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Contribution to the inventory of Bryophytes of the Mamora's forest (Atlantic Morocco)

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ABSTRACT

Forty four bryophyte species (44) (16 mosses; 5 hepatics and 3 anthocerotes) were identified in the forest of Mamora (Atlantic Morocco). Among these species eighteen (18) taxa are new to the bryological flora of Mamora, five (5) are rare taxa.

Keywords: Inventory, Bryophytes, Mamora forest, Morocco.

INTRODUCTION

The bryological flora of Morocco is poorly studied. There is no recent flora to this diverse group, but we dispose a catalog of the Morocco's bryophytes, which sets out on a synthesis bryological diversity of Morocco and contains valuable information on local distribution of species (Ahayoun *et al.*, 2013).

620 species have been identified in different regions of Morocco (Ahayoun *et al.*, 2013), including thirty two (32) were reported in the forest of Mamora (Corbière, 1913a, 1913b; Amann, 1924; Braun- Blanquet *et al.*, 1924; Gattefossé *et al.*, 1932 ; Gattefosse, 1932; Maire and Werner , 1934; Jelenc, 1955a, 1966, 1967; Jovet-Ast, 1955c,1955d, 1956c; Ahayoun *et al.*, 2007, 2008, 2009).

Following the example of these previous crossing harvests conducted by botanists, the forest of Mamora had never been the subject since the richness review and the bryophytes biodiversity. This is in order to fill certain gaps that we have undertaken the inventory of the bryological flora of this area. This gave us new for the region of Mamora.

MATERIALS AND METHODS

Study zone:

Morocco: Mamora Forest Canton A Group IV (GIV), Taicha site

This study concerns an area of the Mamora forest, which is naturally divided into five (5) cantons restricted by the valleys of the wadis as Fouarat, Smento, Tiflet and Touirzet appointed respectively from the west to the east: Canton A, B, C, D and E. The cantons are themselves

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divided into smaller units called groups (G), which are in number of 33. (Cf. Fig. 1).

The site of Taicha, Group IV (GIV) of the Canton A, subject of our study, is located absolutely in the west of the Mamora forest, positioned between the city of Kenitra to the north, the city of Salé in the southwest and the Oued Fouarat in the East. Ecologically, the site Taicha canton A (GIV) is under sub-humid bioclimatic atmospheres, soils are sands of varying depth on clay; they rely on a marl substrate of Miocene or Pliocene sandstone (Fraval *et al.*, 1997).

The average annual precipitation is 600 mm, with a large inter-annual variability. The mean temperature of the warmest month (August) is 27.5 ° C and the average of the coldest month (January) is 6.9 ° C.

The maximum monthly relative humidity is between 90 and 94% with minimum in the summer and maximum in the winter.

METHODOLOGY

Because of the Mediterranean climate of Morocco, bryophytes begin to appear after the autumn and winter rains, but the fruiting bodies are observed only during the spring. Excursions carried out regularly in different parts of the Mamora forest allowed the collection a number of specimens. The samples are photographed before and after harvested and brought to the laboratory for microscopic and macroscopic studies.

Species determination was performed using specialized works and keys of determination (Boulay, 1904; Lacouture, 1905; Trabut, 1941; Augier, 1966; Pierrot, 1982; Douin, 1986; Jovet-Ast, 1961, 1966, 1986; Jahns, 1989; Smith, 1990; Watson, 1981; Bailly *et al.*, 2004; Boudier *et al.*, 2006; Faubert, 2007; Casas, 2009).

Species preceded by an asterisk (*) for the new Mamora; (**) Represent Moroccan rare species.

Figure-1. Geographical map of Mamora forest and its cantons

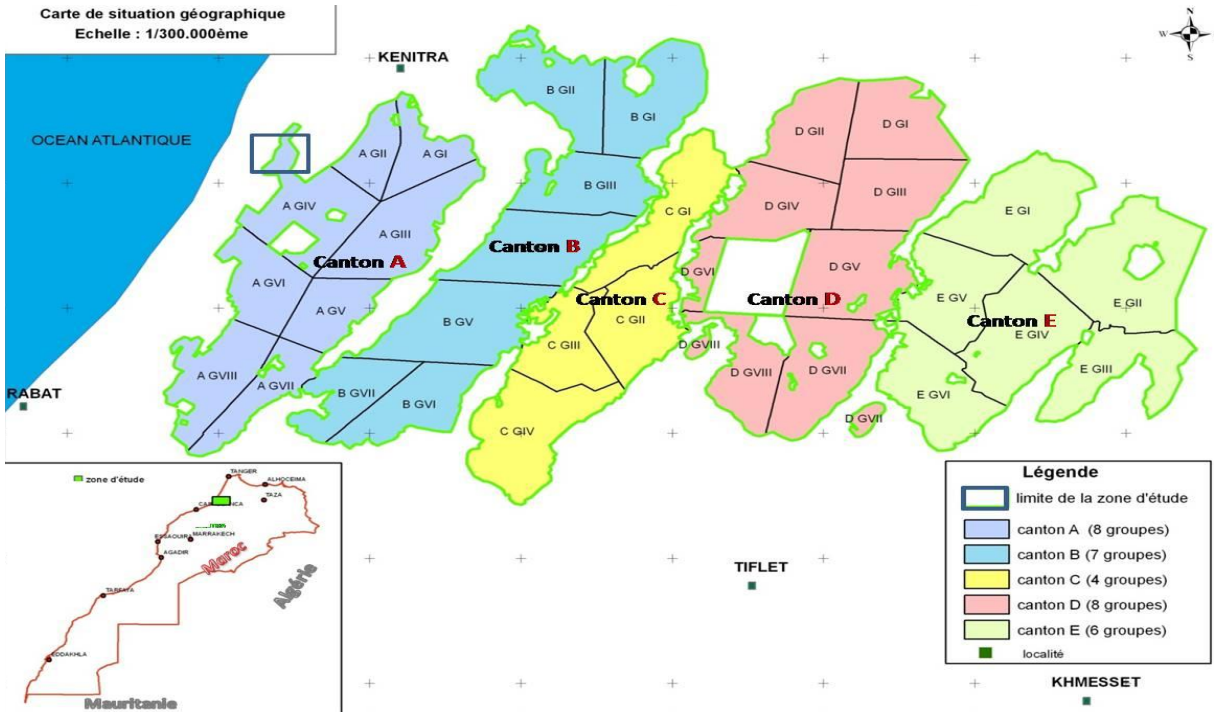
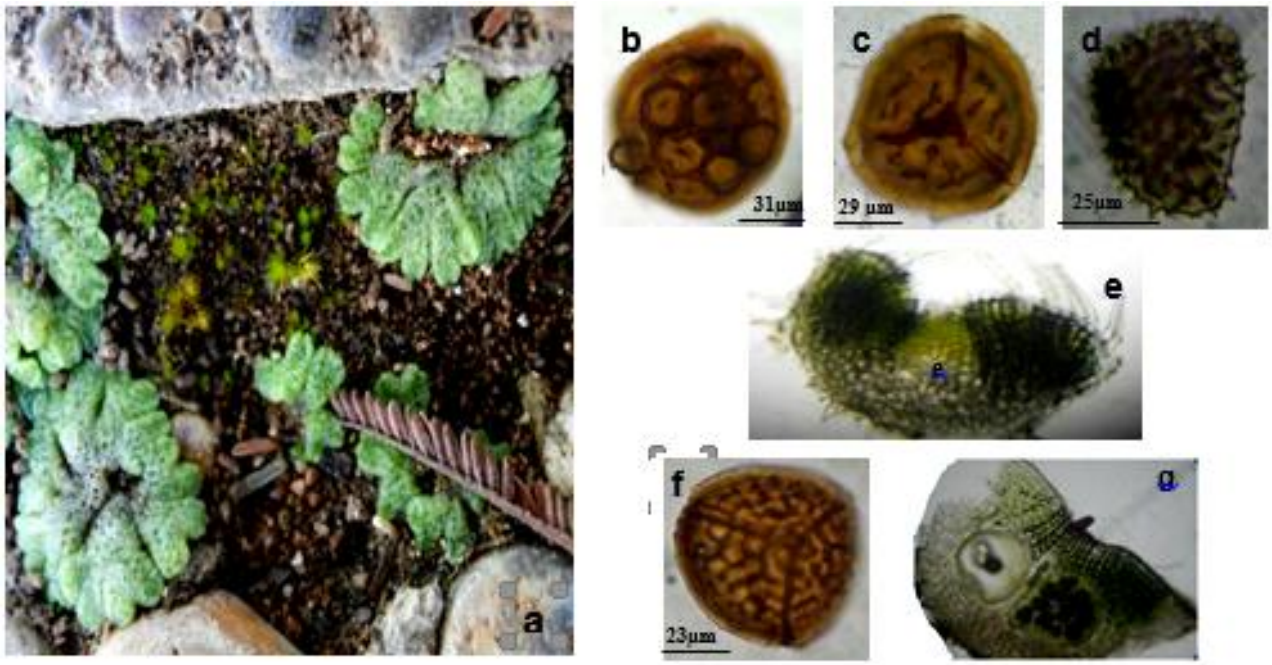


Table 1: List of bryophytes growing in the Mamora forest.

Species	Families
Mosses	
**Brachythecium rutabulum* (Hedw.) Schimp	*Brachytheciaceae* Schimp.
Brachythecium velutinum (Hedw.) Schimp.	
**Bryum argenteum* Hedw.	*Bryaceae* Schwägr.
**Bryum caespiticium* Hedw.	
Bryum capillare Hedw.	
Bryum dichotomum Hedw.	
**Pleuridium acuminatum* Lindb.	*Ditrichaceae* Limpr.
Fissidens bryoides Hedw.	*Fissidentaceae* Schimp.
**Entosthodon fascicularis*	*Funariaceae* Schwägr.
Funaria hygrometrica Hedw.	
**Physcomitrium pyriforme* Brid.	
Orthorichum diaphanum Schrad. ex Brid	*Orthotrichaceae* Arn.
Syntrichia laevipila Brid	*Pottiaceae* Schimp.
Timmiella barbuloides (Brid.) Mönk	
Tortula muralis Hedw.	
**Trichostomum crispulum* Bruch.	
Hepatics	
Corsinia coriandrina (Spreng.) Lindb.	*Corsiniaceae Engl.*
Fossombronia caespitiformis De Not. ex Rabenh.	*Fossombroniaceae* Hazsl.
**Frullania dilatata* (L.) Dum.	*Jubulaceae* H. Klinggr.
**Lunularia cruciata* (Linnaeus) Dum.,	*Lunulariaceae* H. Klinggr.
Oxymitra incrassata (Brotero) Sergio & Sim-Sim	*Oxymitraceae* Müll. Frib. ex Grolle
Riccia atromarginata Levier	*Ricciaceae* Rchb.
Riccia bicarinata Lindb.	
(**)**Riccia canaliculata* Hoffm.	
(**)**Riccia cavernosa* Hoffm.	
Riccia ciliifera Link	
Riccia ciliifera fo*. pedemontana* (Steph.) Mull.	
(**)*Riccia crozalsii* Lev.	
Riccia crystallina	
**Riccia fluitans* L.	
**Riccia glauca* L.	
Riccia gougetiana	
**Riccia huebeneriana* var*. cavernosa* (Hoffm.) Ast	
**Riccia lamellosa* Raddi	
Riccia macrocarpa Lev.	
Riccia sorocarpa Bisch	
(**)*Riccia sorocarpa* var. *heegii* Schiffn.	
**Riccia warnstorfii* Limpr. Ex Warnst.	
Sphaerocarpos michelii Bell.	*Sphaérocarpaceae* Heeg.
**Targionia hypophylla* L.	*Targioniaceae* Dumort.
**Targionia lorbeeriana* Müll.Frib.	
Anthocerotes	
(**)*Anthoceros agrestis* Paton	*Anthocerotaceae* Dumort.
Phaeoceros laevis (L.) Prosk.	
*Phymatoceros bulbic*ulosus (Brot.) Stotler, W. T. Doyle & Crand. Stotl	

Figure-2. Plants *in situ* and structures of Morocco rare taxa — a: *Riccia cavernosa* Hoffm.— plants *in situ*; b, c: spores of *Riccia canalicata* Hoffm. , b: distal side, c: proximal side, d: spore, distal side (DS) Tubercled of *Anthoceros agrestis* Paton; e: cross section of a lobe of *Riccia crozalsii* Lev.; f-g: *Riccia sorocarpa* var. *heegii* Schiffn. : f: proximal face spore; g: cross section of a lobe showing on the dorsal surface of the papilla thallus X400.



In the list of inventoried taxa are presented successively mosses, hepatics and anthocerotes. The nomenclature of this contribution is based on that of Hill *et al.* (2006) for the Mosses and that of Ros *et al*. (2007) for hepatics and anthocerotes.

RESULTS AND DISCUSSION

The final list contains 44 species of bryophytes in 15 families. They grow on the sandy soil; rocks; cork of *Quercus suber* and beside dayas, on dry wadis funds (Table 1 and Figure 2).

A list of 44 taxa of bryophytes was observed in the study site (Mamora forest: Atlantic Morocco), including 16 taxa are mosses, 25 hepatics and 3 anthocerotes.

- Among the 16 taxa of mosses reported in our study:

Seven (7) species are new to Mamora (*Brachythecium rutabulum* (Hedw.) Schimp.; *Bryum argenteum* Hedw.; *Bryum caespiticium* Hedw.; *Entosthodon fascicularis* (Hedw.) Müll. Hal., *Physcomitrium pyriforme* Brid.; *Trichostomum crispulum* Bruch and *Pleuridium acuminatum* Lindb);

- The hepatic class is represented by 25 species, divided into eight (08) families, among these species:

Ten (10) taxa are new to the Mamora forest: *Riccia crystallina* L. Emend. Raddi; *Riccia fluitans* L.; *Riccia glauca* L.; *Frullania dilatata* (L.) Dum.; *Riccia lamellosa* Raddi., *Riccia warnstorfii* Limpr. Ex Warnst, *Targionia lorbeeriana* Müller Frib.; *Targionia hypophylla* L; *Riccia canaliculata* Hoffm; *Riccia sorocarpa* var. *heegii* Schiffn.

Five (05) taxa are rare under previous authors (Jovet-Ast, 1956; Jovet-Ast & Bischler, 1966; Smith, 1990 and B.L Chowdharyl, 2014) (*Riccia canaliculata*; *Riccia crozalsii* Levier; *Riccia cavernosa* Hoffm.; *Riccia sorocarpa* var. *heegii et Anthoceros agrestis* Paton).

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