

Floristic and geobotanical comments concerning Morocco flora. Note 1

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*In memorial of Prof. Dr. José Antonio Fernández Prieto (1950-2019)
one of the best geobotanist of our generation.*

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ABSTRACT: Geobotanic and taxonomic comments of twenty relevant plant species growing wild in Morocco, mostly endemics, selected from our "Catalogus Flora of Morocco: significant species" (in progress), after a critical assessment of the main floristic works in the territory. Also we publish now the new "Geobotanic map of Northwestern Africa territories", utilize as general ubication of the plants and communities in our Moroccan published papers.

KEY WORDS: Global geobotany. New combinations and status. Geobotanic map of territories

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RESUMEN: Se tratan aspectos geobotánicos y taxonómicos inéditos de veinte especies de plantas relevantes nativas de Marruecos, la mayoría endémicas, seleccionadas de nuestro "Catálogo de Flora de Marruecos: especies significativas" (en preparación), tras la evaluación crítica de los principales trabajos florísticos en el territorio. También publicamos el nuevo "Mapa geobotánico de África noroccidental", utilizado para la localización general de las plantas y comunidades en nuestros documentos publicados en Marruecos.

PALABRAS CLAVE: Geobotánica global. Nuevas combinaciones y estatus. Mapa de territorios geobotánicos

1. INTRODUCTION

Within the assiduous global geobotanic collaborate field work researches and projects that we have shared during the last four decades in Northwest Africa (Rivas-Martínez), the most important effort, essential for me, has been the yearly Marseille-Salé "Morocco Botany Mission", conduct, beginning and conclude by P. Quézel (deceased), M. Barbero, A. Benabid (deceased) and Rivas-Martínez (1977-1994). Before and after, long and short botanical expeditions has been also carry throughout Magreb, Sahara and Sahel (Morocco, Algeria, Tunisia, Río de Oro, Hoggar, Tefedest, Djanet, Senegal, Mauritania and Cabo Verde, assist by the University Complutense of Madrid (years 1969-2005) and the CIF (years 1993-2019),

with the help of friends and colleagues particularly: P. Cantó, M. Costa, M. V. Martín, A. Santos, and W. Wildpret. Also has been very important the seven years "Lisboa-Cabo Verde Project", lead by M. Lousa (years 2002-2009) with J.C. Costa, C.M. Duarte and S. Rivas-Martínez, help by T. E. Díaz, I. Gomes, I. Moreira (deceased), A. Penas, S. del Río and S. Rivas Sáenz. Finally, the last eight years "Granada-Morocco Global Geobotanic Project" conduct by J. Molero (years 2011-2020) with A. Benabid (deceased), M. Álvarez, G. Benítez, P. Cantó, M. Costa, T. E. Díaz, M. Kadiri, J.M. Marfíl, A. Merzouki, A. Penas, S. del Río, I. Prieto, S. Rivas Sáenz and S. Rivas-Martínez. [Summarized by S. Rivas-Martínez]. The main literature for the development of this work is Fennane et al., (1999, 2007, 2014), Valdés et al., (2002), and Maire (1952-1987),

which served as the basis for a wider project (J. Molero & al., in progress). In the following list, the symbol [●] indicates that the taxon is endemic from Morocco.

2. LIST OF THE SELECTED MOROCCAN PLANTS

Avenella iberica (Rivas Mart.) Rivas Mart. in *Itinera Geobot.* 18(2): 481. 2011.

Basion.: *Deschampsia flexuosa* (L.) Trin. subsp. *iberica* Rivas Mart. in *Anales Inst. Bot. Cavanilles* 21 (1): 297. 1964.

Comments: This Iberian-Rifean orophilic and acidophilic endemic diploid grass, grow well at high altitude: supra-oromediterranean humid belt in siliceous soils of Rif Mountains: Targuist (M. Tidiquin). Characteristic and bioindicator species of the iberic extra pyrenean and magrebian orophilous class 74. *Junipero sabinae-Pinetea ibericae*.

Cytisus balansae (Boiss.) Ball subsp. ***atlanticus*** (Ball) Cantó & Rivas Mart., stat. nov., hoc loco [●]

Basion.: *Cytisus balansae* var. *atlanticus* Ball in *J. Bot. (London)* 11: 303. 1873.

[*Cytisus balansae* (Boiss.) Ball in *J. Bot. (London)* 11: 303. 1873 subsp. *atlanticus* Ball in *J. Bot. (London)* 11: 303. 1873 ex Cantó & Rivas Mart. in *Lazaroa* 23: 6. 2003 (15-05-2003), in errore; vidi l. c. pg. 6 "subsp. *atlanticus* Ball, non subsp. *atlanticus* (Ball) Ball].

Comments: Oromediterranean subhumid-humid silicicolous ultramafic High Atlasic endemism. Characteristic and bioindicator of the new alliance: *Juniperion africanae*.

Daphne oleoides Schreb. subsp. ***atlantica*** (Maire) Rivas Mart., Molero Mesa, Marfil & G. Benítez, stat. nov., hoc loco [●]

Basion.: *Daphne oleoides* Schreb. var. *atlantica* Maire in *Bull. Soc. Hist. Nat. Afrique N.* 7: 60. 1916.

Comments: *Daphne oleoides* subsp. *atlantica* is a dwarf scrub endemic of upper supra and oromediterranean subhumid-humid bioclimatic belts of Morocco Atlas, Algerian Tell Atlas and Aurès Massif. Is geovicariant taxon of the oromediterranean bétic and penibetic *Daphne oleoides* subsp. *hispanica* (Pau) Rivas-Mart. in *Publ. Inst. Biol. Apl.* 42: 112. 1967. Characteristic and bioindicator of the new alliance: *Juniperion africanae*.

Dracaena ajgal (Benabid & Cuzin) Rivas Mart., Molero Mesa, Marfil & G. Benítez, comb. nova, hoc loco [●]

Basion.: *Dracaena draco* L. subsp. *ajgal* Benabid & Cuzin in *C.R. Acad. Sci. Paris, Life Sciences* 320: 270.1997.

Comments: The exceptional endemic AntiAtlas-Agadir erect tree *Dracaena ajgal*, growing in quartzitic and hard ultramafic cohesive steep rocky slopes, in the limits between the thermomediterranean semiarid *Argania-Olea maroccana* vegetation belt series and the thermomediterranean lower dry *Quercus rotundifolia-Teline segonnei* vegetation belt series (*Quercetea ilicis*) [Fig. 2]. It is geovicariant of the capeverdian endemic thermotropical low semiarid *Dracaena caboverdeana* (Marrero Rodr. & R.S. Almeida) Rivas Mart., Lousâ, J.C. Costa & María C. Duarte in *Int. J. Geobot. Res.* 7: 21. 2017. Cabo Verde, open short tree of the microwoodland savana, characteristic and bioindicator of the capeverdian endemic alliance and class, loc. cit., pgs.: 33 and 44, *Fico gnaphalocarphae-Acacion caboverdeanae (Coccullo pendulae-Sarcostemetetea daltonii)*.

Elymus maroccanus (Font Quer & Pau) Rivas-Mart., Molero Mesa, Marfil & G. Benítez, comb. nova, hoc loco [●]

Basion.: *Agropyrum panormitanum* Parl. var. *maroccanum* Font Quer & Pau, in *Cavanillesia* 4:27. 1931.

Comments: Endemic perennial grass species, growing in meso-supramediterranean subhumid-humid graminaceous grassland mantle forest of Morocco winter rain wet mountains.

Genista pseudoretamoides (Maire) Rivas Mart., Molero Mesa, Marfil & G. Benítez, comb. nova, hoc loco [●]

Basion. & syn. subst.: *Genista retamoides* subsp. *pseudoretamoides* Maire in *Bull. Soc. Hist. Nat. Afrique Nord*, 39: 130. 1940.

Comments: Endemic thermomediterranean-atlántic Morocco, retamoid scrub with pubescent legumes. Characteristic and bioindicator of the alliance *Tetraclinido-Pistacion atlanticae*.

Juniperus africana (Maire) Villar, Types Sols Afr. Nord 1: 91. 1947. [●]

Basion.: *Juniperus thurifera* L. var. *africana* Maire in *Bull. Soc. Hist. Nat. Afr. Nord* 17:125. 1926.

Comments: Strong odoriferous, short to medium long living robust tree (up 17m and 3m diameter), with small triangular pointed smell, leaves scale and persistent oleoresiniferous leaves (Fig. 3). North African endemic (Morocco and Algeria): High and Middle Atlas, Tell Atlas and Aurès Massif, growing in supramediterranean to lower oromediterranean dry to humid bioclimatic belts, climatophilous and edaphoxerophilous mostly on tangel, ranker and rendzinoid shallow soils. Characteristic and bioindicator of the endemic new alliance *Juniperion africanae* (74b. *Juniperetalia africanae*). *Juniperus africana*

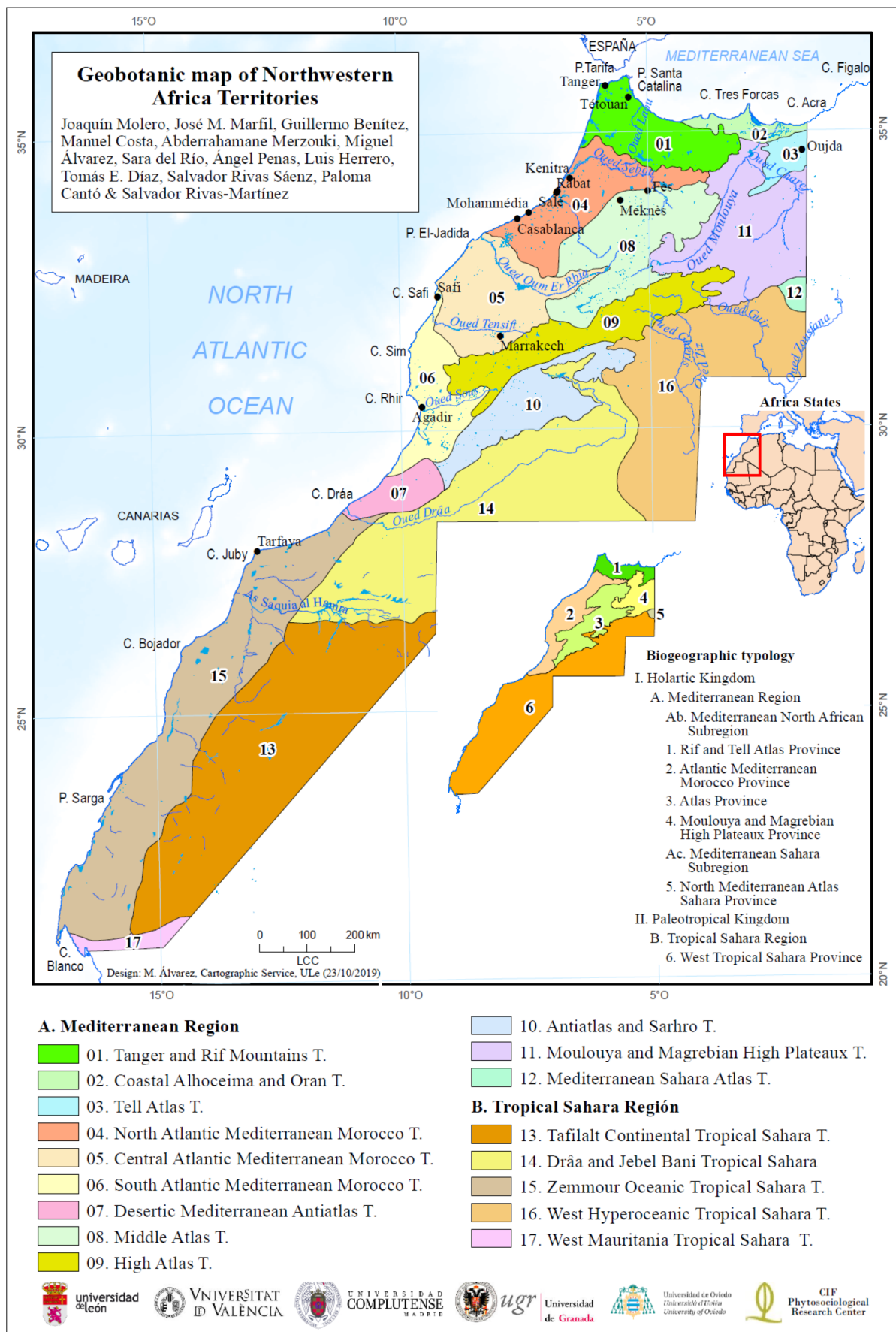


Figure 1. Geobotanic map of Northwestern Africa Territories.
 Figura 1. Mapa geobotánico de los territorios del noroeste de África.



Figure 2. *Dracaena ajgal*, locus classicus, 700 m. Assif Oumarhouz (Jbel Imzi, AntiAtlas. Morocco). Upper thermomediterranean low semiarid: *Davallio canariensis-Dracaenetum ajgal*. Picture: J.M. Marfil, 14-03-2014.

Figura 2. *Dracaena ajgal*, locus classicus, 700 m. Assif Oumarhouz (Jbel Imzi, AntiAtlas. Marruecos). Termomediterráneo superior semiárido inferior: *Davallio canariensis-Dracaenetum ajgal*. Fotografía: J.M. Marfil, 14-03-2014.



Figure 3. *Juniperus africana* edaphoxerophilic (shallow soils) with *Cedrus atlantica* climatophilic (deeps soils calcareous), in upper supramediterranean low humid, prox. Lac Alguelmame Sidi Ali, 1.900m, Moyen Atlas. Morocco. Picture: J. Molero, 29-04-2007.

Figura 3. *Juniperus africana* edafoxerófilo (suelos poco profundos) con *Cedrus atlantica* climatófilo (suelos calcáreos profundos), en supramediterráneo superior húmedo inferior, próx. Lac Alguelmame Sidi Ali, 1900 m, Medio Atlas. Marruecos. Fotografía: J. Molero, 29-04-2007.



Figure 4. *Juniperus badia* and *Quercus rotundifolia* forest. Col Tizi N'Tichka going down to Marrakech (High Atlas), at 1450 m., upper mesomediterranean low subhumid on siliceous soils in an open substitution *Juniperus badia* microforest of the climactic endemic High Atlas Oak, Juniper series: *Luzulo atlanticae-Quercus rotundifoliae sigmetun*. Picture: J. Molero, 21-06-2014.

Figura 4. Bosque de *Quercus rotundifolia* y *Juniperus badia*. Col de Tizi N'Tichka, bajando a Marrakech (Alto Atlas), a 1450 m., mesomediterráneo superior subhúmedo inferior sobre suelos silíceos con microbosque abierto de sustitución de *Juniperus badia*, en la serie climatófila de la encina con enebro endémico magrebi: *Luzulo atlanticae-Quercus rotundifoliae sigmetun* (Alto Atlas). Fotografía: J. Molero, 21-06-2014. .

is a geovicariant species of the West European *Juniperus thurifera* L. (subsp. and var. pl.) and phytosociologically also geovicariant of the hispanic 74.2. *Juniperion thuriferae* Rivas-Mart. in Publ. Inst. Biol. Aplicada (Barcelona) 46: 22. 1969.

This taxon must be added to the rest of Moroccan species of genus *Juniperus*.

Juniperus badia (H. Gay) Rivas Mart., Molero Mesa, Marfil & G. Benitez, comb. nova, hoc loco. [●]

Basion.: *Juniperus oxycedrus* L. var. *badia* H. Gay, in Assoc Franç. Avancem Sci. Compt. Rend. 1889: 501. 1889.

Comments: Thermo-supramediterranean semiarid to humid, strong middle high tree, endemic Mediterranean North African species, growing in open and close *Quercetia ilicis* forest and preforests, with sharp shine acicular leaves, big fruits (>10mm), and pale brown-reddish bark. (fig. 4, 5, 6) Geovicariant of the Iberian endemic juniper tree: *Juniperus oxycedrus* subsp. *lagunae* (Pau ex C. Vicioso) Rivas Mart. in Itinera Geobot. 15(2): 703. 2002.

Juniperus hemisphaerica C. Presl in J. & C. Presl, Delic. Prag.: 142. 1822.

Comments: Dwarf tree, often prostrate, longlived, supra-romediterranean subhumid-humid Atlas of Morocco and Algeria (*Juniperus sabinae-Pinetia ibericae*); is growing also in mediterranean and submediterranean mountains of Spain and Italy (Sicily, Sardinia, Calabria, Southwestern Alps, Sierra Nevada, Central Iberian Mountains, Cantabrian and south Pyrenaican Mountains).

Juniperus macrocarpa Sm. in Sibth. & Sm., Fl. Graec. Prodr. 2: 263. 1816.

Comments: Short but strong robust tree with sharp rigid glaucous acicular leaves and big globose glaucous fruits (>12 mm), growing in thermomediterranean dry to semi-arid deep coastal sand dunes and paleodunes of Tangier and Rif. (*Juniperion turbinatae*).

Juniperus turbinata Guss., Fl. Sicul. Syn. 2: 634. 1844.

[*Juniperus phoenicea* auct Afr. pl., non L., Sp. Pl. 1040. 1753]

Comments: North Africa and South European common small tree growing on shallow rocky soils and coastal sand-dunes in thermo to supramediterranean from upper arid



Figure 5. Branches and fruits of *Juniperus badia* (l.c.)
 Figura 5. Ramas y arcéstidas de *Juniperus badia* (l.c.)

to low subhumid, mostly semicontinental territories (*Quercetea ilicis*).

Luzula mauretanica (Maire & Trabut) Rivas Mart., Molero Mesa, Marfil & G. Benítez, comb. nova, hoc loco [●]

Basion.: *Luzula nodulosa* E. May. var. *mauretanica* Maire & Trab. in Bull. Soc. Hist. Nat. Afrique N. 22: 319. 1931.

Comments: *Luzula mauretanica* (Maire & Trab.) comb. nova, is an algerian-moroccan upper meso-supramediterranean humid shadowy forest endemic species, growing in the "Cedrus atlantica-Quercus tlemcenensis wet forest belt", in the mountains of Rif, Middle Atlas and Tell Atlas. Is geovicariant of the graeco-anatolian *Luzula nodulosa* (Bory & Chaub.) E. May. in Linnaea 22: 410. 1849 (*L. graeca*) having smaller fruits and narrowest leaves.

Pinus maghrebiana (Villar) Rivas Mart., Molero Mesa, Marfil & G. Benítez, comb. nova, hoc loco [●]

Basion.: *Pinus pinaster* Sol. in Aiton var. *maghrebiana* Villar, Types de sols Afrique N.: 84. 1947.

Comments: Is the name species that represent the native Rifean endemic "*Pinus pinaster* taxon grex" of Northwest Africa; geovicariant of the italian and tyrrhenian *Pinus hamiltonii* Ten., Cat. Orto Bot. Napoli 55: 90. 1845 (excl. the European *Pinus mesogeensis* Fieschi & Gausson in Bull. Soc. Hist. Nat. Toulouse 64: 440. 1932). The scales and fruits of the female cones and the trunk cortex are good specie characters.

Pinus mauretanica (Maire & Peyerimh.) Rivas Mart. in Itin. Geobot. 18(2): 487. 2011. [●]

Basion: *Pinus nigra* Arnold var. *mauretanica* Maire & Peyerimh. in Compt. Rend. Hebd. Seances Acad. Ci., 184: 1515. 1927 (*Pinus nigra* Arnold subsp. *mauretanica* (Maire & Peyerimh.) Heywood in Feddes Rept. Spec. Nov. Regni Veg. 66: 150. 1962).



Figure 6. Trunk and bark of *Juniperus badia* (l.c.)
 Figura 5. Tronco y corteza de *Juniperus badia* (l.c.)

Comments: *Pinus mauretanica* is a supramediterranean humid indepent Rif and Tell Atlas, relictual northwest african *Pinus* species; geovicariant of the hispanic *Pinus nigra* Arnold subsp. *latisquama* (Willk.) Rivas Mart. & Heywood in Itin. Geobot. 18(2): 487. 2011. Basion: *Pinus lario* Poirlet var. *latisquama* Willk. in Willk. & Lange, Prodr. Fl. Hispan. 1: 18. 1861.; *Pinus clusiana* sensu auct hisp. pl. non Clemente in Arias & al., Agr. Gen. Herrera: 2: 404. 1818. (*iconotypus*).

Poa rivulorum Maire & Trab. In Bull. Soc. Hist. Nat. Afrique N. 15: 395. 1924. [●]

Comments: Oromediterranean perennial grass of High Atlas, growing on wet relict hystic soils (*Caricetalia nigrae*).

Pterospartum rhiphaeum (Pau & Font Quer) Rivas Mart., Molero Mesa, Marfil & Benítez, comb. nova, hoc loco [●]

Basion. : *Genistella rhiphea* Pau & Font Quer, Iter Marocc. 1927, nº. 277. 1928. in sched.

Comments: Silicicolous crowded rifean endemic scrub species, thermo-mesomediterranean subhumid-humid (61. *Calluno-Ulicetea*). Steams up 2m, with broad undulate wings up 20mm; flowers subsessilis, calyces 6-8 mm, villous with back of standards completment hairy and legumes linear-oblong dense hairy.

Pyrus bourgeana Decne. Jard. Fruit 1: 318, pl. 2. 1871 subsp. *mamorensis* (Trab.) Rivas Mart., Molero Mesa, Marfil & G. Benitez., comb. nova, hoc loco [●]

Basion: *Pyrus mamorensis* Trab. in Bull. Stat. Rech. Forest. N. Afrique 1 (4): 118, pl. 6,7. 1916. [Syn.: *Pyrus mamorensis* Trab. in Bull. Soc. Hist. Nat. Afr. Nord. 7:126. 1916]

Comments: *Pyrus bourgeana* Decne., typus: Sierra de la Cañería, Plasencia, Spain, is synonymus of the West iberian endemic *Pyrus communis* var. *mariana* Willk. in Willk. &



Figure 7. *Pyrus bourgeana* subsp. *mamorensis*. Mamora Forest (Morocco), 150 m, on deep sandy luvic regosol in lower thermomediterranean hyperoceanic dry: *Quercus suber*, natural potential vegetation forest. Picture: J. Molero, 15-05-2018.

Figura 7. *Pyrus bourgeana* subsp. *mamorensis*. Bosque de la Mamora (Marruecos), 150 m, en arenas profundas, regosol lúvico, en termomediterráneo inferior seco hiperoceanico. Fotografía: J. Molero, 15-05-2018.

Lange Prodr. Fl. Hisp. 3(1): 193. 1874. *Pyrus bourgeana* Decne. subsp. *mamorensis* (Trab.) comb. nova, is endemic of the Sebou Basin-Casablanca Sector (Atlantic Mediterranean Morocco Province), and abundant in the thermomediterranean oceanic dry isobioclimate, on deep sandy soil of the *Quercus suber* forest in the <Fôret du Mamora> (Morocco) (Fig. 7). It is geovicariant of the silicicolous south-west iberic luso-extremadurian endemic *Pyrus bourgeana*.

Pyrus gharbensis Trab. in Bull. Soc. Hist. Nat. Afr. Nord. 7: 126. 1916.

Comments: Calcicolous endemic species Algerian-Moroccan, growing in semicontinental mesomediterranean dry and semiarid bioclimatic belts of the Moulouya, West Magrebian High Plateaux and Middle Atlas Sector.

Quercus canariensis Willd. Enum. Pl.: 975. 1809.

[*Quercus mirbeckii* Durieu, Rev. Bot. Recueil Mens. 2: 4261. 1847]

Comments: Tanger-Tetouan Sector and West Rif Mountains biogeographic territory. *Quercus canariensis* woodland also is quite frequent on flat temporihygrophylic deep soils of Tanger-Tetouan Sector: *Rusco hypophylli-Quercetum canariensis gennarietosum diphylloae*. [75.3. *Quercus rotundifoliae-Oleion sylvestris* (Barbero, Quézel & Rivas-Martinez, in Phy-

tocoenologia 19 (3): 316. tb. 3, 1981) Rivas-Martínez, Costa & Izco in Not. Fitosociol. 19 (2): 79. 1986]

Ribes uva-crispa L. subsp. ***atlanticum*** (Ball) Rivas Mart., Molero Mesa Marfil & G. Benítez, comb. nova, hoc loco [●]

Basion.: *Ribes grossularia* L. var. *atlanticum* Ball in J. Linn. Soc. Bot. 16: 449. 1878.

Comments: Magrebian supramediterranean subhumid-humid endemic dwarf scrub species. (*Juniperion africanae*), having very small at hyper-glandular berries.

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