.

Rosmarinus officinalis L.

Rosmarinus tournefortii de Noé.

Salvia officinalis L.

Salvia verbenaca Beats.

Satureja graeca L.

Satureja rotundifolia (Near.) Briq

Satureja vulgaris (L.) Fritsch.

Teucrium fruticans L.

Teucrium polium L.

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- Teucrium pseudochamephitys* L.
Thymus ciliatus Desf.
Thymus munbyanus subsp. *coloratus* (Wood. & Reuter) Greuter & Burdet = *Thymus ciliatus* subsp. *coloratus* (B. & R.) Beats.
- LILIACEAE
Allium nigrum L. = *Allium roseum* L.
Allium roseum subsp. *have-roseum* Windt
Allium senecens L.
Allium triquetrum L.
Aphyllantes monspelinsis L.
Asparagus acutifolius L.
Asparagus albus L.
Asparagus stipularis Forsk.
Asphodelus microcarpus Salzm. & Viv.
Gagea arvensis (Pers.) Dum.
Gallium aparine L.
Gallium parisiense L.
Gallium rotundifolium L.
Minuartia montana L.
Muscari comosum (L.) Millet.
Ornithogallum umbellatum L.
Ruscus aculeatus L.
Ruscus hypophyllum L.
Smilax aspera L.
Drimia maritima (L.) Speta = *Urginea maritima* var. *pancratium* (Stein.) Baker.
- LINACEAE
Linum corymbiferum Desf.
Linum strictum L.
Linum suffruticosum L.
- MALVACEAE
Lavatera maritima Gouan.
Malva sylvestris L.
- MYRTACEAE
Muscari neglectum Guss.
- OLEACEAE
Fraxinus angustifolia Vahl.
Jasminum fruticans L.
Olea europaea L. subsp. *europaea* = *Olea europea* var. *oleaster*
Phillyrea angustifolia L.
Phillyrea latifolia L. = *Phillyrea angustifolia* subsp. *latifolia* (L.) Mr.
- ORCHIDACEAE
Gennaria diphylla (Link.) Parl.
- OROBANCHACEAE
Broomrape alba Steph.
- PALMACEAE
Chamaerops humilis subsp. *argentea* Andre.
- PAPAVERACEAE
Papaver hybridum L.
Papaver rhoeas L.
- PINACEAE
Cedrus atlantica (Endl.) Career = *Cedrus libanotica* Link.
Pinus halepensis Miller.
- Pinus pinea* L.
- PLANTAGINACEAE
Plantago albicans L.
Plantago lagopus L.
Plantago ovata Foresk.
Plantago psyllium L.
Plantago serraria L.
- POACEAE
Aegilops triuncialis L.
Aegilops ventricosa Tausch
Aira cupaniana Guss.
Aira cupaniana subsp. *genuina* Briq.
Ampelodesmos mauritanicus (Poiret) Dur. & Sch. = *Ampelodesma mauritanica* (Poiret) Dur. & Sch.
Avena sterilis L.
Brachypodium distachyon (L.) P.B.
Bromus madritensis L.
Anisantha rubens (L.) Nevski = *Bromus rubens* L.
Bromus squarrosus L.
Bromus tectorum L.
Cynosurus elegans Desf.
Dactylis glomerata L.
Echinaria capitata (L.) Desf.
Festuca atlantica Duv. Jouve.
Festuca scaberrimae Lange.
Festuca caerulescens Desf.
Festuca triflora Desf.
Hordeum murinum L.
Koeleria vallesiana (Honk.) Bert.
Lamarckia aurea (L.) Moehch.
Melica minuta subsp. *major* (Parl.) Trab.
Scandix pecten-veneris L.
Schismus barbatus (L.) tel.
Macrochloa tenacissima (L.) Kunth = *Stipa tenacissima* L.
Vulpia geniculata (L.) Link.
- PRIMULACEAE
Anagallis arvensis subsp. *latifolia* (L.) Br.-Bl. & Mr.
Anagallis arvensis subsp. *phoenicea* (Gouan) Vollus
Maximum androsace L.
- RANUNCULACEAE
Adonis annua L.
Adonis dentata LED.
Clematis cirrhosa L.
Clematis flammula L.
Delphinium peregrinum L.
Nigella damascena L.
Ranunculus bulbosus L.
Ranunculus gramineus L.
Ranunculus spicatus Desf.
- RESEDACEAE
Reseda alba L.
Reseda luteola L.
Reseda phyteuma subsp. *phyteuma* Mr.
- RHAMNACEAE
Rhamnus alternus L. subsp. *alternus*
Rhamnus lycioides subsp. *oleoides* (L.) Jah. & M

Ziziphus lotus (L.) Desf

ROSACEAE

Crataegus oxyacantha L.

Rosa sempervirens L.

Rubus ulmifolius Schott.

Sanguisorba minor Scop.

RUBIACEAE

Asperula arvensis L.

Asperula hirsute L.

Rubia laevis Poir.

Rubia peregrina L.

RUTACEAE

Ruta chalepensis L.

SANTALACEAE

Osyris alba L.

SCROPHULARIACEAE

Anarrhinum fruticosum Desf.

Anarrhinum pedatum Desf.

Linaria gharbensis Beats. & Piterd.

Linaria heterophylla Desf.

Linaria reflexa Desf.

SOLANACEAE

Veronica arvensis L.

THYMELAEACEAE

Daphne gnidium L.

Thymelea nitida Desf

Thymelea virgata Desf

ULMACEAE

Celtis australis L.

VALERIANACEAE

Fedia cornucopiae (L.) Gaerth.

VIOLACEAE

Viola silvestris Lamk.

ZYGOPHYLLACEAE

Fagonia cretica L.

Ziziphus lotus L. A lower altitude the sequence understands the following stages:

- Forest of oaks (Holm oak, oak Zen and oak cork) imbricating some relics of cedar *Cedrus atlantica* (Endl.) Carrière.

- Maquis with holm oak and juniper oxycedre.

- The forests of Zeen oak can also be described as pyrolabile; they occupy the zones with rainfall raised in North Africa, in Portugal and in Spain. The rainfall is always higher than 800 mm and often than 1000 mm.

- Lawns with thyme: *Thymus ciliatus* Desf. and *Thymus munbyanus* subsp. *coloratus* (Boiss. & Reuter) Greuter & Burdet.

The deterioration of the forest structure and the absence of regeneration are as many manifestations of the state of destruction of the strength and the integrity of the forest which constitutes a central axis for any initiative of the development of the zone. The population actuality and the mistakes of alternative solutions, has drawn and draws even the forest resources (aromatic plants: *Rosmarinus officinalis* L., medicinal: *Ammoides pusilla* (Brot.) Breistr., and others). This situation will certainly lead towards an irreversible degradation of the plant cover even to turning into a desert of the environment. This requires the immediate execution of an inclusive and sustainable development strategy based on the conservation and the rehabilitation of these forests, on the one hand, and the improvement of the standard of living of the local population, on the other hand.

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Conclusions

The degradation of the forest of Tlemcen Mts. is the result of the interference of several natural factors, anthropogenic, historical and of forest management. The capacities of resistance of the forest decreased much and the signs of its degradation are very apparent. Repeated fires combined with human action in this forest type cause changes to two different types of vegetation.

In more high altitudes the forest is replaced by groupings with thorny xerophytes similar to those which one finds above the limit altitudinal trees: they cover 60 to 100% of the ground in mixture with the xerophytes thorn-bush: *Genista tricuspidata* subsp. *duriaei* (Spach.) Beats,

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