



THE BRYOPHYTIC FLORA OF THE FIR FOREST OF JBEL LEKRAA (WESTERN RIF, MOROCCO) WITH CENSUS OF NEW SPECIES

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Abstract

As part of the update of the bryoflore of Morocco, the diversity of bryophytes Jbel Lekraa is inventoried. This study site is a mountain of Talassemtane National Park known for its fir forest, *Abies marocana*, a species endemic to Morocco. The sampling of these plants was carried out during three periods and allowed us to identify 61 species of bryophytes including 2 varieties (58 mosses, 2 liverworts and 1 hornwort) grouping 14 families and 29 genera. Most of these species are epiphytes (51%) and localized in the fir forest of Jbel Lekraa. The family of Pottiaceae is the most dominant (27%) followed by Orthotrichaceae then Brachyeciaceae (respectively 18% and 14%). The genus *Orthotrichum* alone comprises 11 species of which one species is endemic to Morocco (*O. scanicum*). This study identified 3 new species for Morocco (*Didymodon sinuosus*, *Sciuro-hypnum reflexum* and *Scleropodium obtusifolium*) and 10 new species for the Rif region. This has enriched the biodiversity of the bryological flora of Morocco as well as that of North Africa.

Key words : Bryoflora, Catalogue, Pine Forest, Rif, Morocco.

Introduction

Rif bryoflore has only been partially studied (Jiménez *et al.*, 2002; Draper *et al.*, 2003; Laouzazni *et al.*, 2018). In order to complete the list of bryophytic species of Morocco, we were interested in this work in the Western Rif and in particular the fir tree of Talassemtane National Park (PNTS), at Jbel Lekraa. This is part of the study that aims to draw up the catalogue of the park's bryoflore.

The Moroccan fir tree is a forest formation whose range is located only in the Western Rif forming two populations in the Talassemtane National Park (PNTS): one east of Chefchaouen and the other north of the park. According to some authors, they correspond to two species, respectively *Abies marocana* Tabut [= *Abies pinsapo* subsp. *marocana* (Trab.) Emb. & Maire] and *A. tazaotana* Huguét del Villar [= *Abies pinsapo* var. *tazaotana* (Cozar ex Villar) Pout. and Tour. (Blérot and M'hirit, 1999; Fennane *et al.*, 1999), which remain the endemic fir tree of Morocco. The tree covers an area of about 4000 ha (including 2000 ha at Jbel Lekraa,

1000 ha at Jbel Tazaot and 1000 ha in Jbel Kelti) in an area that is moderately watered, with annual rainfall ranging from 800 mm to 1200 mm during sampling years (Infoclimat, 2018) and reaching about 1800 mm in the high reliefs. It settles in an altitudinal slice between 1400 and 2100 m. This ecosystem develops in the supra-Mediterranean zone under a humid bioclimate per-wet and under a cold to very cold variant (Benabid, 2000). The Moroccan fir tree is generally found in a sparse state, but locally can be found in dense forests; it extends over calcaire-dolomitic facies. It is either homogeneous or mixed with other forest species such as: cedar, zeen oak, green oak and pine species (Blérot and M'hirit, 1999). The growth of the fir tree is very slow and there are feet up to 50 m high. A plant richness is observed mainly at the level of vascular flora including a large number of endemic species, rare and very rare, which gives the area an original landscape. The bioecological conditions of the environment seem to be hospitable for the installation of bryophytes on different types of substrates. Taxonomic and ecological studies of the fir tree are numerous, mainly botanical or biochemical or genetic

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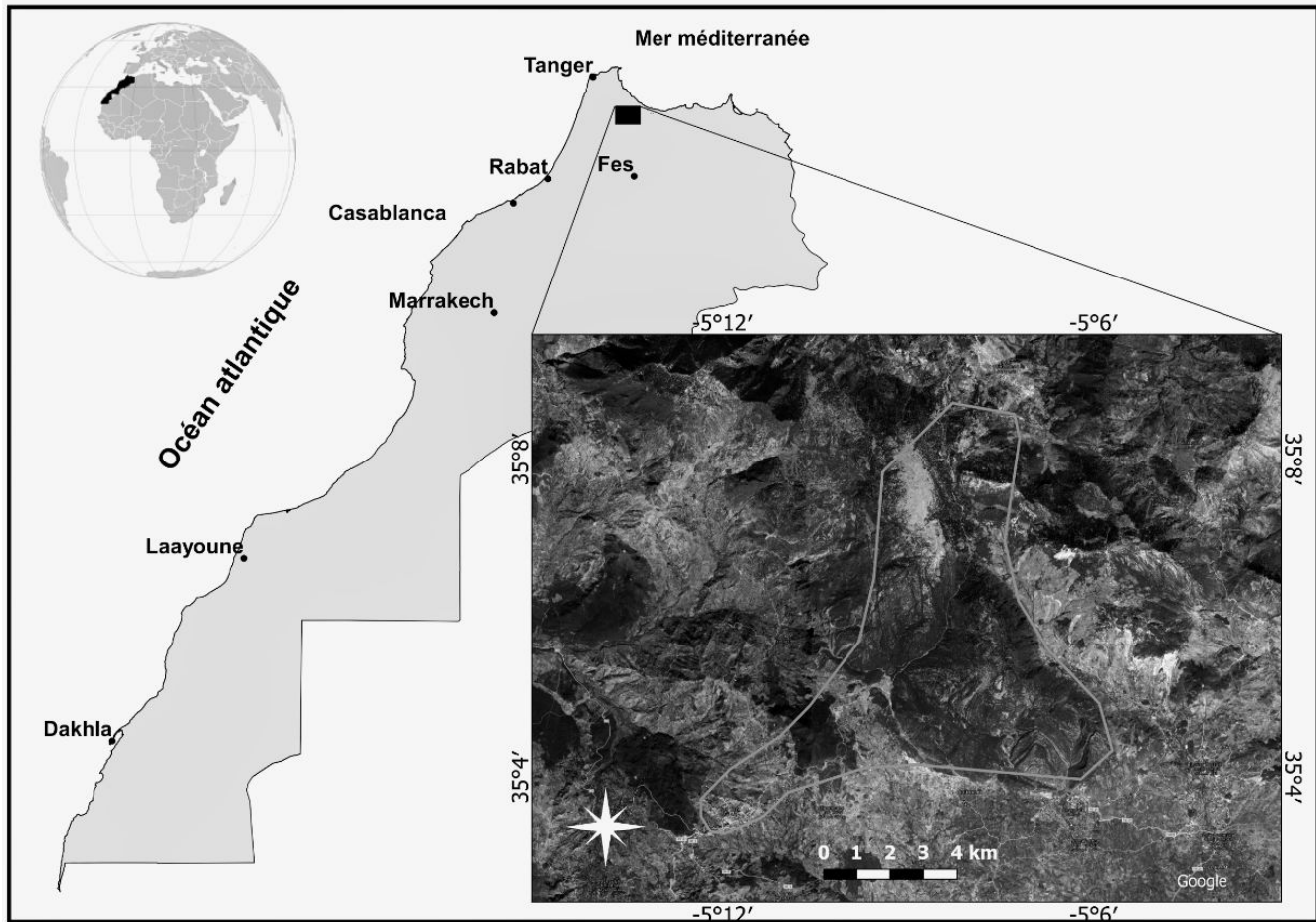


Fig. 1 : Geographical location of the sampling area in Mount Jbel Lekraa (Talassemtane National Park, Western Rif, Morocco).

(Terrab *et al.*, 2007; Alaoui *et al.*, 2011), but those that refer to bryoflore remain very limited (Ahayoun *et al.*, 2013).

Materials and Methods

Description of the study site

Sampling was located at Jbel Lekraa, located east of the town of Chefchaouen (fig. 1), it is the highest calcaireo-dolomitic mass in the PNTS with an altitude of 2159 m (Baumer, 1977). This site is known for its fir tree which is either pure or mixed with other tree species such as *Quercus faginea*, *Q. rotundifolia*, *Cedrus atlantica* and sometimes a few feet of pine trees (*Pinus nigra* and *P. maritima*). Mount Jbel Lekraa benefits from an environment that retains a certain freshness throughout the year and is characterized by four floors of vegetation, namely the thermo-mediterranean below the 1000 m including lawns, the meso-mediterranean (between 1000 - 1400 m) with the formation of *Quercus faginea*, the supra-mediterranean (between 1400-1800 m) where appears *Abies marocana* and the mediterranean mountaineer (1800 m) where *Abies marocana* coexists

with *Cedrus atlantica* (Benabid, 2000). Beyond 1900 m altitude, the mountain appears without vegetation hence its name Jbel Lekraa meaning in arabic “hot mountain”.

The study area was explored over three seasons: February 2014, July 2016 and April 2017. Exploration is carried out along an altitudinal gradient of 858 m to 1715 m, beyond this altitude no bryophytic species have been observed. The samples were taken within a radius of about 10 m on the various substrates bearing bryophytes, i.e. tree trunks, soils and rocks. This allowed the sampling of 12 stations (table 1), each of which includes 1 to 6 samples depending on the distribution of bryophytes in each station. The identification of the harvested species was based on the following determination keys: Boulay (1904), Augier (1966), Pierrot (1982), Casas *et al.* (2006), Casas *et al.* (2009) and Smith (2004). The nomenclature adopted is that of the Mediterranean bryoflore developed by Ros *et al.* (2013) for the mosses and by Ros *et al.* (2007) for liverworts and hornworts.

Results and Discussion

Sampling of the bryophytic flora of the Jbel Lekraa

Table 1 : Description of the sampling stations.

Stations	Altitude (m)	Latitude (N)	Longitude (W)	Vegetation formation
1	887	35°03.636'	5°12.012'	Lawn
2	1113	35°04.381'	5°10.692'	Lawn
3	1163	35°05.551'	5°09.986'	Lawn
4	1205	35°05.134'	5°10.083'	Matorral de chêne vert
5	1294	35°05.383'	5°09.595'	<i>Quercus faginea</i>
6	1501	35°06.776'	5°08.117'	<i>Abies marocana</i> + <i>Quercus faginea</i>
7	1634	35°07.197'	5°08.010'	<i>Abies marocana</i>
8	1639	35°07.426'	5°08.080'	<i>Abies marocana</i> + <i>Quercus faginea</i>
9	1636	35°07.586'	5°08.127'	<i>Abies marocana</i>
10	1647	35°07.586'	5°08.144'	<i>Abies marocana</i>
11	1715	35°08.140'	5°08.248'	<i>Abies marocana</i>
12	1712	35°08.387'	5°08.215'	<i>Abies marocana</i>

fir tree identified 59 species and 2 varieties in 14 families and 29 genera; most of them belong to the Moss class (56 species and 2 varieties) followed by those of the liverworts (2 species) and only one for the hornworts. These species have been encountered on the lawns of the mountain and within the fir trees that are either pure or mixed with other forest trees such *Quercus faginea*, *Quercus rotundifolia*, *Cedrus atlantica*. The following catalogue includes harvested species that are categorized by family and presented in alphabetical order. For each taxon are indicated the state under which the species was encountered [gametophyte and sporophyte (GS) or gametophyte only (G)], the types of substrate, the biotopes (epiphytic and/or saxicolous and/or terricolous), the altitudes and in what plant formation it lives. The new species in the region are preceded by an asterisk and new to Morocco by two asterisks. These are the subject of articles in the course of publications.

Bryophyte catalogue

Anthocerotophyta

Anthocerotaceae

Anthoceros punctatus L.: (G), terricolous (clay soil), slope NW, Alt: 1205 m. Vegetations formations: green oak matorral, forest of *Abies marocana*.

Hepaticophyta

Lunulariaceae

Lunularia cruciata (L.) Lindb.: (GS), terricolous (clay soil), slope NW, Alt: 887 m. Vegetation formation: lawn.

Pelliaceae

Pellia endiviifolia (Dicks.) Dumort.: (GS), saxicolous (limestone rock), slope NW, Alt: between 1205 m and 1634 m. Vegetations formations: green oak

matorral, *Abies marocana* + *Quercus faginea*, *Abies marocana*.

Bryophyta

Brachytheciaceae

Brachythecium velutinum (Hedw.) Ignatov & Huttunen: (G), terricolous (clay soil), slope N; Alt: between 1112 m and 1634 m, found in association with *Didymodon sinuosus* et *Bryum caespiticium* at an altitude of 1634 m. Vegetations formations: lawn, *Abies marocana*.

Eurhynchium praelongum (Hedw) Schimp: (G), soil, slope NW; Alt: between 1163m and 1634m, harvested in combination with *Didymodon sinuosun*, *Brachythecium velutinum* et *Bryum caespiticium* at an altitude of 1634m. Vegetations formations: *Abies marocana*+*Quercus faginea*, *Abies marocana*.

**Homalothecium philippeanum* (Spruce) Schimp: (GS), epiphyte (on trunk, exposed roots and branches of *Abies marocana*), slope NW-N and N ; Alt: between 1501 m and 1714 m. Vegetations formations: *Abies marocana*+*Quercus faginea*, *Abies marocana*.

**Homalothecium lutescens* (Hedw.) H.Rob: (G), epiphyte (on the trunk of *Abies marocana*), slope NW; Alt: between 1112 m and 1714 m, in association with *Pterigonium gracile* at 1501 m. Vegetation formations: lawn, *Abies marocana* + *Quercus faginea*, *Abies marocana*.

Homalothecium sericeum (Hedw.) Schimp: (G), epiphyte (on the trunk of *Abies marocana*), slope NW, Alt: 1501 m at 1646 m. Vegetations formations: *Abies marocana* + *Quercus faginea*, *Abies marocana*.

Isothecium alopecuroides (Lam. ex Dubois) Isov: (G) epiphyte, slope NW, Alt: 1712 m at 1714 m. Vegetation formation: *Abies marocana*.

***Sciuro-hypnum reflexum* (Starke) (Brid) Ignatov & Huttenen: (G), epiphyte and saxicolous respectively on the trunk of *Abies marocana* and on limestone rock, slope NW-N, Alt: 1294 m at 1714 m. Vegetations formations: *Abies marocana* + *Quercus faginea*, *Abies marocana*.

***Scleropodium obtusifolium* (Bruch.) Schimp: (G), epiphyte, slope N, Alt: 1638 m. Vegetation formation: *Abies marocana*.

Scleropodium touretii (Brid.) L.F.Koch: (G), epiphyte, slope NW, Alt: 1635 m at 1638 m. Vegetation formation: *Abies marocana*.

Bryaceae

Bryum caespiticium (Hedw.): (G), terricolous (clay soil), Alt: 1501 m at 1634 m, in association with *Eurhynchium pralongium* and *Orthotrichum affine* at the altitude of 1501 m. Vegetation formation: *Abies marocana*.

Bryum capillare Hedw.: (GS), terricolous (clay soil), Alt: 887 m at 1634 m. Vegetation formations: lawn, *Abies marocana*.

**Bryum pallescens* Schleich. ex Schwägr.: (GS), saxicolous (limestone rock), Alt: 887 m. Vegetation formation: lawn.

Ptychostomum moravicum (Podp.) Ros & Mazimpaka: (G), terricolous (clay soil), Alt: 887 m at 1634 m. Vegetations formations: lawn, *Abies marocana*.

Dicranaceae

Ceratodon purpureus (Hedw.) Brid: (G), terricolous (clay soil), Alt: 1501 m at 1632 m. Vegetations formations: *Abies marocana*+*Quercus faginea*, *Abies marocana*.

Dicranowesia cirrata (Hew.) Lindb.: (G), saxicolous (limestone rock), exposition N, Alt: 1633 m at 1638 m. Vegetation formation: *Abies marocana*.

Funariaceae

Funaria hygrometrica (Hedw.): (G), terricolous (clay soil), slope NW, Alt: 1294 m. Vegetation formation: *Quercus faginea*.

Grimmiaceae

**Grimmia decipiens* (Schultz) Lindb: (GS), saxicolous (limestone rock), slope NW, Alt: 1112 m at 1205 m. Vegetations formations: lawn, green oak matorral, *Abies marocana*.

**Grimmia longirostrie* (Hook): (G), epiphyte, exposition NW-N, Alt: 1294 m. Vegetation formation: *Quercus faginea*.

Grimmia orbicularis Bruch ex Wilson: (G),

saxicolous (limestone rock), slope NW, Alt: 1634 m. Vegetation formation: *Abies marocana*.

Grimmia pulvinata (Hedw.) Sm., Engl. Bot.: (GS), epiphyte (on trunk and apparent roots of *Abies marocana*), slope N, Alt: 1501 m at 1712 m. Vegetations formations: *Abies marocana*+*Quercus faginea*, *Abies marocana*.

Grimmia trichophylla Grev.: (GS), saxicolous (on siliceous rock), slope NW, Alt: 1113 m at 1714 m. Vegetations formations: lawn, matorral de chêne vert, *Abies marocana*+*Quercus faginea*, *Abies marocana*.

Schistidium crassipilum H.H. Blom: (GS), epiphyte (on trunk of *Quercus faginea*), Alt: 1294 m. Vegetation formation: *Quercus faginea*+*Abies marocana*.

Hypnaceae

Hypnum cupressiforme Hedw (Timm ex Hedw.) Brid: (G), epiphyte (on trunk, branches and apparent roots of *Abies marocana*), exposition NW-N, Alt: 1634 m at 1714 m; it also lives in association with *Antitrichia californica* et *Syntrichia ruralis*. Vegetation formation: *Abies marocana*.

**Hypnum cupressiforme* var. *lacunosum* (Brid.): (G), epiphyte, exposition N, Alt: around 1635 m, found in association with *Tortella tortuosa*. Vegetation formation: *Abies marocana*.

Leucodontaceae

Antitrichia californica Sull: (G), epiphyte (on trunk, branches and apparent roots of *Abies marocana*) et saxicolous (limestone rock), slope NW and N, Alt: 1501 m at 1712 m, found in association with *Syntrichia ruralis* at the altitude of 1634 m. Vegetations formations: *Abies marocana*+*Quercus faginea*, *Abies marocana*.

Antitrichia curtispindila (Hedw.) Brid: (G), epiphyte (*Abies marocana*), slope NW, Alt: 1501 m at 1714 m. Vegetations formations: *Abies marocana* + *Quercus faginea*, *Abies marocana*.

Leucodon sciuroides (Hedw) Schwagr: (G), epiphyte, slope N, Alt: 1714 m. Vegetation formation: *Abies marocana*.

Pterogonium gracile (Hedw): (G), epiphyte (on trunk of *Abies marocana*), slope NW-N and NW, Alt: 1501 m at 1635 m, in association with *Homalothecium luteceus* at an altitude of 1501 m. Vegetations formations: *Abies marocana* + *Quercus faginea*, *Abies marocana*.

Leptodontaceae

Leptodon smithii F Weber & D. Mohr: (G), epiphyte, slope N-WN, Alt: 1294 m. Vegetation formation: *Quercus faginea*.

Orthotrichaceae

Orthotrichum affine Schrad. ex Brid: (GS), epiphyte (on trunk of *Abies marocana*), slope N, Alt: 1501 m at 1638 m. Vegetations formations: *Abies marocana* + *Quercus faginea*, *Abies marocana*.

**Orthotrichum anomalum* Hedw.: (GS), epiphyte (on trunk of *Abies marocana*, slope N, Alt: 1501 m. Vegetation formation: *Abies marocana*+*Quercus faginea*.

Orthotrichum cupulatum Brid: (GS), epiphyte, slope NW-N, Alt: 1294 m. Vegetation formation: *Quercus faginea*.

Orthotrichum diaphanum Schrad. ex Brid: (GS), epiphyte (on branches of *Quercus faginea*), slope NW, Alt: 1294 m. Vegetation formation: *Quercus faginea*.

Orthotrichum lyellii Hook. & Taylor: (G), epiphyte (on branches and trunk of *Quercus faginea*), slope NW and NW-N, Alt: 1294 m at 1712 m. Vegetations formations: *Quercus faginea*, *Abies marocana*.

Orthotrichum pallens Bruch ex Brid: (G), epiphyte, slope NW, Alt: 1294 m. Vegetation formation: *Quercus faginea*.

Orthotrichum rupestre Schleich. ex Schwägr: (GS), epiphyte (on branches of *Quercus faginea*), slope NW, Alt: 1294 m. Vegetation formation : *Quercus faginea* +*Abies marocana*.

Orthotrichum scanicum Grönvall: (GS), epiphyte (on trunk of *Abies marocana* and *Quercus faginea*), Alt: 1294 m at 1501 m. Vegetations formations: *Quercus faginea*, *Abies marocana*+*Quercus faginea*.

Orthotrichum schawii Wilson: (G), epiphyte, Alt: 1294 m. Vegetation formation: *Quercus faginea*.

Orthotrichum speciosum var. *speciosum* Nees: (GS), epiphyte (on trunk of *Quercus faginea*), slope NW, Alt: 1294 m at 1501 m. Vegetation formation: *Quercus faginea*, *Quercus faginea*+*Abies marocana*.

Orthotrichum tenellum Bruch ex. Brid: (G), epiphyte, Alt: 1714 m. Vegetation formation: *Abies marocana*.

Pottiaceae

Barbula convoluta Hedw.: (GS), epiphyte, Alt: 1712 m. Vegetation formation: *Abies marocana*.

Didymodon acutus (Brid.) K.Saito: (G), epiphyte, slope NW, Alt: 1646 m. Vegetation formation: *Abies marocana*.

Didymodon fallax (Hedw.) R. H. Zander: (G), epiphyte, Alt: 1646 m. Vegetation formation: *Abies*

marocana.

**Didymodon nicholsonii* Culm.: (GS), terricolous (limestone soil), slope NW, Alt: 1501 m at 1635 m. Vegetation formation: *Abies marocana*+*Quercus faginea*, *Abies marocana*.

**Didymodon rigidulus* Hedw.: (G), saxicolous (limestone rock), slope NW, Alt: 1634 m. Vegetation formation: *Abies marocana*.

***Didymodon sinuosus* (Mitt.) Delogne: (G), terricolous (clay soil), slope NW-N, Alt: 1633 m. Vegetation formation: *Abies marocana*.

Didymodon vinealis (Brid) R.H. Zander: (G), terricolous (sandy soil), slope NW, Alt: 1112 m at 1294 m. Vegetations formations: lawn, *Quercus faginea* + *Abies marocana*.

Syntrichia calcicola J.J Amann: (G), terricolous (clay soil), slope N, Alt: 1501 m at 1646 m. Vegetation formation: *Abies marocana*+*Quercus faginea*.

Syntrichia laevipila (Brid.): (G), epiphyte (on apparent roots of *Abies marocana*), saxicolous (limestone rock) and terricolous (sandy-clay soil), slope NW, Alt: 1633 m. Vegetation formation: *Abies marocana*.

Syntrichia montana (Nees): (G), saxicolous (siliceous rock), Alt : 1634 m, in association with *Tortella tortuosa*. Vegetation formation: *Abies marocana*.

Syntrichia princeps (De Not.) Mitt.: (G), saxicolous (limestone rock), Alt: 1634 m, in association with *Syntrichia ruralis* and *Eurhynchium pralongium*. Vegetation formation: *Abies marocana*.

Syntrichia ruralis (Hedw) F. Weber & D. Mohr: (GS), saxicolous (limestone rock), slope NW, Alt: 1163 m at 1646 m. Vegetations formations: lawn, green oak matorral, *Abies marocana*+*Quercus faginea*, *Abies marocana*.

Timmiella barbulooides (Brid.) Mönk.: (G), terricolous (clay soil), Alt: 887 m. Vegetation formation: lawn.

Tortella flavovirens (Bruch.) Broth: (GS) ; terricolous (clay soil) ; Alt: 887 m at 1163 m. Vegetation formation: lawn.

Tortella tortuosa (Hedw.) Limpr.: (G), saxicolous (siliceous rock), slope NW and NW-N, Alt: 1163 m at 1634 m. Vegetations formations: lawn, green oak matorral, *Quercus faginea*, *Abies marocana*+*Quercus faginea*, *Abies marocana*.

Tortula subulata (Hedw): (GS), saxicolous (limestone rock), slope NW, Alt: 1205 m at 1634 m. Vegetations formations: green oak matorral, *Abies*

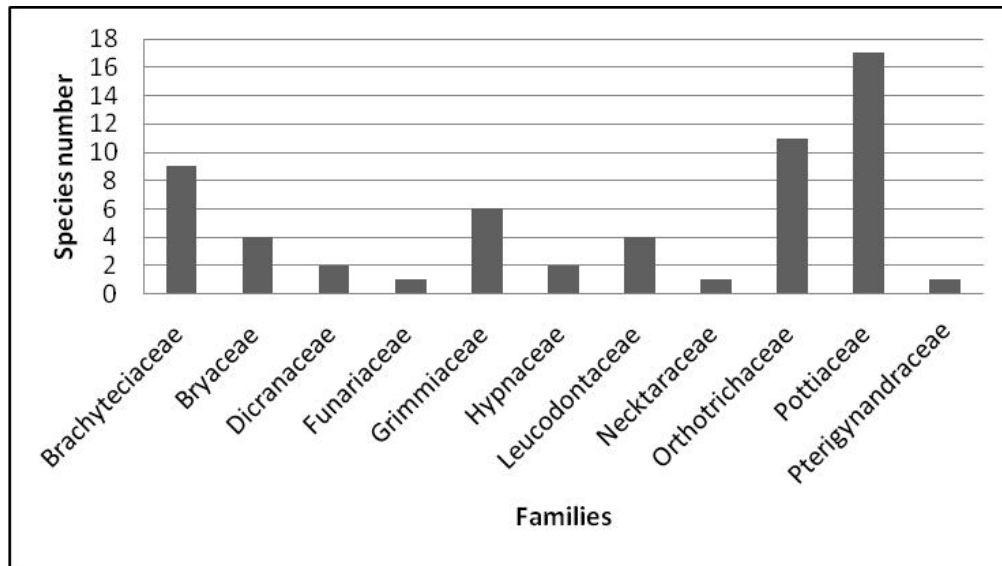


Fig. 2 : Specific diversity by family in the Mosses.

marocana.

**Trichostomum tenuistre* (Hook. & Taylor) Lindb.: (G), terricolous (clay soil), Alt: 1633 m. Vegetation formation: *Abies marocana*.

Pterigynandraceae

Pterigynandrum filiforme Hedw.: (G), epiphyte (on apparent roots of *Abies marocana*), slope NW, Alt: 1501 m at 1633 m. Vegetations formations: *Abies marocana*+*Quercus faginea*, *Abies marocana*.

The Pottiaceae family is the most diverse with 17 species (27%), followed by Orthotrichaceae and Brachytheciaceae (11 species or 18% and 9 species or 14%) respectively (fig. 2). Liverworts are represented by 3 monospecific families and the Hornworts class only by one family and one species. The genus *Orthotrichum* is the most diverse. It comprises 11 species of which *Orthotrichum scanicum* is listed as endemic to northern Morocco under its name synonym *O. lewinskyae* (Lara and Mazimpaka, 2001) and all these species are epiphytes. Draper *et al.* (2003) identified 12 species and 2 varieties of the genus *Orthotrichum* at Jbel Bouhalla, a Rif mountain in northern Morocco, of which 9 taxa are in common.

The altitudinal slice ranging from 1290 m to 1636 m has a wide bryophytic mat reflecting a significant taxonomic richness (from 15 to 31 taxa). In this environment, a certain humidity is provided thanks to the zeane and then the fir tree which is mixed with the cedar favoring a microclimate that has contributed to the installation of these plants. Also, around 1715 m altitude, the number of species rises again slightly which may be due to the north exposure of the sampled fir tree. Between

885 m and 1165 m, bryoflore is not well developed as these stations correspond to lawns experiencing frequent trampling, such as grazing and human activity, which could be the major cause of the low distribution of Bryophytes. Compared to bryophytic studies in the Rif and/or Morocco (Cano *et al.*, 2000; Draper *et al.*, 2006; Ros *et al.*, 2007; Ahayoun *et al.*, 2013; Ros *et al.*, 2013; Laouzazni *et al.*, 2018), 3 new species have been identified for the first time in Morocco, *Scleropodium obtusifolium* (F/ Brachytheciaceae) then *Sciuro-hypnum reflexum* (F/ Pottiaceae) and *Didymodon sinuosus* (F/ Pottiaceae), they are marked with the symbol (**) and observed only in gamophytic form, as well as 10 species newly recorded in the region and marked by the symbol (*). This shows that the exploration of new environments not yet studied allows to complete the catalog of bryophytes of Morocco with new species.

Corticolous and epiphytic species appear to be the most represented (31 species) followed by terricolous (18 species) and saxicolous (13 species). There are also taxa encountered in two ways of life, such as *Brachythecium reflexum*, *Antitrichia californica* and *Syntrichia laevipela*, which are saxicoal and epiphytic. During this prospecting, we noticed the abundance, at the site of their collection, of *Grimmia trichophylla*, *Antitrichia californica* and *Sciuro-hypnum reflexum* which have a wide altitudinal distribution. These are mountain species observed at the study site for each of these three species, respectively starting at 1113 m, 1501 m and 1294 m above sea level. *G. trichophylla* is saxicole, living exclusively on siliceous rocks (RBG, 2018). *Antitrichum californica* is widespread mainly in fir stands; it seems to be in almost exclusive liaison with

Abies maroccana. It is a Mediterranean mountain species requiring wet places (Casas *et al.*, 2006; Draper *et al.*, 2006) and which is found in North Africa only in Morocco and Algeria (Ros *et al.*, 2013). In the study site, it sometimes lives in association with *Syntrichia ruralis* and *Hypnum cupressiform*. While *Sciurohypnum reflexum*, which is new in Morocco (article currently published) and even in North Africa is also a mountain species (Casas *et al.*, 2006) encountered in our study site on limestone rocks and on the trunk of the fir tree. Two species, *Barbula convoluta* and *Isothecium alopecuroides* were only found at high altitudes, starting at 1700 m. However, *Bryum pallescens*, *Lunularia cruciata* and *Timmiella barbulooides* are found only at low altitudes (approximately 887 m). *B. pallescens* is classified as a mountain species and high mountains in the Iberian Peninsula (Casa *et al.*, 2006) and distributed from 0 to 1205 m in northern European countries (Smith, 2004).

This work provides a complement to the work done by Jiménez *et al.* (2002) and Draper *et al.* (2003) in Jbel Bouhalla, a mountain located in the Chefchaouen region of the Rif. These authors inventoried 48 epiphytic taxa, 29 of which are in common with those in our study. Most of the species surveyed prefer a moist habitat that is found precisely in this type of environment. The latter has an epiphytic-rich bryoflore (31 taxa), which is explained by the fact that the site is a forest ecosystem favoring their facilities. This contribution has enriched the biodiversity of the bryological flora of Morocco as well as that of North Africa.

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