Forests and Preforests

Natural plant communities, dominated by trees and/or high shrubs, more or less dense. Hyper-humid, Humid, Sub-humid and Semi-arid bioclimates; warm, cool, temperate and cold winters. Inframediterranean to Supramediterranean belts.

Quercetea pubescentis Doing Kraft 1955 ex Scamoni and Passarge 1959

Oak, mixed deciduous and conifer (*Abies*, *Cedrus*) forests. Hyper-humid and Humid bioclimates. Supramediterranean belt.

Querco-Cedretalia atlanticae *Barbéro, Loisel & Quézel 1974*

Violo munbyanae-Cedrion atlanticae Barbéro, Quézel, and Rivas-Martinez 1981

- *Agropyro marginati-Cedretum atlanticae* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean, Mountain mediterranean. Sub-humid; very cold winter. 1880–2000 m. Marly limestone.

  Eastern Middle-Atlas (Bou Iblane: Taffert) (Fig. 1).
- *Berberido hispanicae-Cedretum atlanticae* Benabid 1984

  Supramediterranean, Mountain mediterranean. Humid, Hyper-humid; cold to very cold winter. 1600–1900 m. Limestone.

  Western Rif (Central-eastern part of the "dorsale calcaire").

  Subassociations:

  – *quercetosum rotundifoliae*
  – *geranietosum malviflorae*

M. S. Taleb, M. Fennane, *Vascular Plant Communities of Morocco*, Geobotany Studies, https://doi.org/10.1007/978-3-319-93704-5_1

Fig. 1 *Agropyro marginati-Cedretum atlanticae* (ph. Taleb)

- *Ficario ranunculoidis-Quercetum fagineae* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean. Sub-humid, Humid; cold winter. 1400–1520 m. Shists, sandstone, quartz.

  Rif (jbel Tidighine).
- *Luzulo forsteri-Cedretum atlanticae* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean, Mountain mediterranean. Humid, Hyper-humid. 1500–1900 m. Siliceous: schists. Deep forest brown soil.

  North Middle-Atlas (Tazekka) Rif (central Rif).
- *Paeonio maroccanae-Abietetum marocanae* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean, Mountain mediterranean. Humid, Hyper-humid; cool, cold and very cold winter. 1500–1750 m. Limestone. Deep soils.

  Western Rif (region of Chaouen: jbel Tazzaot) (Fig. 2).

  Subassociations:

  – *abietetosum maroccanae*
  – *quercetosum rotundifoliae*

- *Polysticho setiferi-Prunetum lusitanicae* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean. Humid; cold to very cold winter. 1480–1600 m. Limestone, siliceous.

  Ripisylva of the wadis and permanent sources of the Middle-Atlas (Tazekka) and the central western Rif.

Fig. 2 *Paeonio maroccanae-Abietetum marocanae*, Rif (massif Talassemtane) (ph. Ibn Tattou)

- *Trifolio ochroleuci-Quercetum fagineae* Benabid 1984
  Supramediterranean. Humid; cool and cold winter. 1400–1600 m. Limestone; earthy and deep soils.
  Western Rif (valleys and northern slopes of the "dorsale calcaire") (Fig. 3).
- *Violo munbyanae-Quercetum pyrenaicae* Benabid 1984
  Supramediterranean. Humid, Hyper-humid; cold winter. 1300–1700 m. Siliceous; earthy and deep.
  Summits of the centro-western Rif until jbel Outka toward the east and Tidighine toward the north.
  Many affinities with *Luzulo-Cedretum* wich appears in altitude toward the east.
  Subassociations:
  - *quercetosum pyrenaicae*
  - *quercetosum canariense*

Paeonio maroccanae-Cedrion atlanticae Barbéro, Quézel, and Rivas-Martinez 1981

- *Agyrocytiso battandieri-Cedretum atlanticae* Barbéro, Quézel, and Rivas-Martinez 1981

Fig. 3 *Trifolio ochroleuci-Quercetum fagineae*, Rif.

Supramediterranean, Mountain mediterranean. Humid; very cold winter. 1650–2000 m. Basalt, dolomite, limestone; deep soils.

Ravins and thalwegs of the tabular Middle-Atlas (Fig. 4).

- *Argyrocytiso battandieri-Quercetum rotundifoliae* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean, Mountain mediterranean. Humid. 1900–2000 m. Cracked basalt.

  Central Middle-Atlas (south flank of the jbel Habri).
- *Paeonio maroccanae-Quercetum canariense* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean, Mountain mediterranean. Humid; very cold winter. 1560–1730 m. Basalt, limestone, dolomite; deep forest brown soils, thick superficial humiferous horizon.

  Central Middle-Atlas (atlantic exposure, regions of El Hajeb, Azrou and Ifrane).

  Subassociations:

  – *quercetosum canariense*
  – *argyrocytisetosum battandieri*
  – *cedretosum atlanticae*

- *Piptathero paradoxi-Cedretum atlanticae* Quézel, Barbéro and Benabid 1987

  Supra- and Mountain mediterranean. Humid; very cold winter. 1800–2150 m. Marly-calcareous, rocky substrate.

Fig. 4 *Argyrocytiso battandieri-Cedretum atlanticae*, central Middle-Atlas (ph. Taleb)

Eastern High-Atlas (jbel Sloul, cliffs of the Maâsker, Mitkane, Cirque Jaâffar) (Fig. 5).

Quercetea ilicis Br.-Bl. ex A. Bolòs and O. de Bolòs in Bolos y Vayreda 1950

(*Pino halepensis-Quercetea ilicis* De Foucault and Julve 1991)

Evergreen forests and preforests of *Quercus, Tetraclinis, Juniperus, Argania, Pinus*... Humid, Sub-humid, Semi-arid and Arid bioclimates. Superior mediterranean, Mesomediterranean, Thermomediterranean and Inframediterranean belts.

Quercetalia ilicis *Br.-Bl. ex Molinier 1934 em. Rivas-Martinez 1975*

(*Quercetalia rotundifolio-ilicis* De Foucault and Julve 1991)

Fig. 5 *Piptathero paradoxi-Cedretum atlanticae*, Eastern High-Atlas (jbel Sloul) (ph. Taleb)

Oleo sylvestris-Quercion rotundifoliae Barbéro, Quézel, and Rivas-Martinez 1981

- *Myrto communis-Quercetum suberis* Barbéro, Quézel, and Rivas-Martinez 1981
  Thermomediterranean. Sub-humid, Humid; temperate to warm winter. 100–360 m. Sandstone.
  MA-1 (Bab Azhar) R-1-2 (Western Rif).
  Subassociations:
  - *myrtetosum communis*
  - *quercetosum cocciferae*
- *Tetraclino articulatae-Quercetum cocciferae* Benabid 1984 em. Benabid and Fennane 1994
  Thermomediterranean. Sub-humid. 130–360 m. Limestone, marls.
  North-western Rif.
- *Rusco hypophylli-Quercetum canariense* Rivas-Martinez 1974
  Thermomediterranean. Humid; warm winter. 80–350 m. Sandstone.
  Rif (Tangerian peninsula).
- *Rusco hypophylli-Quercetum cocciferae* Benabid 1984
  Thermomediterranean. Sub-humid, Humid. From sea level on atlantic slope, up to 900–1000 m in the Beni Snassen and Rif regions. Calcareous sandstone,

marly sandstone, argilaceous, schistous sandstone; soils brown forest, red ferralitic or rendzina.

Oriental mountains (Beni Snassen) Rif (Tangerian peninsula).

Nowadays represented only by small forest tasks in sacred sites.

Subassociations:

- *tetraclinetosum articulatae*
- *brachypodietosum sylvaticae*
- *myrtetosum communis*
- *luzuletosum forsteri*

- *Smilaci mauritanicae-Quercetum rotundifoliae* Barbéro, Quézel, and Rivas-Martinez 1981

  Thermo- and Mesomediterranean. Sub-humid, Humid; temperate, hot winter. 400–900 m. Limestone, marl, sandstone, schist; superficial rocky soil.

  Northern Morocco (region of Taza, southern reverse of the rifain ridges), Middle-Atlas and western High-Atlas.
- *Tamo communis-Oleetum sylvestris* Benabid 1984

  Thermomediterranean. Semi-arid, Sub-humid, Humid; temperate to warm winter. 0–500 m. Marls, clays; vertisols.

  Western Rif.

  Oleaster formation, nowadays represented by samll tasks in sacred sites.

  Subassociations:

  - *ceratonietosum siliquae*
  - *fraxinetosum angustifoliae*

- *Telino linifoliae-Quercetum suberis* Zeraia 1981

  Thermomediterranean. Semi-arid, lower Sub-humid; temperate to hot winter. Sandy soils.

  Northern atlantic Morocco (Maamora forest of *Quercus suber*) (Fig. 6).
- *Violo cochleatae-Fraxinetum angustifoliae* Benabid 1984

  Thermomediterranean. Sub-humid, Humide; temperate winter. 400–700 m. Limestone-marl, dolomite-limestone, schist. Deep soil, rich, essentially colluvial and constantly moist without being hydromorphic.

  Western Rif.

Balansaeo glaberrimae-Quercion rotundifoliae Barbéro, Quézel, and Rivas-Martinez 1981

- *Arbuto unedi-Quercetum rotundifoliae* Achhal 1986

  Mesomediterranean. Sub-humid. 1000–1800 m. Granite, dolomite, basalt, schist; deep soil, rich, essentially colluvial and constantly moist without being hydromorphic.

  Central High-Atlas (Fig. 7).

  Subassociations:

Fig. 6 *Telino linifoliae-Quercetum suberis*, Maamora forest (ph. Taleb)

Fig. 7 *Arbuto unedi-Quercetum rotundifoliae* (ph. Taleb)

  - *phillyretosum mediae*
  - *quercetosum suberis*

- *Balansaeo glaberrimae-Cedretum atlanticae* Barbéro, Quézel, and Rivas-Martinez 1981

  Supramediterranean, Mountain Mediterranean. Sub-humid, Humid; warm winter. 1600–2300 m. Limestone, basalt.

Central Middle-Atlas and Rif.

Mixed formations cedar/green oak.

- *Balansaeo glaberrimae-Quercetum canariense* Barbéro, Quézel, and Rivas-Martinez 1981

  Mesomediterranean, Supramediterranean. Humid. 1200–1500 m. Siliceous; deep colluvial soils.

  Northern Middle-Atlas (Tazekka).

  Subassociations:

  – *geranietosum malviflori*
  – *arbutetosum unedi*

- *Balansaeo glaberrimae-Quercetum rotundifoliae* Barbéro, Quézel, and Rivas-Martinez 1981

  Mesomediterranean, Supramediterranean. Sub-humid, Humid; temperate, cool winter. 750–1950 m.

  Middle-Atlas (Tazekka) and Rif.

  Subassociations:

  – *violetosum denhardtii*
  – *centaureetosum taganae*
  – *phlomidetosum samiae*

- *Cytiso triflori-Quercetum canariense* Benabid 1984

  Mesomediterranean. Humid, Hyper-humid; temperate winter. 1000–1400 m. Sandstone.

  Rif (west Rif, Outka).

  Subassociations:

  – *quercetosum canariense*
  – *quercetosum pyrenaicae*

- *Euphorbio briquetii-Quercetum rotundifoliae* Tregubov 1963

  Mesomediterranean. Sub-humid. 1000–1300 m. Schistous.

  Oriental mountains (high summits of Beni Snassen).

- *Festuco scaberrimae-Quercetum rotundifoliae* Quézel, Barbéro, Benabid, and Rivas-Martinez 1992a

  Mesomediterranean, Superior mediterranean. Sub-humid. 1000–1700 m. Compact limestone.

  Oriental mountains (mountains of Debdou, Bou Khouali and Hamza).

- *Genisto jahandiezii-Quercetum rotundifoliae* Barbéro, Quézel, and Rivas-Martinez 1981

  Meso- and Supramediterranean. Sub-humid; cold winter. 1400–1600 m. Limestone.

  Eastern Middle-Atlas (Taffert) (Fig. 8).

  Open forest with *Ampelodesma mauritanica* and *Genista quadriflora*; dense green oak formation with *Arabis nova* subsp. *iberica* and *Neottinea intacta*.

- *Luzulo atlanticae-Quercetum rotundifoliae* Barbéro, Quézel, and Rivas-Martinez 1981

Fig. 8 *Genisto jahandiezii-Quercetum rotundifoliae*, Eastern Middle-Atlas (ph. Taleb)

Meso- and Superior mediterranean. Semi-arid, Sub-humid, Humid. 1050–2050 m. Mainly siliceous: sandstone, schist, dolomite.

Central High-Atlas (regions of Aït Barka, Tizi-n-Test, Agaiouar, Taslida and Tizi-n-Zonguen).

Subassociations:

- *juniperetosum phoeniceae*
- *luzuletosum atlanticae*
- *cytisetosum balansae*

- *Paeonio maroccanae-Quercetum rotundifoliae* Barbéro, Quézel, and Rivas-Martinez 1981

  Meso- and Supramediterranean. Humid, Hyper-humid. 1300–1600 m. Compact limestone, dolomitic limestone; brown red ferralitic soils.

  Rif (Tazzaot mountain NW of Chaouen).
- *Sileno melliferae-Quercetum rotundifoliae* Quézel, Barbéro and Benabid 1987

  Supra- and Mountain mediterranean. Sub-humid. 1500–2100 m. Limestone, marl, sandstone; rocky soils.

  Eastern High-Atlas (mountains Sloul, Aberdouz, Hayim, Ayachi and Maasker).
- *Teucrio afrae-Quercetum suberis* Barbéro, Quézel, and Rivas-Martinez 1981

  Meso- and Supramediterranean. Sub-humid, Humid. 1000–1500 m. Siliceous; brown soils, acide to moder.

  Central Rif.

  Mixed formations with oak suber abundant and green oak; degraded areas are marked by proliferation of *Cistus* spp.

Fig. 9 *Ampelodesmo mauritanicae-Chamaeropetum humilis* (ph. Taleb)

Pistacio lentisci-Rhamnetalia alaterni *Rivas-Martinez 1975*

(*Pino halepensis-Tetraclinetalia articulatae* De Foucault 1993)
(*Zizypho loti-Rhoetea oxyacanthae* De Foucault 1993 p.p.)

Asparago albidi - Rhamnion oleoidis Rivas Goday ex Rivas-Martinez (1975) and *Tetraclino articulatae-Pistacion atlanticae* Rivas-Martinez , Costa, and Itzco 1986

For these two syntaxa, the phytosociological value is not quite clear; their limits are matter of controverse depending on authors. Therefore, we prefer to present them together.

- *Ampelodesmo mauritanicae-Chamaeropetum humilis* Quézel, Barbéro, Benabid, and Rivas-Martinez 1992a

  Thermo- and Mesomediterranean. Sub-humid, Humid. 1100–1320 m. Limestone, marly calcareous.

  North-Eastern Middle-Atlas (Limestone plateau between Tazekka and the foothills of Bou-Iblane) (Fig. 9).

  Groupement belonging to the Mesomediterranean serial of green oak: degradation of *Genisto jahandiezii-Quercetum rotundifoliae*.

Fig. 10 *Bupleuro gibraltarici-Pinetum halepensis* (ph. Taleb)

- *Argyrolobio linnaeni-Pinetum halepensis* Achhal 1986
  Thermomediterranean. Semi-arid. 1700–2000 m. Sandstone, limestone.
  Central High-Atlas (High valley Agoundis).
- *Asparago aphylli-Calycotometum villosae* Rivas-Martinez 1975
  Thermomediterranean. Sub-humid, Humid. 30–150 m. Marly, siliceous.
  Northern Morocco (Tangerian peninsula).
  Matorral groupement, *Cistus monspeliensis* abundant.
- *Bupleuro gibraltarici-Pinetum halepensis* Tregubov 1963
  Thermomediterranean. Sub-humid. 650–850 m. Compact limestone; deep soils.
  Oriental mountains (Bni-Snassen: jbel Lakhdar) (Fig. 10).
- *Calycotomo intermediae-Oleetum sylvestris* Quézel, Barbéro, Benabid, Loisel, and Rivas-Martinez 1988
  Thermomediterranean. Arid, Semi-arid; temperate, warm winter. 80–320 m. Limestone, sandstone, marl; red soils.
  Littoral region of Al Hoceima and further towards the east.
  Preforest formation, proclimacic, still present only in small sacred areas.
- *Calycotomo intermediae-Tetraclinetum articulatae* Barbéro, Quézel, and Rivas-Martinez 1981
  Thermomediterranean. Sub-humid; temperate to warm winter. 400–1070 m. Limestone, marl.
  Northern Middle-Atlas (Tazekka) Rif (Tangerian peninsula between Sebta and Tangier).

Fig. 11 *Ceratonio siliquae-Tetraclinetum articulatae* (ph. Taleb)

Tetraclineria more or less degraded.
Subassociations:

– *tetraclinetosum articulatae*
– *pinetosum halepensis*

- *Ceratonio siliquae-Tetraclinetum articulatae* Fennane 1988
  Thermomediterranean. Semi-arid, Sub-humid; temperate winter. 150–850 m. Limestone, marl.
  Oriental mountains (Bni-Snassen, Debdou valley) (Fig. 11).
  Proclimacic Tetraclineria.
- *Chamaeropo humilis-Rhamnetum lycioïdis* Bolos 1957
  Thermomediterranean. Limestone.
  Northern Morocco.
- *Clematidi cirrhosae-Ceratonietum siliquae* Barbéro, Quézel, and Rivas-Martinez 1981
  Sub-humid; temperate, warm winter. 500–970 m. Limestone; rocky soil.
  Western High-Atlas (jbel Amsitten), Middle-Atlas, North atlantic Morocco (central plateau), Rif.
  Subassociations:

  – *aristolochietosum baeticae*
  – *ceratonietosum siliquae*

- *Coronillo valentinae-Pinetum halepensis* Quézel, Barbéro, Benabid, and Rivas-Martinez 1992a
  Thermomediterranean. Sub-humid. 1000–1200 m. Sandstone, schist.

Fig. 12 *Cytiso fontanesii-Pinetum halepensis*, Eastern Middle-Atlas (ph. Taleb)

Oriental mountains (Debdou, Lalla Mimouna).

Mixed forest, dominated by two main species *Pinus halepensis* and *Quercus rotundifolia*.

- *Coronillo viminalis-Tetraclinetum articulatae* Barbéro, Quézel, and Rivas-Martinez 1981

  Thermomediterranean. Semi-arid. 420–670 m. Schist.

  Middle atlantic Morocco (Central plateau between Oued Zem and Oulmès).

  Subassociations:

  – *tetraclinetosum articulatae*

- *Cytiso fontanesii-Pinetum halepensis* Achhal 1986

  Thermomediterranean. Semi-arid, Sub-humid. 1400–1700 m. Calcareous marl.

  Eastern Middle-Atlas (Bou Nacer mountains), Central High-Atlas (between Amizmiz and Imi n'Tala).

  Edapho-climatic association, linked to marly calcareous substrates.

  Not reported by Benabid (2000) (Fig. 12).

- *Digitali laciniatae-Buxetum balearicae* Quézel, Barbéro, Benabid, Loisel, and Rivas-Martinez 1988

  Thermomediterranean. Sub-humid, Humid. 800–1100 m. Limestone.

  Northern and locally eastern slopes of the northern Rif chain, like on jbel Kelti, but also further south.

- *Genisto sparsiflorae-Tetraclinetum articulatae* Fennane 1988

  Thermomediterranean. Semi-arid.

  Middle atlantic Morocco (Haha, Ida-ou-Tanane).

Fig. 13 *Junipero phoeniceae-Tetraclinetum articulatae* (ph. Taleb)

Not reported by Benabid (2000).

- *Junipero oxycedri-Tetraclinetum articulatae* Fennane 1988

  Thermomediterranean. Semi-arid. 100–1300 m. Schist, marly calcareous, limestone, dolerites.

  North east of the Middle-Atlas (region of Bechchine south Taza) untill region of Jerada including north bordure of the oriental high plateaux, eastern Rif (south of Aïn Zorah, region of Anguied-Mezguittem).
- *Junipero phoeniceae-Pistacietum lentisci* Achhal 1986

  Thermomediterranean. Semi-arid;cold winter. 1350–1660 m. Limestone, sandstone, schist, basalt, quartzite.

  Central High-Atlas.

  Not reported by Benabid (2000).
- *Junipero phoeniceae-Tetraclinetum articulatae* Fennane 1982 em. 1988

  Inframediterranean. Semi-arid. 50–160 m. Calcareous sand, sandstone, calcareous sandstone.

  Middle atlantic Morocco (region of Essaouira, jbel Hadid NE of Essaouira) (Fig. 13).
- *Lavandulo dentatae-Tetraclinetum articulatae* Fennane 1988

  Thermomediterranean. Semi-arid; temperate winter. 900–1400 m. Limestone, calcareous marl, schist, dolerites, dolomitic limestone.

  High-Atlas (Nfiss valley, south slope of the High-Atlas).

Fig. 14 *Lavandulo dentatae-Tetraclinetum articulatae* (ph. Taleb)

Association showing many species of *Pistacio-Rhamnetalia*, but quite infiltraded by those of *Acacio-Arganietalia*, hence its originality (Fig. 14).

- *Lonicero implexae-Tetraclinetum articulatae* Fennane 1988
  Thermomediterranean. Semi-arid, Sub-humid. 480–930 m. Siliceous, pelites, limestone, sandstone, granit.
  Northern atlantic Morocco (Central plateau).
- *Periploco laevigatae-Tetraclinetum articulatae* Benabid 1984
  Thermomediterranean. Arid, Semi-arid. 30–350 m. Limestone, calcareous marl, schist.
  Rif (region Bou-Hmed, eastern Rif), Mediterranean coast (Littoral zone east of Al Hoceima) (Fig. 15).
  Proclimacic groupement.
  Subassociations:
  - *tetraclinetosum articulatae*
  - *arganietosum spinosae*
- *Phillyreo latifoliae-Oleetum sylvestris* Barbéro, Quézel, and Rivas-Martinez 1981
  Thermomediterranean. Semi-arid; warm winter. 300–700 m. Schist, sandstone, quatrz, flysch; deep soils.
  Middle atlantic Morocco (Central plateau: regions of khorifla, Khatouat, Sidi Bettache?).
- *Phillyreo latifoliae-Pistacietum lentisci* Benabid 1984
  Thermomediterranean. Sub-humid, Humid. 5–15 m. Sands.

Fig. 15 *Periploco laevigatae-Tetraclinetum articulatae*, Eastern Mediterranean coast (ph. Taleb)

Rif (region of Tangier, untill Moulay Bou-Selham).

Degraded groupement developed on the maritime dunes.

- *Phillyreo mediae-Tetraclinetum articulatae* Fennane 1988

  Thermomediterranean. Semi-arid; temperate winter. 100–750 m. Sandstone, pelite, schist, limestone.

  Northern atlantic Morocco (Central plateau: lower valleys of Beht, Bou Regreg and Grou in the countryside of Rabat-Casablanca).
- *Pistacio atlanticae-Ziziphetum loti* Benabid 1988

  Thermomediterranean. Semi-arid. 930–1000 m. Limestone, schist, sandstone.

  Northern atlantic Morocco (eastern Central plateau: plains and hills between Azrou and Khenifra) (Fig. 16).
- *Polygalo balansae-Tetraclinetum articulatae* Barbéro, Quézel, and Rivas-Martinez 1981

  Thermomediterranean. Semi-arid. 800–1400 m. Marls, limestones, schists, dolomites.

  Northern piedmont of the High-Atlas.

  Subassociations:

  – *tetraclinetosum articulatae*
  – *pinetosum halepensis*
  – *ceratonietosum siliquae*

- *Querco rotundifoliae-Tetraclinetum articulatae* Fennane 1988

  (*Arbuto unedi-Tetraclinetum articulatae* Fennane 1982)

Fig. 16 *Pistacio atlanticae-Ziziphetum loti* (ph. Taleb)

Thermomediterranean. Semi-arid, Sub-humid. 750–1350 m. Marl, sandstone, limestone, schist, calcareous marl, dolomite.

High-Atlas (from Ourika valley to the region of El Ksiba).

Association of upper horizons of Tetraclineria infiltrated with green oak and many mesophilic species.

Subassociations:

- *tetraclinetosum articulatae*
- *pinetosum halepensis*
- *arbutetosum unedi*
- *ceratonietosum siliquae*

- *Rhus pentaphyllae-Pistacietum atlanticae* Barbéro, Quézel, and Rivas-Martinez 1981

  Thermomediterranean. Semi-arid; temperate winter. 300–730 m. Limestone, marl; superficial soils.

  Northern atlantic Morocco (Central plateau).

  Subassociations:

  - *rhuscetosum pentaphyllae*
  - *rhamnetosum oleoidis*

- *Rosmarino officinalis-Tetraclinetum articulatae* Fennane 1988

Fig. 17 *Tetraclino articulatae-Juniperetum turbinatae*, region of Berkine (ph. Taleb)

Thermomediterranean. Semi-arid; temperate winter. 800–1220 m. Limestone, marls, sandstone, pelites, marly calcareous.

Middle-Atlas (north and north east piedmont of Tazekka), Northern atlantic Morocco (Mdez valley).

Association with many species of *Rosmarinetalia*.

Subassociations:

- *tetraclinetosum articulatae*
- *juniperetosum phoeniceae*

- *Rosmarino tournefortii-Tetraclinetum articulatae* Fennane 1988

Thermomediterranean. Arid, Semi-arid. 220–1040 m. Marls, limestones, marly calcareous, sandstones, pelites.

Oriental mountains (Bni Snassen), Eastern plateaux (oriental high plateaux).

Association with many species of *Rosmarinetalia*.

Subassociations:

- *pinetosum halepensis*

- *Tetraclino articulatae-Juniperetum turbinatae* Quézel, Barbéro, Benabid, and Rivas-Martinez 1992a

Thermomediterranean. Semi-arid. 900–1100 m. Limestones, sandstones. Colluvial soils.

Eastern Middle-Atlas (Melloulou valley) (Fig. 17).

Subassociations:

- *pistacietosum lentisci*

Fig. 18 *Tetraclino articulatae-Euphorbietum resiniferae*, region of Bni-Mellal

– *oleetosum sylvestris*

- *Tetraclino articulatae-Euphorbietum resiniferae* Fennane 1988
  Thermomediterranean. Aride, Semi-arid. 920–1050 m. Dolomite, limestone.
  North piedmont of the High-Atlas (regions of Bezou, Tanant, Bin el-ouidane, Bni Mellal, El Ksiba) (Fig. 18).
  Association marked by the abundance of *Euphorbia resinifera* beside *Tetraclinis articulata.*
- *Tetraclino articulatae-Jasminetum fruticantis* Fennane 1988
  Thermomediterranean. Semi-arid; temperate winter. 600–1100 m. Dolomite, marls, limestone, sandstones.
  Middle-Atlas (northern piedmont of Tazekka).
  Association covering small areas, more or less isolated.
- *Tetraclino articulatae-Pinetum halepensis* Fennane 1988
  Thermomediterranean. Semi-arid, Sub-humid. 820–1150 m. Calcareous schist, marly calcareous, pelites, schists, marls, sandstone.
  Rif (region of Aknoul).
- *Helianthemo lavandulifoliae-Fumanetum calycinae* Peltier 1982
  Thermomediterranean. 900–950 m. Gypsiferous marls, green marls.
  Anti-Atlas (north flank of the jbel near Aït Chleuh), Western High-Atlas (Ida-ou-Tanane).
  Association rich with species of *Rosmarinetalia.*

- *Lavandulo stoechae-Cistetum salviifoliae* Peltier 1982
  Thermomediterranean. 900–1100 m. Compact red clay, mixed with sandstone, doleritic basalts often vacuolar; superficial soil.
  Anti-Atlas (north flank of the jbel Ouaskal bordering the cuvette of Bigoudine), Western High-Atlas (Ida-ou-Tanane).
  Association rich with species of *Rosmarinetalia.*

Ericion arboreae Rivas-Martinez (1975) 1987

- *Cytiso arborei-Quercetum cocciferae* Quézel, Barbéro, Benabid, and Rivas-Martinez 1992a
  Thermomediterranean. Semi-arid. 750–1020 m. Limestone, dolomite, schist, granite.
  Oriental Mountains (Bni Snassen).
  Subassociations:
  - *ericetosum arborae*
  - *ampelodesmetosum mauritanicae*
  - *tetraclinetosum articulatae*
- *Erico arboreae-Myrtetum communis* Quézel, Barbéro, Benabid, Loisel, and Rivas-Martinez 1988
  Thermomediterranean. Sub-humid, Humid. 110–840 m. Schist, sandstone.
  Rif (regions of Tetouan, Oued Laou, Chaouen).
- *Erico arboreae-Quercetum cocciferae* Quézel, Barbéro, Benabid, and Rivas-Martinez 1992a
  Thermomediterranean. Semi-arid, Sub-humid. 550–1130 m. Sandstone, schist.
  Northern Middle-Atlas (Tazekka), Mediterranean coast (Karn mountain east of Al Hoceima).
  Preforest groupement: sparse suber oak; undergrowth with *Quercus coccifera, Cistus spp., Erica spp*.
  Subassociations:
  - *quercetosum cocciferae*
  - *quercetosum canariensis*
  - *eryngietosum tricuspidati*
- *Phillyreo latifoliae-Quercetum cocciferae* Quézel, Barbéro, Benabid, Loisel, and Rivas-Martinez 1988
  Thermomediterranean. Sub-humid, Humid. 400–1350 m. Sandstone.
  Rif (Rhomara and valley of Oued Nekor).
  Subassociations:
  - *phlomidetosum caballeroii*
  - *quercetosum rotundifoliae*
- *Phillyreo latifoliae-Arbutetum unedonis* Rivas-Goday and Galiano 1959
  Sub-humid, Humid.
  Northern Morocco.

For Benabid (2000: 261), this association belong to the alliances *Asparago-Rhamnion/Tetraclino-Pistacion*

Juniperion turbinatae Rivas-Martinez (1975) 1987

(*Juniperion lyciae* Barbéro, Quézel, and Rivas-Martinez 1981)

- *Clematido cirrhosae-Juniperetum lyciae* Barbéro, Quézel, and Rivas-Martinez 1981
  Thermomediterranean. Sub-humid. Sandy.
  Northern atlantic Morocco (maritime dunes of Mehdia).
- *Pino pinastri-Juniperetum lyciae* Barbéro, Quézel, and Rivas-Martinez 1981
  Thermomediterranean. Humid. 200–500 m. Sandstone, more or less consolidated sand.
  Rif (Punta Cires west of Tangier).
- *Rhamno rotundifolii-Juniperetum turbinatae* Quézel, Barbéro, Benabid, Loisel, and Rivas-Martinez 1988
  Thermomediterranean. Semi-arid. Sandy.
  North eastern Morocco (littoral zone of Saïdia).
  Juniperia, maritime dunes.

Junipero oxycedri-Rhamnion atlanticae Quézel and Barbéro 1986

- *Cisto laurifolii-Quercetum rotundifoliae* Achhal 1986
  Supramediterranean. Semi-arid. 2000–2400 m. Schist, sandstone.
  Central High-Atlas.
- *Coronillo ramosissimae-Quercetum rotundifoliae* Achhal 1986
  Mesomediterranean. Semi-arid. 1100–1800 m. Sandstone, limestone, schist.
  Central High-Atlas.
  Subassociations:
  - *sarothamnetosum arborei*
  - *pistacietosum terebenthii*
- *Festuco coeruleae-Quercetum rotundifoliae* Achhal 1986
  Mesomediterranean. Semi-arid. 1300–1800 m. Schist, sandstone, limestone.
  Central High-Atlas.
- *Junipero oxycedri-Pistacietum lentisci* Achhal 1986
  Meso- and Supramediterranean. Semi-arid; cold winter. 1350–1660 m. Schist, sandstone, basalt, limestone, quartzite; deep soils.
  Internal valleys of the Central High-Atlas.
- *Leuzeo coniferae-Pinetum halepensis* Quézel, Barbéro, and Benabid 1987
  Mesomediterranean. Semi-arid. 1250–1650 m. Marl, limestone.
  Eastern High-Atlas.
- *Cisto villosi-Telinetum segonnei* Peltier 1982

Fig. 19 *Cisto villosi-Telinetum segonnei*, Anti-Atlas (jbel Kest) (ph. Peltier)

Mesomediterranean. 1450–2000 m. Pleated sedimentary quartzites, silty, clayey silty, sandy silt.

Anti-Atlas (north flank of the jbel Kest, reliefs around Talmst, Asner, Ou-Gouguène, Imin-n-Taghzout, main summits of Tikwyène, Taskra, Amzlouye in the granitic massif of the Kerdous) (Fig. 19).

- *Cisto villosi-Genistetum ferocis* Peltier 1982

  Thermomeditarranean. 650–1450 m. Semi-arid. Quartzitic, rhyolitic, sandstone; deep soils.

  Western Anti-Atlas (West flank of the jbel Kest, reliefs around Aguert-ou-Dab, Amalou, Dar-Ourtane, Agoulmin, Oulbène, Tililout, Aougounz).

  Association of transition between *Pistacio-Rhamnetalia* and *Acacio-Arganietalia.*

Quercion fruticosae Barbéro, Quézel, and Rivas-Martinez 1981

- *Phillyreo angustifoliae-Quercetum fruticosae* Barbéro, Quézel, and Rivas-Martinez 1981

  Thermomediterranean. Humid. 1500–1800 m. Schistic.

  Rif (Tangerian Peninsula).

  Matorral: suberia (suber oak) and zeeneria (zeen oak) degraded.

Other Associations

- *Cytiso barbari-Ononidetum speciosae* Quézel, Barbéro, Benabid, Loisel, and Rivas-Martinez 1988

Mesomediterranean. Sub-humid. 1100–1500 m. Schists.

Central and eastern Rif.

Association little known, even by its authors (cf. Quézel et al. 1988: 83); not affiliated to any alliance.

Acacio gummiferae-Arganietalia spinosae *Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos* 1982

(*Zizypho loti-Rhoetea oxyacanthae* De Foucault 1993 p.p.)

Senecio anteuphorbii-Arganion spinosae Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

- *Artemisio huguetii-Traganopsidetum glomeratae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

  Inframediterranean. 100–150 m. Arid; warm winter. Compact sandstone and sandstone boulders; stony soils.

  Littoral south of Sidi Ifni.
- *Crepido pinnatifidae-Warionietum saharae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

  Inframediterranean. 280–300 m. Arid; warm winter. Quartzite or sandstone, rocky substrate.

  Littoral south of Sidi Ifni.

  Subrupicolous association.
- *Davallio canariensis-Dracaenetum ajgal* Benabid and Cuzin 1997

  Infra- and Thermomediterranean. 400–1400 m. Semi-arid, Sub-humid; temperate to warm winter. Quartzite. Cliffs.

  Anti-Atlas (borders of assif Amaghouz) (Fig. 20).
- *Digitario commutatae-Warionietum saharae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

  Inframediterranean. 100–350 m. Arid; warm winter. Marly substrate; rocky soils with a high inclination.

  Middle atlantic Morocco and western High-Atlas (coastal region between Cape Tafelney and Oued Massa, extending inland to the N'Fiss valley).
- *Euphorbio beaumerianae-Arganietum spinosae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

  Inframediterranean. 20–200 m. Semi-arid, Arid; warm winter. Generally limestone; superficial soils.

  Middle atlantic Morocco (littoral between Cape Tafelney and Oued Massa) (Fig. 21).

  Subassociations:

  – *salsoletosum*
  – *euphorbietosum regis-jubae*
  – *genistetosum (ferox) microphyllae*

Fig. 20 *Davallio canariensis-Dracaenetum ajgal*, western Anti-Atlas (ph. Mangelsdorff in www.Teline.fr)

- *Euphorbio echini-Arganietum spinosae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

  Inframediterranean. 120–400 m. Arid, Semi-arid; warm winter.

  Western Anti-Atlas, Middle atlantic Morocco (littoral region from Agadir to Sidi Ifni) (Fig. 22).
- *Helianthemo australis-Retametum monospermae* Benabid, Machrouh, and Schoenenberger 1994

  Infra- and Thermomediterranean. Semi-arid, Arid.

  Littoral hills between Safi and Sidi Ifni.
- *Limoniastro grandiflori-Arganietum spinosae* Quézel, Barbéro, Benabid, and Rivas-Martinez 1995

  250–750 m. Quatrzite.

  Inframediterranean (south limit), Thermomediterranean. Semi-arid, Arid. Colluvial spaces and thalweg in south of the western Anti-Atlas before oued Drâa (regions of Guelmim, Foum el-Hisn. . .).

  Subassociations:

  – *acacietosum raddianae*
  – *arganietosum spinosae*

- *Limonio mucronati-Traganetum moquinii* Benabid, Machrouh, and Schoenenberger 1994

  Inframediterranean. Semi-arid, Arid.

  Middle atlantic Morocco: association fixing the maritime dunes in the south of Agadir.

Fig. 21 *Euphorbio beaumerianae-Arganietum spinosae*, Anti-Atlas (ph. Taleb)

Fig. 22 *Euphorbio echini-Arganietum spinosae*, Anti-Atlas (ph. Taleb)

Fig. 23 *Periploco laevigatae-Arganietum spinosae*, western Anti-Atlas (ph. Taleb)

- *Penniseto dichotomae-Rhuscetum tripartitae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982
  Saharan. Sandy loam soils.
  Saharan Morocco (graras of Seguia el-Hamra; between Tarfaya and Laayoun).
- *Periploco laevigatae-Arganietum spinosae* Peltier and Msanda 1995
  Infra- and Thermomediterranean. 200–750 m. Arid, Semi-arid. Limestone, dolomite; docky soils.
  Western Anti-Atlas (Kerdous) (Fig. 23).
  Not reported by Benabid (2000).
  Subassociations:
  - *warionietosum saharae*
  - *convolvuletosum trabutiani*
  - *salsoletosum longifoliae*
  - *haloxylonetosum scopariae*
- *Periploco laevigatae-Juniperetum turbinatae* Benabid 2000
  Infra- or Thermomediterranean? Semi-arid, temperate winter.
  Middle atlantic Morocco (maritime dunes of Essaouira).
- *Polycnemo fontanesii-Arganietum spinosae* Peltier and Msanda 1995
  Thermomediterranean. Semi-arid. 700–900 m in north exposure, 800–1000 m in southern exposure. Limestone, dolomite.
  Anti-Atlas, replacing *Periploco-Arganietum* mid-altitude.

- *Traganopsidio glomeratae-Euphorbietum echini* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982
  Saharan. Silty sand; rocky or relatively deep soils and talus slopes.
  Sahara (borders of the graras in Seguia al-Hamra).
  Subassociations:
  - *euphorbietosum echini*
  - *pulicarietosum lozanoi*
- Groupement with *Euphorbia balsamifera* var. *rogerii* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982
  Saharan. Rocky sandy soils.
  Saharan Morocco (south margins of Seguia el-Hamra).

Acacion gummiferae Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

- *Ephedro cossonii-Acacietum gummiferae* Barbéro, Quézel, and Rivas-Martinez 1981
  Thermomediterranean. Arid, Semi-arid. 700–1050 m. Limestone, marls, schists, dolomite.
  Middle atlantic Morocco (small sacred areas bordering the Haouz cuvette).
- *Ephedro cossonii-Arganietum spinosae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982
  Inframediterranean. Arid, Semi-arid; cold winter. 1000–1550 m. Acid rocks, often granite balls.
  Anti-Atlas.
- *Euphorbio echini-Tetraclinetum articulatae* Fennane 1988
  Inframediterranean. Arid, Semi-arid. 1050–1250 m. Compact limestone more or less fissured.
  Anti-Atlas (north of Bou Izakaren).
  The southernmost association of *Tetraclinis articulata.*
- *Hesperolaburno platyphylli-Arganietum spinosae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982
  Infra- and lower Thermomediterranean. Arid, Semi-arid; cool winter. 600–1100 m. Acid substrates.
  North western Anti-Atlas.
- *Oleo salicifoliae-Arganietum spinosae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982
  Infra- and lower Thermomediterranean. Semi-arid; temperate to warm winter. 400–1100 m. Limestone, sandstone, marls.
  High-Atlas (South-western and eastern flanks of the Ida-ou-Tanane massif) (Fig. 24).
- *Oleo salicifoliae-Tetraclinetum articulatae* Fennane 1988

Fig. 24 *Oleo salicifoliae-Arganietum spinosae*, western High-Atlas (Ida-ou-Tanane) (ph. Taleb)

Infra- and lower Thermomediterranean. Arid, Semi-arid. 250–1100 m. Limestone, dolomite, marly calcareous, marls, colluvions, sandstone.

High-Atlas (South-western and eastern flanks of the Ida-ou-Tanane massif).

- *Polygalo balansae-Arganietum spinosae* Barbéro, Benabid, Quézel, Rivas-Martinez, and Santos 1982

  Infra- and lower Thermomediterranean. Arid, Semi-arid. 1000–1350 m. Limestone, marls; superficial and eroded soils.

  Anti-Atlas, foothills of the High-Atlas in the north of Aoulouz.

  Clear Argan forest, chamaephytes dominants.
- *Rubio longifoliae-Euphorbietum resiniferae* Barbéro, Quézel, and Rivas-Martinez 1981

  Thermomediterranean. Semi-arid, temperate winter. 680–900 m. Limestone. Superficial soils.

  High-Atlas of Demnate, Middle-Atlas (region of Beni Mellal).
- *Tetraclino articulatae-Arganietum spinosae* Fennane 1988

  Infra- and Thermomediterranean. Arid, Semi-arid. 750–1300 m. Pelites, sandstones, limestones, marly-calcareous.

  High-Atlas (Argana basin and southern slopes of the western High-Atlas) (Fig. 25).

  Among the meridional tetraclinaies of Morocco, *Tetraclino-Arganietum* is distinguable by its heterogenous flora showing species of the two alliances *Acacion gummiferae* and *Ephedro-Juniperion*.

Fig. 25 *Tetraclino articulatae-Arganietum spinosae*, western High-Atlas (region of Argana) (ph. Taleb)

Other Associations

- *Aeonio arborei-Sonchetum pinnatifidi* Gehu and Biondi 1998
  Infra- or? Thermomediterranean. Semi-arid. Cliffs, rock walls cracked, steep slopes, very hard to access. warm exposures.
  Middle atlantic Morocco (north of Safi).
- *Arganio spinosae-Anagyrisetum foetidae* Peltier 1982
  Thermomediterranean. Semi-arid. 800–900 m. Limestone, marls. Deep soils, clayey.
  Middle atlantic Morocco (watershed of the Oued Souss: hills of Imouila).
  Argania is the dominant tree of the association.
- *Arganio spinosae-Artemisietum incultae* Peltier 1982
  Thermomediterranean. Arid. 800–1400 m. Limestone, dolomite. Shallow soils, colluvions.
  Anti-Atlas (Watershed of the Oued Souss: adrar Fouilim, adrar Minount, jbel Tanchkirra, jbel Taghzout).
- *Arganio spinosae-Cymbopogonetum schoenanthis* Peltier 1982
  Infra-, Thermomediterranean. 350 et 950 m. Arid, Semi-arid. Silty clay loam.
  High-Atlas (watershed of the Oued Souss: jbel Aouerir-Ichentane, jbel Bou-Addou, Aït Lahcen-ou-Saïd and other parts of the southern flank of the High-Atlas).

Fig. 26 *Arganio spinosae-Genistetum ferocis*, Anti-Atlas (ph. Taleb)

Clear formation with *Argania spinosa* and some rares *Tetraclinis articulata* and *Olea europaea* subsp. *oleaster.*

- *Arganio spinosae-Euphorbietum beaumierianae* Peltier 1982

  Inframediterranean. Semi-arid; warm winter. 50–300 m. Limestone, clay, marl, dolomite; rocky soils.

  Middle atlantic Morocco (Western and southern margins of the Ida-ou-Tanane massif from Agadir untill Cap Rhir).

  Subassociations:

  – *euphorbietosum rejis-jubae*
  – *rhuscetosum pentaphyllae*

- *Arganio spinosae-Euphorbietum echini* Peltier 1982

  Inframediterranean. Arid, Semi-arid. 350–1100 m. Schistous limestone, dolomite.

  Anti-Atlas (Aït Brahim, Aït Barka, Tinouainane, Tourhach, Tislane, Isk Timichcha, Abatoutou, etc.), Middle atlantic Morocco (lower Souss plain, along the road Tiznit-Agadir).

- *Arganio spinosae-Genistetum ferocis* Peltier 1982

  Infra- and lower Thermomediterranean. Semi-arid. 350–650 m. Limestone, dolomite; stoney on the surface, relatively deep soil.

  Anti-Atlas (northern fringes of the Kerdouss massif) (Fig. 26).

  Main arborescente/arbustive species: *Olea europaea* subsp. *oleaster*, *Ceratonia siliqua*, *Acacia gummifera.*

Fig. 27 *Arganio spinosae-Haloxyletum scopariae*, Anti-Atlas (ph. Taleb)

- *Arganio spinosae-Haloxyletum scopariae* Peltier 1982
  Infra- and lower Thermomediterranean. Arid, Semi-arid. 250–700 m. Deep loamy soils.
  Northern Anti-Atlas in the regions of Tazemmourt, Tinoainane, south of Taroudant (Bled El-Jdida, bled Tiouna, bled Bou Ghanem), etc. (Fig. 27).
  Mixed formation of *Argania spinosa* and *Acacia gummifera.*
- *Arganio spinosae-Hysperolaburnetum platycarpi* Peltier 1982
  Infra- and lower Thermomediterranean. Semi-arid. 350–1000 m. Limestone, dolomite. Ferralitic red soils.
  Anti-Atlas.
- *Arganio spinosae-Rhuscetum pentaphyllae* Peltier 1982
  Infra-, Thermomediterranean. Arid, Semi-arid. 600–1100 m. Schists, limestones, dolomites, yellow marls.
  Western High-Atlas (Ida-ou-Tanane, Tafingoult, Tagadirt n-ouchbarou, Tamaloukt, Taskat, adrar n-Tguilist, adrar n-Isseldaten Tagadirt . . .).
  Well represented in the Ida-ou-Tanane region.
- *Pistacio lentisci-Maytenetum senegalensae* Peltier 1982
  Thermomediterranean. 800–1250 m. Semi-arid. Rhyolites, granit, limestone, dolomite, schist. Deep soils of decarbonated loam.
  South flank of the Eastern High-Atlas (Surroundings of Aouzioua and jbel Bou-Taggount).
  Matorral more or less arborated.

Fig. 28 *Retamo dasycarpae-Juniperetum phoeniceae*, High-Atlas (ph. Taleb)

Ephedro majoris-Juniperetalia *Quézel and Barbéro (1981) 1986*

Ephedro majoris-Juniperion phoeniceae Quézel and Barbéro (1981) 1986

- *Coronillo ramosissimae-Juniperetum phoeniceae* Quézel and Barbéro 1981
  Thermomediterranean, Mesomediterranean. Arid, Semi-arid. 1000–1900 m. schist, Sandstone, dolomite.
  Central High-Atlas (N'Fiss valley).
- *Warionio saharae-Antirrhinetum ramosissimae* Quézel and Barbéro 1981
  Thermomediterranean. 1000–1300 m. Arid, Semi-arid. Rocky substrates.
  Western High-Atlas.
- *Retamo dasycarpae-Juniperetum phoeniceae* Quézel and Barbéro 1981
  Mesomediterranean, Superior mediterranean. Sub-humid; cold winter. 1300–2200 m. Marls, sandstone.
  Western High-Atlas (Fig. 28).
- *Zizipho loti-Rhuscetum tripartitae* Quézel, Barbéro, Benabid, and Rivas-Martinez 1994
  Thermomediterranean. Arid. 1100–1300 m. Limestone. Rocky substrates.
  Region of Errachidia, south flank of the Anti-Atlas: region of Tta-Tisgui ou Mallou.

Fig. 29 *Adenocarpo bacquei-Buxetum balearicae* subassociation retametosum, Eastern High-Atlas (ph. Taleb)

Junipero thuriferae-Quercion rotundifoliae Quézel and Barbéro (1981) 1986

- *Adenocarpo bacquei-Buxetum balearicae* Quézel and Barbéro 1981
  Thermo-, Meso- and Superior mediterranean. Arid, Semi-arid. 1600–2000 m. Limestone, marly-calcareous. Rocky substrate.
  Endemic of the Eastern High-Atlas (Dades cliffs; south flanks of the lower slopes of the jbel Aberdouz).
  Subassociations (Taleb and Fennane 2009):
  - *buxetosum balearicae*
  - *retametosum sphaerocarpae* (Fig. 29).
- *Berberido hispanicae-Fraxinetum dimorphae* Quézel and Barbéro 1981
  Superior and Mountain mediterranean. Semi-arid, Sub-humid; very cold winter. 1700–2200 m. Limestone, marl, stony or rocky substrate.
  Eastern High-Atlas (Ayachi, Maasker, National Parc of the Eastern High-Atlas), Central High-Atlas, Eastern Middle-Atlas (Fig. 30).
  Subassociations (Taleb and Fennane 2009):
  - *fraxinetosum dimorphae*
  - *juniperetosum thuriferae*

Fig. 30 *Berberido hispanicae-Fraxinetum dimorphae*, Eastern Middle-Atlas (ph. Taleb)

- *Bupleuro spinosi-Juniperetum phoeniceae* Quézel and Barbéro 1981
  Mountain mediterranean. Semi-arid; very cold winter. 1900–2800 m. Limestone, schist, quartzite. Rocky substrate.
  Anti-Atlas (jbel Saghro), Eastern High-Atlas (jbel Aberdouz), central High-Atlas.
- *Bupleuro spinosi-Juniperetum thuriferae* (Achhal 1986) Taleb and Fennane 2009
  (*Bupleuro spinosi-Juniperetum phoeniceae* Quézel and Barbéro 1981 *subassociation juniperetosum thuriferae* Achhal 1986)
  Mountain mediterranean, lower Oromediterranean. Semi-arid, Sub-humid; very cold winter. 2050–2600 m. Limestone, gabbro; rocky substrate.
  Eastern High-Atlas (jbel Aberdouz) (Fig. 31).
  Subassociation (Taleb and Fennane 2009):
  - *berberidetosum hispanicae*
- *Buxo balearicae-Quercetum rotundifoliae* Quézel and Barbéro 1981
  Superior and Mountain mediterranean. Semi-arid; cold to very cold winter. 1500–2200 m. Limestone, marls, rocky substrate.
  Eastern High-Atlas (Aberdouz, Ayachi and Masker mountains), Eastern Middle-Atlas (Bou-Nacer) (Fig. 32).
  Subassociations (Taleb and Fennane 2009):

Fig. 31 *Bupleuro spinosae-Juniperetum thuriferae*, Eastern High-Atlas (ph. Taleb)

Fig. 32 *Buxo balearicae-Quercetum rotundifoliae*, Eastern Middle-Atlas (Bou-Nacer) (ph. Taleb)

Fig. 33 *Crataego laciniatae-Berberidetum hispanicae*, Eastern High-Atlas (ph. Taleb)

  - *buxetosum balearicae*
  - *pinetosum halepensis*

- *Buxo sempervirentis-Juniperetum thuriferae* Quézel 1957

  Mountain mediterranean, Oromediterranean. Semi-arid; cold to very cold winter. 2200–2600 m. Sandstone, limestone. More or less fixed scree at the base of cliffs.

  High-Atlas (Akka n'Tazzert).
- *Crataego laciniatae-Berberidetum hispanicae* Quézel, Barbéro, Benabid, Loisel, and Rivas-Martinez 1992b

  Mountain mediterranean. Semi-arid, Sub-humid. 2000–2200 m. Limestone.

  Eastern High-Atlas (jbel Fazaz, Msadrid, Issoal), Eastern Middle-Atlas (Bou Nacer, Bou Iblane, Tichoukt) (Fig. 33).
- *Lonicero arboreae-Cedretum atlanticae* Barbéro, Quézel, and Rivas-Martinez 1981

  Mountain mediterranean, Oromediterranean. Sub-humid; cold and very cold winter. 2100–2350 m. Limestone, granit, dolomitic limestone; earthy soil, covered with rocks.

  Eastern High-Atlas (mountains Hayïm, Tazigzaout, Sloul, Taouarist, Ayachi and Masker), Eastern Middle-Atlas (Bou Nacer) (Fig. 34).
- *Ormenido scariosae-Quercetum rotundifoliae* Quézel and Barbéro 1981

  Supramediterranean, Mountain mediterranean. Semi-arid, Sub-humid; very cold winter. 1800–2450 m. Limestone, granit, marly-calcareous, rocky substrates.

  Oriental High-Atlas (valleys of Ahansal, Aït Bouguemez, Aït M'hamed, jbels Hayïm, Aberdouz, Ayachi, Maâsker) (Figs. 35 and 36).

Fig. 34 *Lonicero arboreae-Cedretum atlanticae*, Eastern Middle-Atlas (Bou-Nacer) (ph. Taleb)

Fig. 35 *Ormenido scariosae-Quercetum rotundifoliae*, Eastern High-Atlas (ph. Taleb)

Fig. 36 *Ormenis scariosa* (ph. Taleb)

- *Polygalo balansae-Quercetum rotundifoliae* Achhal 1986
  Mesomediterranean. Semi-arid, Sub-humid; cold winter. 1700–2000 m. Sandstone, schist.
  Central High-Atlas.
- *Retamo dasycarpae-Quercetum rotundifoliae* Achhal 1986
  Superior and Mountain mediterranean. 1600–2500 m, Semi-arid, Sub-humid; cold winter. Schist, dolomite, basalte, sandstone.
  South flank of the central High-Atlas.
- *Buxo balearicae-Juniperetum phoeniceae* Taleb and Fennane 2009
  Mesomediterranean, Superior mediterranean. Semi-arid; cold to cool winter. 1600–2000 m. Limestone; eroded soils.
  Eastern High-Atlas (Ziz valley, south flanks of the mountains Aberdouz, Ayachi and Masker) (Fig. 37).
- *Berberido hispanicae-Ribesetum uva-crispae* Taleb and Fennane 2009
  Mountain mediterranean. Semi-arid, Sub-humid; cold winter. 2050–2500 m. Earthy limestone.
  Eastern High-Atlas (mountains of Ayachi, Masker, Sloul, Tazigzaout, Taourist, Issoual, plateau des lacs), Eastern Middle-Atlas (Fig. 38).

Fig. 37 *Buxo balearicae-Juniperetum phoeniceae* (ph. Taleb)

Fig. 38 *Berberido hispanicae-Ribesetum uva-crispae*, Eastern Middle-Atlas (Bou-Nacer) (ph. Taleb)