

An updated checklist of the wetland vascular flora from Morocco

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Abstract

This work consists of a synthesis of previous data in order to establish an updated inventory of the wetland flora of Morocco, increased by state of conservation (risk of extinction), geographical distribution and autoecological data. A total of 672 wetland plant species, subspecies, varieties, and forma from Moroccan wetlands are inventoried, corresponding to 91 botanical families. Cyperaceae and Poaceae have the most wetland plant taxa (20.4%), followed by Asteraceae and Fabaceae (13.9%). Of these wetland vascular plant taxa, 16.2% are endemic and 44.8% are on the IUCN Red List. The floristic regions of North Atlantic Morocco and Rif house around 69.6% and 68.5% of wetland vascular flora respectively. The eutrophic wet habitats favour the growth of 32.4% of the taxa inventoried. Three taxa are invasive among some 17 introduced ones.

Keywords: Conservation, Distribution, Endemism, Red List, Wetland Flora.

Introduction

Wetlands are areas where drylands come into contact with water or are water-saturated and are characterized by the presence of water-dependent plant and animal species. The different wetland units pose delimitation problems due to their often seasonal nature and their functional link with hydrological systems, and do not integrate perfectly into aquatic/terrestrial classification systems (Shine & de Klemm, 1999).

Natural and artificial wetlands are currently of great importance. Many studies have examined roles, functions, richness and condition of these ecosystems. They characterize them above all as a support for exceptional biodiversity, because many plant and animal species require this type of habitat for their survival and, in turn, play a vital role in the well-being of the environment by water filtration, river flow regulation and pollution retention (Ennabili & Ater, 1996-1998; Ennabili, 1999; Ennabili & Gharnit, 2003b; Hammada *et al.*, 2004; El

Madihi *et al.*, 2007; Maman & Laurent, 2010).

Part of the extraordinary biodiversity of wetlands is constituted by vascular plants, including all ferns and flowering plants, which have attracted the interest of many studies in the Mediterranean basin (Ennabili *et al.*, 1996-1998; Ennabili, 1999; Ennabili & Gharnit, 2003a-b; Hammada *et al.*, 2004; Ennabili & Ater, 1996-1997-2005; Ennabili & Radoux, 2006; El Madihi *et al.*, 2007; Hammada, 2007; Ghrabi-Gammar *et al.*, 2009; Molina *et al.*, 2009; Bagella & Caria, 2012; Rhazi *et al.*, 2012; Libiad *et al.*, 2012-2015; Douville *et al.*, 2016).

On the northern shore of the Mediterranean basin, the knowledge of the wetland flora is regularly updated (Bagella & Caria, 2012; Douville *et al.*, 2016), and is far from exhaustive way, as evidenced by the new data regularly included in the databases. There is then an obligation of regular identification of vegetation to define unknown plant groups (Douville *et al.*, 2016).

In the south Mediterranean region, knowledge of wetland flora is generally considered to be old, non-updated and unsystematic, given the lack of detailed collections (disturbances, endemism, uses...), and many unexplored areas. Studies should be carried out on the inventory of national wetland ecosystems, including identification and mapping of hygrophytes to update existing data, assess their conservation status, and propose measures for their conservation (Ghrabi-Gammar *et al.*, 2009).

Morocco is the country with the richest southern region of the Mediterranean in terms of biodiversity, due to its different ecological systems, ranging from the humid mountains to the Saharan environment (Benabid, 2000; HCP, 2006; Benzyane *et al.*, 2010). Specific work on the wetland vascular flora focused on many aspects, namely phytodiversity, ecology, biomass production, retention of macroelements, proposals for integration in the management of surface water, and wastewater treatment (Ennabili, 1999; Ennabili *et al.*, 1996-1998-2000; Ennabili & Gharnit, 2003a-b; Bennig, 2004; Hammada *et al.*, 2004; Ennabili & Ater, 1996-1997-2005; Ennabili & Radoux, 2006; Hammada, 2007; Molina *et al.*, 2009; Ezzahri *et al.*, 2001-2010; Rhazi *et al.*, 2012,; Khabbach, 2013; Libiad, 2013;

Libiad *et al.*, 2012-2015; El Madihi *et al.*, 2017; Khabbach *et al.*, 2019).

Under the Ramsar Convention's definition of wetlands and with regard to the moisture tolerance, the wetland plants include three groups: (i) hygrophilous taxa, growing and thriving in wet habitats, (ii) semi-hygrophilous taxa, thriving at a time in strictly wet and xeric habitats, or periodically colonizing wetlands, and (iii) non-hygrophilous or opportunistic taxa, accidentally found in wetlands or colonizing them in post-submersion periods (Ennabili & Ater 1996, Ennabili 1999, Ennabili & Gharnit, 2003b; Hammada *et al.*, 2004,; Hammada, 2007; Libiad *et al.*, 2012; Libiad, 2013; Fennane *et al.*, 1999-2007-2014).

“Hygrophyte” and “hygrophilous” terms describe plants living (preferring or requiring) wet locations, where water abounds relatively either in the soil or in the atmosphere and this obviously during the active period of its growing cycle. According to the current state of the knowledge, together with of data on geographical distribution, endemism, conservation and autoecology, this work aims to develop a taxonomic inventory of the vascular flora from the Moroccan wetlands, thriving in variable wet habitats, including land-water margins, shallow waters, and temporary or intermittently wet lands and substrates.

Methodology

This work consisted of an exhaustive consultation of works on wetland flora, conducted in a chronological publication for more than 20 years. These works were done in varying contexts and involved scales ranging from one sub-locality (Ennabili & Gharnit, 2003a; Libiad *et al.*, 2011; Khabbach *et al.*, 2011, 2019) to more than one region (Ennabili *et al.*, 1996; Ennabili & Ater, 1996; Valdés *et al.*, 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004), or even the whole country (Hammada *et al.*, 2004; Fennane *et al.*, 1999-2007-2014); others have targeted a

category of wetlands such as temporary ponds (Molina *et al.*, 2009; Rhazi *et al.*, 2012; El Madihi *et al.*, 2017). Additional data from field prospecting not having been published were also taken into account in this work under the mention “Unpublished data”.

Verification of herbaria associated with these studies is not the object of this work, seeing the complexity of this task: multitude of herbaria involving several institutions and/or countries, insufficient upstream traceability of exsiccata, conservation problem, modest means of

research... Instead, the emphasis will be on updating taxonomy, geographical distribution, conservation status, and autoecology of the vascular wetland flora from Morocco based on studies published over the past two decades. The nomenclature and the status of wetland vascular plants were updated, and reviewed critically and comparatively according to APB (2020) and IUCN (2017) respectively.

The floristic distribution adopted involves eleven Moroccan floristic divisions (Figure 1). The taxa endemism concerns the proximal territories of Morocco (MAR), namely Algeria (DZA), Canary Islands (ESP.CN), Iberian Peninsula (ESP.PRT), Mauritania (MRT), and

Tunisia (TUN). The status of taxa included in the IUCN Red List is identified on the basis of the following types of threat: Critically endangered (CE), Endangered (E), Near threatened (Nt), Vulnerable (V), Least concern (Lc) and Data Deficient (Dd). As concerns the population trend of taxa, four categories are defined depending on their conservation status: increasing (I), stable (S), decreasing (D), and unknown (U) (IUCN, 2017).

Where appropriate, information on auto-ecology, habitat and origin of taxa are given, and the following abbreviations were used: eutrophic (Eu), mesohalophilic (Hm), halophilic (Ha), introduced (In), invasive (Iv), tolerating polluted sites (Pl), sciaphile (Sc), and naturalized (N) taxa.

Results

The taxa are numbered consecutively and presented as follows: species, subspecies, variety or forma [synonym (s)]; geographical distribution; endemism; the IUCN red list status; auto-ecology and habitat, depending on the data availability. The data sources are grouped subsequently after each botanical family to make the text more readable.

ISOETALES

Isoetaceae

(Fennane et al., 1999; Molina et al., 2009; Valdés et al., 2002; Chambouleyron, 2012; Rhazi et al., 2012; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020).

1. *Isoetes histrix* Durieu ex Bory; HA-Mam-Man-R; Eu.
2. *Isoetes lacustris* L. [*I. setacea* Lam.]; Mam-R; Lc-U; Eu.
 - *Isoetes longissima* Bory & Durieu; AA-HA-MA-Mam-Man-Op-R; E-D; Eu. It includes:
3. *I. longissima* Bory & Durieu subsp. *longissima* [*I. velata* subsp. *velata*]; AA-HA-MA-Mam-Man-Op-R; E-D; Eu.
4. *I. longissima* subsp. *adspersa* (A. Braun) Troia & Greuter [*I. velata* subsp.

adspersa (A. Braun) Batt. & Trab.]; Man; Eu.

EQUISETALES

Equisetaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Hammada, 2007; Libiad, 2013; Valdés, 2013; Libiad et al., 2015; IUCN, 2017; APB, 2020; Unpublished data).

5. *Equisetum ramosissimum* Desf.; All Morocco; Eu.
6. *Equisetum telmateia* Ehrh. [*E. maximum* auct.]; Man-R; Lc-I; Eu-Sc.

OPHIOGLOSSALES

Ophioglossaceae

(Fennane et al., 1999; Valdés et al., 2002; APB, 2020).

7. *Botrychium lunaria* (L.) Sw.; HA-R.
8. *Ophioglossum vulgatum* L.; AA-HA-LM-MA-R.

POLYPODIALES

Aspleniaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Carine et al., 2006; Molero Briones & Montserrat Martí, 2006; Valdés, 2013; APB, 2020; Unpublished data).



Figure 1. Floristic divisions of Morocco. Caption: AA, Anti Atlas; As, Saharan Atlas; HA, High Atlas; LM, Mediterranean Coastline; MA, Middle Atlas; Mam, Middle Atlantic Morocco; Man, North Atlantic Morocco; Ms, Saharan Morocco; Om, Mountains of the Eastern Morocco; Op, Plateaus of the Eastern Morocco; R, Rif. Modified source: Fennane *et al.* (1999).

9. *Asplenium adiantum-nigrum* L.; AA-HA-LM-MA-Man-Ms-Op-R; Sc.
10. *Asplenium ceterach* L.; HA-LM-MA-Man-Om-Op-R.
11. *Asplenium hemionitis* L.; LM-Man-Op-R; Sc.
12. *Asplenium sagittatum* (DC.) Bange; R.
13. *Asplenium scolopendrium* L. [*Phyllitis scolopendrium* (L.) Newman]; HA-MA-Man-Op-R; Sc.
14. *Asplenium trichomanes* subsp. *coriaceifolium* K. Rasbach, Rasbach & al.; Om; Sc.
15. *Asplenium trichomanes* subsp. *quadrivalens* D. E. Mey.; LM-MA-Man-Om-Op-R; Sc.

Blechnaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; APB, 2020).

16. *Blechnum spicant* (L.) Roth; Man-R; Sc.

Davalliaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; APB, 2020).

17. *Davallia canariensis* (L.) Sm.; LM-Man-Op-R.

Dennstaedtiaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada, 2007; APB, 2020; Unpublished data).

18. *Pteridium aquilinum* (L.) Kuhn; LM-MA-Man-Op-R; Sc.

Dryopteridaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Carine et al., 2006; Valdés, 2013; APB, 2020).

19. *Dryopteris affinis* (Lowe) Fraser-Jenk; R; Lc-S.
20. *Dryopteris filix-mas* (L.) Schott [*D. f. - m. var. crenata* (Milde) Hayeck]; HA-R; Sc.

Osmundaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Chambouleyron, 2012; IUCN, 2017; APB, 2020).

21. *Osmunda regalis* L. [*O. r. var. plumieri*]; Man-R; Lc-U (Figure 2).



Figure 2. *Osmunda regalis* L., diffuse water-source, Khmiss Sahel-Larache (1997).

Pteridaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al.,

2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Valdés, 2013; IUCN, 2017; APB, 2020).

22. *Adiantum capillus-veneris* L.; All Morocco; Lc-S; Sc.
23. *Pteris vittata* L. [*P. longifolia* L.]; LM-Man-R; Lc-I.

Thelypteridaceae

(Fennane et al., 1999; Valdés et al., 2002; IUCN, 2017; APB, 2020).

24. *Cyclosorus interruptus* (Willd.) H. Itô [*Thelypteris interrupta* (Willd.) K. Iwats.]; Man; Lc-U; Eu.
25. *Thelypteris confluens* (Thunb.) C. V. Morton [*T. palustris* (A. Gray) Schott]; Man; Lc-D; Eu.

Woodsiaceae

(Fennane et al., 1999; Valdés et al., 2002; APB, 2020).

26. *Athyrium filix-femina* (L.) Roth; MA-Man-R.

SALVINIALES**Marsileaceae**

(Fennane et al., 1999; Valdés et al., 2002; Hammada, 2007; Molina et al., 2009; Rhazi et al., 2012; El Madihi et al., 2017; IUCN, 2017; APB, 2020).

27. *Marsilea minuta* L.; Man; Lc-S.
28. *Marsilea strigosa* Willd. [*M. pubescens* Ten]; AA-HA-MA-Mam-Man; Eu-Hm.
29. *Pilularia minuta* Durieu; Mam-Man-R; E-D; Eu.

Salviniaceae

(Fennane et al., 1999; Hammada, 2007; APB, 2020).

30. *Azolla filiculoides* Lam.; Man; In-N-Eu.

LAURALES**Lauraceae**

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; APB, 2020).

31. *Laurus nobilis* L.; Man; R.

NYMPHAEALES

Nymphaeaceae

(Ennabili et al., 1996; Ennabili, 1999; Fennane et al., 1999; Ennabili & Gharnit, 2003b; Hammada, 2007; APB, 2020).

32. *Nymphaea alba* L. [*N. a.* var. *minoriflora* (Borb.) Asch. & Gr.]; Man-R; Eu (Figure 3).



Figure 3. *Nymphaea* marsh, Boucharene-Larache (1996). Close-up view of *Nymphaea alba* L. (upper-left).

CERATOPHYLLALES

Ceratophyllaceae

(Fennane et al., 1999; Valdés et al., 2002; IUCN, 2017; APB, 2020).

33. *Ceratophyllum demersum* L.; HA-MA-Mam-Man-R; Lc-S.
 34. *Ceratophyllum submersum* L.; Mam-Man; Lc-S; Eu.

RANUNCULALES

Ranunculaceae

(Ennabili, 1999; Fennane et al., 1999; Ennabili et al., 2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Molero Briones & Montserrat Martí, 2006; Euro+Med, 2006; Hammada, 2007; Molina et al., 2009; Chambouleyron, 2012; Rhazi et al., 2012; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

35. *Aconitum vulparia* subsp. *neapolitanum* (Ten.) Muñoz Garm. ex Molero & C. Blanché [*A. lycoctonum* subsp. *neapolitanum* (Ten.) Nyman, *A. lycoctonum* var. *atlanticum* (Coss.) Batt.]; AA-HA-MA.

36. *Aquilegia vulgaris* L.; HA-MA-R.
 - *Ficaria verna* Huds. [*Ranunculus ficaria* L.]; MA-Man-Op-R. It includes:
 37. *F. verna* subsp. *calthifolia* (Rchb.) Nyman [*Ranunculus ficaria* subsp. *nudicaulis* (A. Kern.) Rouy & Foucaud]; R.
 38. *Myosurus minimus* L.; HA-MA; Eu.
 39. *Ranunculus acris* L.; R; Lc-S.
 40. *Ranunculus aquatilis* L.; HA-MA-Mam-Man-R; Lc-S; Eu-Hm.
 41. *Ranunculus arvensis* L.; MA-Man-Op-R.
 42. *Ranunculus batrachioides* Pomel; HA-MA-Op; Nt-D; Eu.
 43. *Ranunculus bulbosus* L.; AA-HA-LM-MA-Mam-Man-Op-R; Eu.
 44. *Ranunculus circinatus* Sibth.; MA.
 45. *Ranunculus dyris* (Maire) H. Lindb.; AA-HA; MAR; Lc-U.
 46. *Ranunculus flammula* L. [*R. f.* var. *angustifolius* Wallr.]; Man-R; Lc-S; Eu.
 47. *Ranunculus hederaceus* L.; Man; Lc-U.
 48. *Ranunculus lateriflorus* DC; HA-LM-R; Lc-S; Eu.
 49. *Ranunculus macrophyllus* Desf.; LM-Mam-Man-Om-Op-R; Eu.
 50. *Ranunculus muricatus* L.; HA-LM-MA-Mam-Man-Om-Op-R; Eu.
 51. *Ranunculus ophioglossifolius* Vill.; HA-LM-MA-Mam-Man-Om-R; Lc-D; Eu.
 52. *Ranunculus peltatus* subsp. *baudotii* (Gren. & Godr.) C. D. K. Cook [*R. baudotii* Gren. & Godr.]; Mam-Man; Lc-S; Eu.
 53. *Ranunculus peltatus* Schrank subsp. *peltatus*; R.
 54. *Ranunculus peltatus* subsp. *saniculifolius* (Viv.) C. D. K. Cook [*R. saniculifolius* Viv.]; Man-R; Eu-Hm.
 55. *Ranunculus peltatus* subsp. *sphaerospermus* (Boiss. & Blanche) Meikle [*R. sphaerospermus* Boiss. & Blanche]; R; Lc-S; Hm.
 56. *Ranunculus penicillatus* (Dumort.) Bab.; HA-Man-R; Lc-S.

57. *Ranunculus repens* L.; HA-MA-Op-R; Eu.
58. *Ranunculus sardous* Crantz; LM-Mam-Man-Om-Op; Eu.
59. *Ranunculus sceleratus* L.; MA-Man-R; Lc-U; Eu.
60. *Ranunculus trichophyllus* Chaix; AA-HA-MA-Mam-Man-Ms-Om-Op-R; Lc-S; Eu.
61. *Ranunculus trilobus* Desf.; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Eu.
62. *Ranunculus tripartitus* DC.; AA-Man-R; Eu.
63. *Thalictrum speciosissimum* L.; HA-MA-Man-R; MAR-DZA-ESP.PRT.

CUCURBITALES

Coriariaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ennabili & Radoux, 2006; Khabbach, 2013; Valdés, 2013; APB, 2020; Unpublished data).

64. *Coriaria myrtifolia* L.; LM-Man-Op-R.

FAGALES

Betulaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Valdés, 2013; IUCN, 2017; APB, 2020).

65. *Alnus glutinosa* (L.) Gaertn. [*A. g.* subsp. *glutinosa*]; LM-Man-R; Lc-S.
66. *Betula pendula* subsp. *fontqueri* (Rothm.) Moreno & Peinado [*B. fontqueri* Rothm.]; LM-R; MAR-ESP.PRT; E-U.

MALVALES

Malvaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006-; Libiad, 2013; Valdés, 2013; APB, 2020).

67. *Malva maroccana* (Batt. & Trab.) Verloove & Lambinon [*Lavatera maroccana* (Batt. & Trab.) Maire]; Mam-Man-Op; MAR-ESP.PRT.
68. *Malva olbia* (L.) Alef. [*Lavatera olbia* L.]; LM-MA-Mam-Man-Om-Op-R.

69. *Malva trimestris* (L.) Salisb. [*Lavatera trimestris* L.]; LM-MA-Man-Op-R.
70. *Modiola caroliniana* (L.) G. Don; R; In.

CARYOPHYLLALES

Aizoaceae

(Ozenda, 2004; APB, 2020).

71. *Mesembryanthemum cryptanthum* Hook. f.; Ms.

Amaranthaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Ennabili et al., 2000; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada et al., 2004; Euro+Med, 2006; Hammada, 2007; APB, 2020; Unpublished data).

72. *Arthrocaulon macrostachyum* (Moric.) Piirainen & G. Kadereit [*Arthrocnemum macrostachyum* (Moric.) K. Koch, *A. macrostachyum* Ung. Sternb.]; LM-Mam-Man-Ms-Op-R; Ha.
73. *Atriplex chenopodioides* Batt.; Man-R; MAR-DZA-ESP.PRT; Ha.
74. *Caroxylon gaetulum* (Maire) Akhani & Roalson; Ms; Ha.
75. *Halimione portulacoides* (L.) Aellen [*Atriplex portulacoides* L.]; LM-Mam-Man-Ms-Op-R; Eu-Ha.
76. *Halocnemum strobilaceum* (Pall.) M. Bieb; Ms-Op; Ha.
77. *Halopeplis amplexicaulis* (Vahl) Ung. -Sternb. ex Ces., Pass. & Gibelli; Mam-Man-Ms; Ha.
78. *Salicornia arabica* L.; LM-Mam-Man-Ms-Op-R; Ha
79. *Salicornia europaea* L.; Mam-Man; Eu-Ha.
80. *Sarcocornia fruticosa* (L.) A. J. Scott [*Arthrocnemum fruticosum* (L.) Moq., *Salicornia fruticosa* (L.) L.]; LM-Mam-Man-Ms-Op-R; Ha.
- *Sarcocornia perennis* (Mill.) A. J. Scott [*Arthrocnemum perenne* (Mill.) Moss ex Fourc., *Salicornia perennis* Mill.]; LM-Mam-Man-Ms-R; Eu-Ha. It includes:
81. *S. perennis* (Mill.) A. J. Scott var. *perennis*; LM-Mam-Man-Ms-R; Eu-Ha.

82. *Suaeda maritima* (L.) Dumort [S. m. var. *perennans* Maire, S. m. subsp. *pannonica* (G. Beck) Soó ex P. W. Ball, S. *albescens* Lázaro Ibiza, S. *salsa* (L.) Pall.]; LM-Mam-Man-Ms-Op-R; Ha.
83. *Suaeda vermiculata* Forssk. ex J. F. Gmel. [S. *mollis* (Desf.) Delile]; Ms; Eu-Ha.

Caryophyllaceae

(Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada et al., 2004; Molero Briones & Montserrat Martí, 2006; Euro+Med, 2006; Hammada, 2007; Molina et al., 2009; Rhazi et al., 2012; Khabbach, 2013; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

84. *Cerastium atlanticum* Durieu; AA-HA-LM-MA-Mam-Man-R; MAR-DZA-TUN.
85. *Cerastium cerastoides* (L.) Britton; HA.
- *Cerastium diffusum* Pers.; AA-HA-MA-Man-Op-R. It includes:
86. *C. diffusum* Pers. subsp. *diffusum*; AA-HA-MA-Man-Op-R.
- *Cerastium fontanum* Baumg.; R; Eu. It includes:
87. *C. fontanum* Baumg. subsp. *fontanum*; R.
- *Corrigiola litoralis* L.; MA-Mam-Man-R; Lc-S; Eu. It includes:
88. *C. litoralis* subsp. *litoralis*; AA-HA-MA-Mam-Man-Ms-R.
89. *Illecebrum verticillatum* L.; Mam-Man-R; Eu (Figure 4).
90. *Loeflingia hispanica* L. subsp. *hispanica*; All Morocco.
91. *Polycarpon tetraphyllum* (L.) L.; LM-MA-Mam-Man-Om-Op-R.
92. *Sagina apetala* Ard.; LM-MA-Man-Op-R.
93. *Sagina procumbens* L. subsp. *procumbens*; HA-Man-R.
94. *Sagina procumbens* subsp. *atlasica* Dobignard; AA-HA; MAR.
95. *Sagina sabuletorum* Lange; AA-HA-LM-MA-Man-Op-R; MAR-ESP.PRT.



Figure 4. *Illecebrum verticillatum* L., peatland, Khmiss Sahel-Larache (1997).

96. *Sagina saginoides* (L.) H. Karst.; HA-Man-R.
97. *Silene laeta* (Aiton) A. Braun; Man-R
98. *Spergula echinosperma* (Celak.) E. H. L. Krause [*Spergularia echinosperma* (Celak.) Asch. & Graebn.]; MA.
99. *Spergula tangerina* (P. Monnier) G. López [S. *tangerina* P. Monnier]; LM-Man-Op-R; Ha.
100. *Spergularia embergeri* P. Monnier; LM-Om-Op-R; MAR; V-D; Ha.
101. *Spergularia flaccida* (Madden) I. M. Turner [*Spergula fallax* (Lowe) E. H. L. Krause]; AA-HA-LM-Mam-Ms-R.
102. *Spergularia media* subsp. *sauvagei* (P. Monnier) Lambinon & Dobignard [S. *maritima* subsp. *sauvagei* P. Monnier]; LM-Mam-Op-R; MAR-DZA-TUN.
103. *Stellaria alsine* Grimm.; AA-HA-Man-R.

Plumbaginaceae

(Fennane et al., 1999; Valdés et al., 2002; Hammada et al., 2004; Ozenda, 2004; Euro+Med, 2006; Hammada, 2007; Rankou et al., 2013; IUCN, 2017; APB, 2020).

104. *Limonium auriculae-sifolium* (Pourr.) Druce; Man; Eu-Ha.
105. *Limonium duriaei* (Girard) Kuntze; LM-Ms-Op; MAR-DZA; V-D; Eu-Ha.
106. *Limonium narbonense* Mill.; LM-Man-Op-R; Eu-Hm.
107. *Limonium ornatum* (Ball) Kuntze; HA-Mam; MAR; V-U; Ha.

108. *Saharanthus ifniensis* (Caball.) M. B. Crespo & Lledó [*Limoniastrum ifniense* (Caball.) Font Quer]; Ms; MAR-DZA-MRT; Ha.

Polygonaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Ennabili et al., 2000; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada et al., 2004; Molero Briones & Montserrat Martí, 2006; Euro+Med, 2006; Hammada, 2007; Molina et al., 2009; Khabbach et al., 2011; Chambouleyron, 2012; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; Libiad et al., 2015; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

109. *Persicaria amphibia* (L.) Delarbre [*P. amphibia* (L.) S. F. Gray]; MA-Man-R; Lc-U.
110. *Persicaria decipiens* (R. Br.) K. L. Wilson [*P. salicifolia* (Brouss. ex Willd.) Assenov, *P. s.* var. *salicifolia*, *Polygonum salicifolium* Willd.]; AA-HA-LM-Mam-Man-Ms-R.
111. *Persicaria hydropiper* (L.) Delarbre [*P. hydropiper* (L.) Spach, *Polygonum hydropiper* L.]; MA-Man-R; Lc-S.
112. *Persicaria lapathifolia* (L.) Delarbre [*P. lapathifolia* (L.) S. F. Gray, *Polygonum lapathifolium* L.]; HA-LM-MA-Mam-Man-Op-R; Lc-U; Eu-Hm-Pl.
113. *Persicaria maculosa* Gray [*Polygonum persicaria* L.]; HA-MA-Mam-Man-R; Lc-U; Eu.
114. *Persicaria senegalensis* (Meisn.) Soják; Man; Lc-U.
115. *Rumex acetosa* L. [*R. acetosa* var. *atlantis* Maire]; AA-HA-LM-MA-Man-Om-Op-R.
116. *Rumex algeriensis* Barratte & Murb.; R; MAR-DZA; E-U.
117. *Rumex conglomeratus* Murray; HA-LM-MA-Mam-Man-Om-Op-R; Eu.
118. *Rumex crispus* L.; HA-LM-MA-Mam-Man-Om-Op-R.
119. *Rumex ginii* Jahand. & Maire; HA-MA; MAR; Nt-U.
120. *Rumex obtusifolius* L.; MA-Man-R.
121. *Rumex palustris* Sm; MA-Man-R; Lc-S; Eu.
- *Rumex pulcher* L.; HA-LM-MA-Mam-Man-Om-Op-R; Eu. It includes:

122. *R. pulcher* subsp. *anodontus* (Hauskn.) Rech. f.; Man.

Portulacaceae

(Fennane et al., 1999; Valdés et al., 2002; Valdés, 2013; IUCN, 2017; APB, 2020).

123. *Montia fontana* subsp. *amporitana* Sennen; AA-HA-LM-MA-Mam-Man-Op-R; Lc-S.
124. *Montia fontana* subsp. *chondrosperma* (Fenzl) Walters [*M. minor* C.C. Gmel.]; HA-Op-R.

Tamaricaceae

(Ennabili, 1999; Fennane et al., 1999; Ennabili et al., 1996-2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Ennabili & Radoux, 2006; Hammada, 2007; Khabbach, 2013; Libiad, 2013; Libiad et al., 2012-2015; IUCN, 2017; APB, 2020; Unpublished data).

125. *Tamarix africana* Poir. [*T. getula* Batt., *T. africana* L.]; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Hm.
126. *Tamarix amplexicaulis* Ehrenb. [*T. pauciovulata* J. Gay ex Batt., *T. balansae* J. Gay ex Batt.]; Man-Ms-R; Ha.
127. *Tamarix boveana* Bunge; LM-Ms-Op; V-D; Ha.
128. *Tamarix canariensis* Willd. [*T. gallica* subsp. *leucocharis* Maire, *T. g.* subsp. *epidiscina* var. *submutica* Maire & Trabut, *T. g.* subsp. *epidiscina* var. *lagunae* (A. Caballero) Maire, *T. weyerlii* Pau]; LM-Mam-Man-Ms-Op-R; Lc-U; Hm.
129. *Tamarix gallica* L.; LM-MA-Man-Ms-Om-Op-R; Hm.

BRASSICALES

Brassicaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006-; Hammada, 2007; Molina et al., 2009; Rankou et al., 2013; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

130. *Arabis hirsuta* (L.) Scop.; MA.
131. *Barbarea intermedia* Boreau; MA-Man-Op-R.

132. *Cardamine pratensis* subsp. *atlantica* (Emb & Maire) Greuter & Burdet; HA; MAR; V-S.
133. *Cochlearia glastifolia* L.; MA; MAR-ESP.PRT.
134. *Lepidium coronopus* (L.) Al-Shehbaz [*Coronopus squamatus* (Forssk.) Asch.]; AA-LM-MA-Mam-Man-Ms-Om-Op-R; Eu.
135. *Lepidium lepidioides* (Coss. & Durieu) Al-Shehbaz [*Coronopus lepidioides* (Coss. & Durieu) Kuntze]; Ms.
136. *Lepidium violaceum* (Munby) Al-Shehbaz [*Coronopus violaceus* (Munby) Kuntze]; MA-Man; MAR-DZA; V-D; Eu.
137. *Nasturtium africanum* Braun-Blanq. subsp. *africanum*; MA-Man; MAR; V-D.
138. *Roripella atlantica* (Ball) Greuter & Burdet; AA-HA; MAR.
- *Rorippa africana* (Braun-Blanq.) Maire [*Nasturtium africanum* Braun-Blanq.]; MA-Man; MAR; E-D; Eu. It includes:
139. *R. africana* subsp. *mesatlantica* Litard. & Maire [*Nasturtium africanum* subsp. *mesatlanticum* (Litard. & Maire) Greuter & Burdet]; MA-Man; MAR.
140. *Rorippa hayanica* Maire; MA; MAR; V-D.
141. *Rorippa nasturtium-aquaticum* (L.) Hayek [*Nasturtium officinale* R. Br.]; All Morocco; Lc-U; Eu.
142. *Schouwia purpurea* (Forssk.) Schweinf.; Ms.
143. *Sisymbrella aspera* (L.) Spach subsp. *aspera* [*S. a.* subsp. *boissieri* (Coss.) Heywood]; HA-MA-Man-R; MAR-ESP.PRT.
144. *Sisymbrella aspera* subsp. *munbyana* (Boiss. & Reut.) Greuter & Burdet; MA-Om-R; MAR-DZA; V-U.

ERICALES

Ericaceae

(Fennane et al., 1999; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; APB, 2020).

145. *Erica carnea* subsp. *occidentalis* (Benth.) Lainz [*E. erigena* R. Ross]; R.
146. *Erica ciliaris* L.; Man-R; Eu (Figure 5).



Figure 5. *Sphagnum* and *Erica* peatland, Khmiss Sahel-Larache (1997). Close-up view of *Erica ciliaris* L. (upper-left).

147. *Erica terminalis* Salisb.; R.

Primulaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada, 2007; Chambouleyron, 2012; Valdés, 2013; IUCN, 2017; APB, 2020).

148. *Lysimachia arvensis* f. *parviflora* (Hoffmanns. & Link) B. Bock [*Anagallis arvensis* subsp. *parviflora* (Hoffmanns. & Link) Arcang.]; As-HA-MA-Mam-Man-Op-R.
149. *Lysimachia ephemeron* L.; MA.
150. *Lysimachia tenella* L. [*Anagallis tenella* (L.) L.]; LM-MA-Man-Om-Op-R.
151. *Lysimachia tyrrenia* U. Manns & Anderb. [*Anagallis crassifolia* Thore]; Man-R; Nt-D (Figure 6).
152. *Primula acaulis* subsp. *atlantica* (Maire & Wilczek) Greuter & Burdet; MA-Man-Op-R; MAR-DZA.

Theophrastaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Hammada, 2007; Libiad et al., 2012; Libiad, 2013; IUCN, 2017; APB, 2020; Unpublished data).

153. *Samolus valerandi* L.; All Morocco; Lc-U; Hm.



Figure 6. *Lysimachia tyrrhenia* U. Manns & Anderb., permanent stream, Khmiss Sahel-Larache (1997).

FABALES

Fabaceae

(Ennabili & Ater, 1996; El Ennabili, 1999; Ennabili et al., 2000; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006-; Fennane et al., 2007; Hammada, 2007; Molina et al., 2009; Chambouleyron, 2012; Rhazi et al., 2012; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

154. *Astragalus arpilobus* subsp. *hauarensis* (Boiss.) Podlech [*A. hauarensis* Boiss.]; Ms.
155. *Cullen americanum* (L.) Rydb.; LM-Mam-Man-Op-R; Lc-U.
156. *Cullen plicatum* (Delile) C. H. Stirt.; Ms.
157. *Dorycnium rectum* (L.) Ser.; HA-LM-MA-Mam-Man-Om-Op-R.
158. *Galega officinalis* L.; R.
159. *Genista ancistrocarpa* Spach; Man-R; MAR-ESP.PRT; E-D; Eu.
160. *Genista carpetana* subsp. *nociva* (Pau & Font Quer) C. Vicioso & M. Laínz; R; MAR.
161. *Indigofera articulata* Gouan; Man
162. *Lathyrus angulatus* L.; AA-HA-LM-MA-Mam-Man-Op-R.
163. *Lathyrus pratensis* L.; HA-MA-Man-Op.
164. *Lotus angustissimus* L.; Man-R.
165. *Lotus benoistii* (Maire) Lassen; Mam-Man; MAR; CE-D.
166. *Lotus conimbricensis* Brot; HA-MA-Mam-Man-Op-R; Eu.
167. *Lotus corniculatus* L.; AA-HA-LM-MA-Mam-Man-Ms-Op-R.
168. *Lotus palustris* Willd.; HA-LM-MA-Mam-Man-Op-R; Lc-U.
169. *Lotus parviflorus* Desf. [*L. hispidus* DC.]; LM-Mam-Man-Op-R; Eu.
170. *Lotus pedunculatus* Cav.; LM-MA-Mam-Man-Op-R.
171. *Lotus subbiflorus* Lag. [*L. hispidus* Desf.]; Man-Op-R.
172. *Melilotus elegans* Salzm. ex Ser.; MA-R.
173. *Melilotus indicus* (L.) All.; MA-Mam-Man-R; Ha.
174. *Ornithopus sativus* Brot.; Mam-Man.
175. *Tetragonolobus maritimus* (L.) Roth; AA-HA-MA-Mam-Ms-R; Lc-U.
176. *Trifolium campestre* Schreb. [*T. ciliatum* Poir., *Chrysaspis campestris* Desv]; LM-MA-Man-Om-Op-R.
177. *Trifolium cernuum* Brot.; HA-Man-R.
178. *Trifolium cherleri* L.; LM-Man-R.
179. *Trifolium dubium* Sibth.; AA-HA-LM-MA-Man-R.
180. *Trifolium fragiferum* L.; HA-LM-MA-Mam-Man-Om-Op-R.
181. *Trifolium gemellum* subsp. *atlanticum* (Ball) Dobignard; HA-MA-Op-R; MAR-DZA-ESP.PRT.
182. *Trifolium glomeratum* L.; LM-MA-Man-Om-Op-R.
183. *Trifolium humile* Ball; HA-MA-R; MAR.
184. *Trifolium isthmocarpum* Brot.; LM-MA-Mam-Man-Op-R
185. *Trifolium michelianum* Savi; MA-Mam-Man-R; Eu.
186. *Trifolium micranthum* Viv.; MA-Mam-Man-R; Eu.
187. *Trifolium obscurum* Savi; LM-MA-Man-Op-R; Lc-S.
188. *Trifolium ornithopodioides* L.; LM-MA-Mam-Man-R.
189. *Trifolium pallidum* Waldst. & Kit.; Man-R.
190. *Trifolium repens* L.; HA-LM-MA-Mam-Man-Op-R.
191. *Trifolium resupinatum* L.; LM-Man-R.

192. *Trifolium retusum* L.; MA.
193. *Trifolium scabrum* L.; LM-MA-Man-Om-Op-R; Lc-S.
194. *Trifolium spumosum* L.; LM-Mam-Man-Om-Op-R.
195. *Trifolium strictum* L.; HA-LM-Man-R.
196. *Trifolium tomentosum* L.; AA-HA-LM-MA-Mam-Man-Om-Op-R.

SAXIFRAGALES

Crassulaceae

(Fennane et al., 1999; Valdés et al., 2002; Euro+Med, 2006-; Molina et al., 2009; El Madihi et al., 2017; APB, 2020).

197. *Crassula vaillantii* (Willd.) Roth.; AA-HA-MA-Mam-Man.
198. *Monanthes atlantica* Ball [*Sedum surculosum* Coss.]; AA-HA; MAR.
199. *Sedum lagascae* Pau [*S. maireanum* Sennen]; R; MAR-DZA-ESP.PRT.
200. *Sedum melanantherum* DC.; HA; MAR-ESP.PRT.
201. *Sedum nevadense* Coss.; AA-HA-MA-Man.

Haloragaceae

(Valdés et al., 2002; Fennane et al., 2007; Hammada, 2007; Rhazi et al., 2012; Rankou et al., 2013; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020).

202. *Myriophyllum alterniflorum* DC.; Mam-Man-R; Lc-U; Eu.
203. *Myriophyllum spicatum* L.; AA-HA-MA-Mam-Man-Ms-R; Lc-U; Eu.
204. *Myriophyllum verticillatum* L.; MA-Man; Lc-U; Eu.

Saxifragaceae

(Fennane et al., 1999; Valdés et al., 2002; IUCN, 2017; APB, 2020).

205. *Parnassia palustris* L.; HA-MA-Man-R; Lc-D.
206. *Saxifraga maweana* Baker; R; MAR.

MYRTALES

Lythraceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006-; Fennane et al., 2007; Hammada, 2007; Molina et al., 2009; Rhazi

et al., 2012; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020).

207. *Lythrum baeticum* Gonz. Albo; Mam-Man; MAR-ESP.PRT; Nt-D; Eu.
208. *Lythrum borysthenicum* (Schrank) Litv. [*Peplis numulariifolia* (Loisel.) Jord.]; Mam-Man-R; Lc-S; Eu.
209. *Lythrum hyssopifolia* L.; Mam-Man-Ms-R; Lc-S; Eu.
210. *Lythrum portula* (L.) D. A. Webb [*Peplis portula* L.]; MA-Man-Op-R; Lc-S (Figure 7).



Figure 7. *Lythrum portula* (L.) D. A. Webb, wet ravine, Khmiss Sahel-Larache (1997).

211. *Lythrum salicaria* L.; Man-R; Lc-S; Eu-Hm (Figure 8).
212. *Lythrum thymifolia* L.; Mam-Man-Op; Lc-D; Eu.
213. *Lythrum tribracteatum* Salzm. ex Spreng.; Mam-Man-R; Lc-S; Eu.

Onagraceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Euro+Med, 2006-; Fennane et al., 2007; Rankou et al., 2013; Valdés, 2013; IUCN, 2017; APB, 2020).

214. *Epilobium atlanticum* Litard. & maire; HA; MAR-ESP.PRT.
215. *Epilobium hirsutum* L.; AA-HA-MA-Mam-Man-Ms-R; Lc-U; Eu.
216. *Epilobium obscurum* Schreber; HA.
217. *Epilobium parviflorum* Schreb.; HA-LM-MA-Mam-Man-Op-R; Lc-U; Eu.
218. *Epilobium psilotum* Maire & Sam.; HA; MAR; Nt-U.
- *Epilobium tetragonum* L.; HA-LM-Man-Op-R. It includes:



Figure 8. *Lythrum salicaria* L., El-Ma Wadi, Laâwamra-Larache (1996).

219. *E. tetragonum* subsp. *lamyi* (F. W. Schultz) Nyman; Man-R.

220. *Ludwigia palustris* (L.) Elliott; Man-Ms-R; Lc-U; Eu.

SANTALALES

Santalaceae

(Valdés et al., 2002; Hammada, 2007; Valdés, 2013; APB, 2020).

221. *Osyris alba* L.; LM-MA-Mam-Man-Om-Op-R; Hm.

AQUIFOLIALES

Aquifoliaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Valdés, 2013; APB, 2020; Unpublished data).

222. *Ilex aquifolium* L.; LM-MA-Man-Op-R.

ROSALES

Cannabaceae

(Fennane et al., 1999; APB, 2020).

223. *Humulus lupulus* L.; Man.

Rhamnaceae

(Fennane et al., 2007; Valdés et al., 2002; IUCN, 2017; APB, 2020).

224. *Frangula alnus* Mill. subsp. *alnus*; Man-R; Eu.

225. *Rhamnus cathartica* L.; Mam; Lc-S.

Rosaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Euro+Med, 2006-; Hammada, 2007; Chambouleyron, 2012; Khabbach, 2013; Valdés, 2013; Libiad, 2013; Rankou, et al. 2013; Libiad et al., 2015; IUCN, 2017; APB, 2020; Unpublished data).

226. *Alchemilla atlantica* H. Lindb. [*A. mairei* H. Lindb.]; HA; MAR.

227. *Alchemilla gourzae* Ibn Tattou [*A. lindbergiana* Emb.]; HA; MAR.

228. *Aphanes minutiflora* (Azn.) Holub; R.

229. *Crataegus laciniata* Ucria [*C. orientalis* subsp. *presliana* K. I. Ch., *C. o.* subsp. *preslia*]; LM-MA-Man-Op-R.

230. *Potentilla micrantha* Ramond ex DC.; LM-MA-Man-Op-R; Sc.

231. *Potentilla reptans* L. [*P. reptans* var. *typica* Domin f. *vulgaris* Asch. & Gr.]; HA-LM-MA-Mam-Man-Om-Op-R.

232. *Prunus lusitanica* L. subsp. *lusitanica*; LM-MA-Man-Op-R; E-U (Figure 9).

233. *Prunus padus* L.; MA; Lc-S.

234. *Rosa sempervirens* L.; LM-MA-Man-Om-Op-R.

235. *Rubus ulmifolius* (Schott) [*R. discolor* Weihe & Nees]; LM-MA-Man-Op-R.

Urticaceae

(Fennane et al., 1999; Valdés et al., 2002; Valdés, 2013; APB 2020).

236. *Parietaria mauritanica* Durieu; AA-HA-LM-MA-Mam-Man-Om-Op-R; Sc.

MALPIGHIALES

Elatinaceae

(Fennane et al., 1999; Valdés et al., 2002; Rhazi et al., 2012; El Madihi et al., 2017; IUCN, 2017; APB, 2020).



Figure 9. *Prunus lusitanica* L. subsp. *lusitanica*, cleared forest, water source, J'bel Alam-Tetouan (1996).

- 237. *Elatine alsinastrum* L.; LM-Mam-Man-R; Nt-D; Eu.
- 238. *Elatine brochonii* Clavaud; MA-Mam-Man-R; Nt-D; Eu.
- 239. *Elatine macropoda* Guss. [*E. hydropiper* auct.]; HA-MA-Mam-Man-R; Lc-D; Eu.

Euphorbiaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Carine et al., 2006; Molero Briones & Montserrat Martí, 2006; Fennane et al., 2007; Hammada, 2007; Molina et al., 2009; Rankou et al., 2013; IUCN, 2017; APB, 2020).

- 240. *Euphorbia falcata* L.; LM-MA-Man-Om-Op-R; Eu.
- 241. *Euphorbia hirsuta* L. [*E. pubescens* Vahl]; LM-Man-Om-Op-R (Figure 10).
- 242. *Euphorbia nereidum* Jahand. & Maire; MA-Mam; MAR; V-U.
- 243. *Euphorbia paniculata* Desf.; LM-Mam-Man-R; Lc-U.
- 244. *Euphorbia serpens* Kunth [*Chamaesyce serpens* (Kunth) Small]; Op; Hm.



Figure 10. *Euphorbia hirsuta* L., Laou-Wadi marsh, Chefchaouen (2001).

Hypericaceae

(Fennane et al., 1999; Valdés et al., 2002; Euro+Med, 2006-; Hammada, 2007; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; El Madihi et al., 2017; APB, 2020; Unpublished data)

- 245. *Hypericum aegyptiacum* L.; AA-As-HA-Mam.
- 246. *Hypericum coadunatum* C. Sm. ex Link; HA-R; MAR- ESP.CN.
- 247. *Hypericum hircinum* subsp. *metroi* (Maire & Sauvage) Sauvage; MA-Man-Op; MAR.
- 248. *Hypericum psilophyllum* (Diels) Maire; HA-Ms; MAR-DZA-TUN.
- 249. *Hypericum pubescens* Boiss.; AA-HA-LM-MA-Mam-Man-Om-Op-R.
- 250. *Hypericum tetrapterum* Fr. [*H. quadrangulum* L.]; Man-R; Eu.
- 251. *Hypericum tomentosum* L. subsp. *tomentosum*; HA-LM-MA-Mam-Man-Op-R.
- 252. *Hypericum tomentosum* subsp. *wallianum* Maire; HA; MAR.
- 253. *Hypericum undulatum* Willd.; R; Eu.

Linaceae

(Valdés et al., 2002; Fennane et al., 2007; Valdés, 2013; El Madihi et al., 2017; APB, 2020).

- 254. *Linum maritimum* L.; LM-MA-Man-Om-Op-R; Eu.
- 255. *Radiola linoides* Roth; MA-Mam-Man-R; Eu.

Salicaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Fennane et al., 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Ozenda, 2004; Ennabili & Radoux, 2006; Hammada, 2007; Libiad et al., 2012-2015; Khabbach, 2013; Libiad, 2013;

Valdés, 2013; IUCN, 2017; APB, 2020; Unpublished data).

256. *Populus alba* L.; As-HA-LM-MA-Mam-Man-Ms-Om-Op-R; In.
 257. *Populus euphratica* Olivier; LM-Mam-Man-Ms-Op-R; Ha (Figure 11).
 258. *Populus nigra* L.; AA-HA-LM-MA-Man-Om-Op-R; Dd-U; In.
 259. *Salix alba* L. [*S. a.* subsp. *caerulea* (Sm.) Rech. fil., *S. a.* var. *caerulea* f. *pendula* Hort, *S. a.* var. *vitellina* (L.) Seringe, *S. a.* subsp. *vitellina* (L.) Schübl. & G. Martens]; HA-LM-MA-Man-Om-Op-R; Lc-S.



Figure 11. Riparian forest of *Populus euphratica* Olivier, Moulouya river-mouth, Chararba-Sâidia. Riverfront (upper-1994) and back view (lower-1998).

260. *Salix atrocinerea* Brot. [*S. cinerea* subsp. *atrocinerea* (Brot.) Guinier]; LM-Man-Op-R.
 261. *Salix babylonica* L.; R; In-Pl.
 262. *Salix cinerea* L.; HA-MA-Man-R; Lc-S.
 263. *Salix elaeagnos* Scop.; MA-R.
 264. *Salix pedicellata* Desf. subsp. *pedicellata* [*S. p.* subsp. *pedicellata*, *S. p.* subsp. *eu-pedicellata* Maire & Weiller f. *latifolia* Maire & Weiller]; AA-As-HA-LM-MA-Mam-Man-Om-Op-R; Lc-S.
 265. *Salix purpurea* L.; AA-HA-LM-MA-Mam-Man-Op-R; Lc-S; Pl.

Violaceae

(Fennane et al., 1999; Valdés, et al. 2002; Valdés, 2013; IUCN, 2017; APB, 2020).

266. *Viola canina* L.; Man-R; Eu.

267. *Viola palustris* L.; HA-Man-R; Lc-U; Eu.

268. *Viola pyrenaica* Ramond ex DC.; R; Lc-S.

269. *Viola reichenbachiana* Boreau; LM-MA-Man-R; Sc.

270. *Viola suavis* M. Bieb.; R; Sc.

GERANIALES

Geraniaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Fennane et al., 2007; Molina et al., 2009; APB, 2020).

271. *Erodium moschatum* (L.) L'Hér. [*E. moschatum* (Burm.) L'Hor.]; LM-MA-Man-Op-R; Ha.

272. *Geranium dissectum* L.; AA-HA-LM-MA-Mam-Man-Op-R; Eu.

APILAES

Apiaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Euro+Med, 2006-; Fennane et al., 2007; Hammada, 2007; Molina et al., 2009; Chambouleyron, 2012; Rhazi et al., 2012; Rankou et al., 2013; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

273. *Apium graveolens* L.; LM-Mam-Man-Ms-Om-Op-R; Lc-I.

274. *Carum jahandiezii* Litard. & Maire; MA; MAR; Nt-U.

275. *Carum lacuum* Emb.; HA; MAR; V-U.

276. *Carum verticillatum* (L.) W. D. J. Koch; MA-Man-R; Lc-S.

277. *Chaerophyllum atlanticum* Coss. ex Batt.; HA-MA; MAR; Nt-U.

- *Daucus carota* L.; LM-MA-Man-Om-Op-R. It includes:

278. *D. carota* L. subsp. *carota*; LM-Man-Om-Op-R.

279. *Eryngium atlanticum* Batt. & Pit.; Mam-Man-Ms-Op-R; MAR; Nt-D; Eu.

280. *Eryngium corniculatum* Lam.; R; Lc-U; Eu.

281. *Eryngium maroccanum* Pit.; MA; MAR; Nt-S.

282. *Eryngium pusillum* L. [*E. barrelieri* Boiss.]; LM-Op; Eu.

283. *Eryngium variifolium* Coss.; AA-HA; MAR; V-U.
 284. *Helosciadium inundatum* (L.) W. D. J. Koch [*Apium inundatum* (L.) Rchb. f.]; LM-Mam-Man-R; Lc-S; Eu.
 - *Helosciadium nodiflorum* (L.) W.D.J. Koch [*Apium nodiflorum* (L.) Lag.]; AA-HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-S; Hm (Figure 12). It includes:

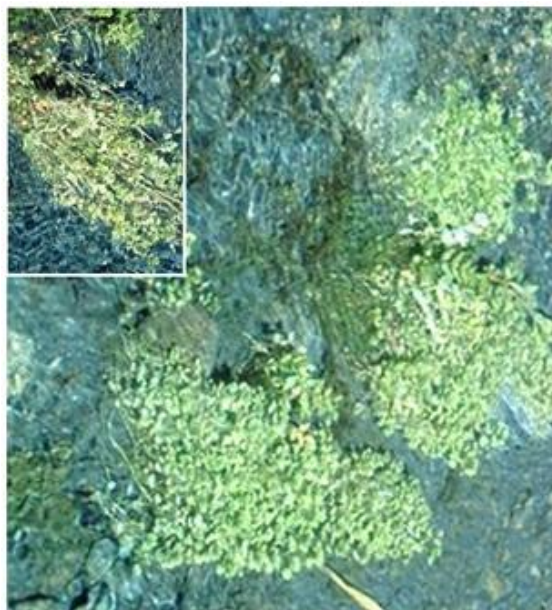


Figure 12. The main bed of Kanar-Ichiritenne Wadi, Chefchaouen (1995). Close-up view of *Helosciadium nodiflorum* (L.) W. D. J. Koch (upper-left).

285. *H. nodiflorum* subsp. *mairei* (Molina Abril & Sard.Rosc.) Stinca & Motti; Man; Ha.
 286. *Helosciadium repens* (Jacq.) W. D. J. Koch [*Apium repens* (Jacq.) Lag.]; HA-LM-MA-Mam-Man-Op-R.
 287. *Imperatoria hispanica* Boiss [*Peucedanum hispanicum* (Boiss.) Endl.]; HA-Man-Om-R; MAR-DZA-ESP.PRT.
 288. *Laserpitium emilianum* Emb.; HA; MAR.
 289. *Magydaris pastinacea* (Lam.) Pail.; LM-MA-Man-Om-R.
 290. *Meum athamanticum* Jacq.; HA.
 291. *Oenanthe crocata* L.; LM-MA-Man-R; Eu-Sc.
 292. *Oenanthe fistulosa* L.; Mam-Man-R; Lc-S; Eu.
 293. *Oenanthe globulosa* L.; Man-Op-R; Lc-S; Eu.
 294. *Oenanthe peucedanifolia* Pollich; Man; Eu.
 295. *Oenanthe pimpinelloides* subsp. *callosa* (Salzm. ex DC.) Maire; LM-MA-Man-R; Nt-U; Eu.
 296. *Sanicula europaea* L.; LM-MA-Man-R; Sc.

SOLANALES

Convolvulaceae

(Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Molero Briones & Montserrat Martí, 2006; Fennane et al., 2007; Hammada, 2007; El Madihi et al., 2017; IUCN, 2017; APB, 2020).

297. *Calystegia sepium* (L.) R. Br.; Man-R; Lc-U.
 298. *Convolvulus fatmensis* Kunze; Ms.
 299. *Cressa cretica* L.; AA-LM-Mam-Man- Ms-Op-R; Lc-U; Eu-Ha.

Solanaceae

(Valdés et al., 2002; Fennane et al., 2007; APB, 2020).

300. *Solanum dulcamara* L.; HA-LM-MA-Mam-Man-Op-R; Eu.

CALLITRICHALES

Callitrichaceae

(Ennabili, 1999; Ennabili et al., 2000; Ennabili & Gharnit, 2003b; Ennabili & Ater, 1996-1997-2005; Fennane et al., 2007; Hammada, 2007; Molina et al., 2009; Euro+Med, 2006-; Valdés et al., 2002; Rankou et al., 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020).

301. *Callitriche brutia* Petagna [*C. palustris* subsp. *pedunculata* (DC.) Emb. & Maire]; HA-MA-Mam-Man-R; Lc-S; Eu.
 302. *Callitriche cribrata* Schotsman; HA-MA-Mam-Man-R; Nt-U.
 303. *Callitriche lusitanica* Schotsman; Mam-Man-R; MAR-DZA-TUN-ESP.PRT; Eu.
 304. *Callitriche mathezii* schotsman; Man-R; MAR; E-D; Eu.

305. *Callitriche obtusangula* Le Gall; Mam-Man-R; Eu.
 306. *Callitriche palustris* L.; Man-R; Lc-S; Eu.
 307. *Callitriche regis-jubae* Schotsman; Man-R; Dd-U; Eu.
 308. *Callitriche stagnalis* Scop.; AA-HA-LM-MA-Mam-Man-Om-Op-R; Lc-S; Eu (Figure 13).
 309. *Callitriche truncata* Guss.; HA-MA-Mam-Man-R.

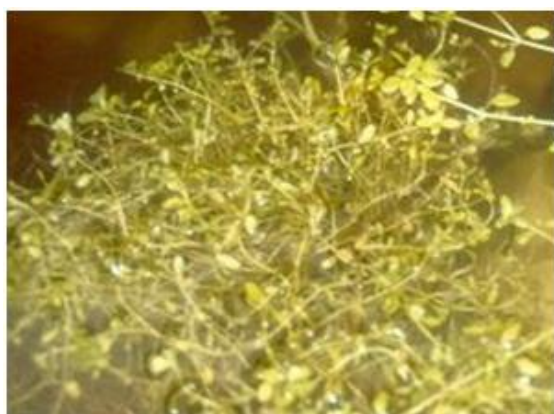


Figure 13. *Callitriche stagnalis* Scop., water source, J'bel Zem Zem, F'nideq-M'diq (1996).

LAMIALES

Acanthaceae

(Valdés et al., 2002; Fennane et al., 2007; Chambouleyron, 2012; APB, 2020).

310. *Acanthus mollis* L.; LM-MA-Man-Om-Op-R.
 311. *Barleria schmittii* Benoist; Ms; MAR-MRT.

Boraginaceae

(Ennabili, 1999; Ennabili & Gharnit, 2003b; Fennane et al., 2007; Hammada, 2007; Rhazi et al., 2012; Euro+Med, 2006-; Valdés et al., 2002; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

312. *Heliotropium curassavicum* L.; AA-Mam; In.
 313. *Heliotropium supinum* L.; AA-LM-MA-Mam-Man-Om-Op-R.
 314. *Myosotis arvensis* (L.) Hill; HA.
 315. *Myosotis debilis* Pomel; Man-R; MAR-DZA-ESP.PRT; Eu.

316. *Myosotis laxa* subsp. *caespitosa* (Schultz) Nordh. [*M. lingulata* Lehm.]; HA-Man-R.
 317. *Myosotis ramosissima* Rochel; AA-HA-LM-MA-Mam-Man-Om-Op-R.
 318. *Myosotis sicala* Guss.; Mam.
 319. *Myosotis welwitschii* Boiss. & Reuter; Man-R; MAR-ESP.PRT; Lc-S.
 320. *Ogastemma pusillum* (Coss. & Durieu ex Bonnet & Barratte) Brummitt; AA-As-Ms.

Lamiaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Fennane et al., 2007; Hammada, 2007; Chambouleyron, 2012; Libiad et al., 2011-2012; Khabbach, 2013; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; IUCN, 2017; APB, 2020; Unpublished data).

321. *Lamium flexuosum* Ten.; HA-LM-MA-Man-Op-R.
 322. *Lycopus europaeus* L.; AA-LM-MA-Mam-Man-Op-R; Lc-S.
 323. *Mentha aquatica* L.; Mam-Man; Lc-S; Eu.
 324. *Mentha cervina* L.; Man; Nt-D.
 325. *Mentha gattefossei* Maire; AA-HA-MA-Ms; MAR; Nt-D.
 326. *Mentha longifolia* (L.) L.; HA-MA-Man-Op-R; Lc-S.
 - *Mentha suaveolens* Ehrh. [*M. macrostachya* Ten., *M. rotundifolia* auct., non (L.) Huds., *M. r.* var. *melillensis* Sennen, *M. rotundifolia* auct., non (L.) Ruds]; All Morocco; Lc-S; Eu. It includes:
 327. *M. suaveolens* Ehrh. subsp. *suaveolens*; R.
 328. *Prunella hyssopifolia* L.; Man-R.
 329. *Prunella vulgaris* L.; HA-LM-MA-Man-Op-R; Lc-U.
 330. *Teucrium scordium* subsp. *scordioides* (Schreb.) Maire & Petitm.; Man-R; Eu.

Lentibulariaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006-; Fennane et al., 2007; Hammada, 2007; IUCN, 2017; APB, 2020).

331. *Pinguicula fontiqueriana* Romo, Peris & Stübing [*P. vulgaris* auct.]; R; MAR; V-D.
332. *Utricularia australis* R. Br. [*U. vulgaris* subsp. *major* auct.]; Man-R; Lc-U; Eu.
333. *Utricularia gibba* L.; Man; Lc-U; Eu.
334. *Utricularia minor* L.; HA-Ms; Lc-U.
335. *Utricularia vulgaris* L.; MA-Man-R; Lc-S; Eu.

Oleaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Ennabili & Radoux, 2006; Fennane et al., 2007; Valdés, 2013; APB, 2020; Unpublished data).

336. *Fraxinus angustifolia* Vahl; HA-LM-MA-Mam-Man-Om-Op-R.

Plantaginaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006-; Fennane et al., 2007; Hammada, 2007; Libiad, 2013; Rankou et al., 2013; Libiad et al., 2015; IUCN, 2017; APB, 2020; Unpublished data).

337. *Littorella uniflora* (L.) Asch.; R; Lc-U.
338. *Plantago lanceolata* L.; AA-Mam-Man-R.
339. *Plantago major* L. subsp. *major*; MA-Man.
340. *Plantago major* subsp. *intermedia* (Gilib.) Lange; LM-MA-Man-Op-R.
341. *Plantago pilgeriana* Hassemer [*P. lanceolata* subsp. *lacustris* (Maire) Maire, *P. lacustris* (Maire) Pilger]; MA; MAR; V-D.
342. *Plantago rhizoxylon* Emb.; HA-MA-Op; MAR.

Scrophulariaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Euro+Med, 2006-; Fennane et al., 2007; Hammada, 2007; Khabbach, 2013; Valdés, 2013; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

343. *Bartsia trixago* L.; HA-LM-MA-Mam-Man-Om-Op-R.

344. *Bellardia viscosa* (L.) Fisch. & C. A. Mey. [*Parentucellia viscosa* (L.) Caruel]; HA-LM-MA-Mam-Man-Om-Op-R.
345. *Chaenorhinum villosum* (L.) Lange; LM-MA-Mam-Man-Op-R.
346. *Euphrasia willkommii* Freyn; HA.
347. *Gratiola linifolia* Vahl; Man-R; MAR-ESP.PRT; Lc-S; Eu.
348. *Kickxia commutata* (Bernh. ex Rchb.) Fritsch; HA-LM-MA-Mam-Man-Om-Op-R; Eu.
349. *Limosella aquatica* L.; Mam; Lc-S.
350. *Linaria fallax* Coss. ex Batt.; Ms; MAR-DZA-TUN; Nt-U.
351. *Pedicularis sylvatica* subsp. *lusitanica* (Hoffmanns. & Link) Cout., MA-Man-R; MAR-ESP.PRT; Eu. - *Scrophularia auriculata* L. [*S. aquatica* L.]; HA-LM-MA-Mam-Man-Om-Op-R; Lc-S. It includes:
352. *S. auriculata* subsp. *lyrata* (Willd.) Gamisans [*S. jalui* (Gattef. & Weiller) Ibn Tattou]; HA; MAR-DZA-TUN-ESP.PRT.
353. *S. auriculata* subsp. *valentina* (Rouy) Ortega Oliv., Serra & al. [*S. balbisii* Hornem.]; HA-LM-MA-Mam-Man-Op-R.
354. *Scrophularia laevigata* Vahl [*S. foliosa* Pomel]; LM-Man-Op-R; MAR-DZA-TUN-ESP.PRT.
355. *Scrophularia sambucifolia* L.; HA-LM-Man-Op-R; MAR-DZA-TUN-ESP.PRT.
356. *Veronica anagallis-aquatica* L. [*V. a.-a.* subsp. *aquatica* (Bernh.) Maire]; All Morocco; Lc-U; Eu.
357. *Veronica anagalloides* Guss. [*V. anagallis-aquaticus* subsp. *anagalloides* (Guss.) Batt.]; LM-MA-Mam-Man-Op-R; Lc-U; Eu.
358. *Veronica beccabunga* L.; HA-LM-MA-Man-Om-Op-R; Lc-U.
359. *Veronica catenata* Pennell; LM-MA-Mam-Man-Om-Op-R; Lc-S.
360. *Veronica repens* DC.; HA; Lc-S.

Verbenaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Ennabili & Radoux, 2006; Fennane et al., 2007; Hammada, 2007; Molina et al., 2009; Chambouleyron, 2012; Rhazi et al., 2012; Libiad, 2013; Valdés, 2013; Libiad et al., 2012-2015; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

361. *Phyla nodiflora* (L.) Greene var. *nodiflora* [*Lippia nodiflora* (L.) Michx., *L. nodiflora* (L.) Rich.]; LM-Mam-Man-R; Lc-S; Eu (Figure 14).



Figure 14. *Phyla nodiflora* (L.) Greene var. *nodiflora*, Laou-Wadi marsh, Chefchaouen (2001).

362. *Verbena supina* L.; AA-LM-Mam-Man-Ms-Op-R; Lc-S; Eu.
363. *Vitex agnus-castus* L.; All Morocco.

GENTIANALES

Apocynaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Ozenda, 2004; Ennabili & Radoux, 2006; Fennane et al., 2007; Hammada, 2007; Khabbach et al., 2011-2012; Libiad, 2013; Khabbach, 2013; Valdés, 2013; Libiad et al., 2011-2012-2015; IUCN, 2017; APB, 2020; Unpublished data).

364. *Nerium oleander* L.; All Morocco; Lc-U.
365. *Vinca difformis* Pourr.; HA-LM-Man-R.

Asclepiadaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Ozenda, 2004; Molero Briones & Montserrat Martí, 2006; Fennane et al., 2007; Libiad, 2013; IUCN, 2017; APB, 2020; Unpublished data).

366. *Asclepias curassavica* L.; LM-Man; In.
367. *Calotropis procera* (Aiton) W.T. Aiton; AA-Mam-Ms.
368. *Cynanchum acutum* L.; Mam-Man-R; Lc-I.
369. *Gomphocarpus fruticosus* (L.) W. T. Aiton; LM-Man-R; In.
370. *Leptadenia pyrotechnica* (Forssk.) Decne; Ms.

Gentianaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Ennabili et al., 2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Ozenda, 2004; Euro+Med, 2006; Fennane et al., 2007; Hammada, 2007; Molina et al., 2009; Rhazi et al., 2012; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; Libiad et al., 2015; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

- *Centaurium pulchellum* (Sw.) Druce; AA-As-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-U. It includes:
371. *C. pulchellum* subsp. *grandiflorum* (Batt.) Maire [*C. candelabrum* H. Lindb.]; HA-LM-Mam-Man-Ms-Om-Op-R; MAR; Lc-S.
372. *Centaurium spicatum* (L.) Fritsch; AA-HA-LM-MA-Mam-Man-Ms-Om-Op-R; Eu.
373. *Centaurium tenuiflorum* (Hoffmanns. & Link) Fritsch [*C. pulchellum* subsp. *tenuiflorum* (Hoffmanns. & Link) Maire]; LM-MA-Man-Om-Op-R.
374. *Cicendia filiformis* (L.) Delarbre; LM-Mam-Man-R; Eu.
375. *Exaculum pusillum* (Lam.) Caruel; LM-Mam-Man-R; Nt-U; Eu.
376. *Gentiana atlantica* Litard. & Maire; HA; MAR.
377. *Gentiana ciliata* L.; HA.
378. *Gentiana sierrae* Briq. [*G. penetii* (Litard. & Maire) Romo]; HA; MAR-ESP.PRT.
379. *Gentiana tenella* Rottb.; HA.
380. *Gentiana torneyana* Litard. & Maire; HA; MAR.

Rubiaceae

(Valdés et al., 2002; Molina et al., 2009; Fennane et al., 2014; El Madihi et al., 2017; IUCN, 2017; APB, 2020).

381. *Galium debile* Desv.; Man-R; Lc-S; Eu.
 382. *Galium elongatum* C. Presl; Man; Lc-S; Eu.
 383. *Galium palustre* L.; Man-R; Lc-S; Eu.
 384. *Oldenlandia capensis* L. f; Man; Lc-U; Eu.
 385. *Sherardia arvensis* L.; LM-MA-Man-Om-Op-R; Eu.

DIPSACALES

Caprifoliaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006; Hammada, 2007; APB, 2020).

386. *Lonicera biflora* Desf.; LM-MA-Mam-Man-Op-R; MAR-DZA-ESP.PRT.

Dipsacaceae

(Ennabili & Ater, 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006; Fennane et al., 2014; APB, 2020).

387. *Cephalaria mauritanica* Pomel [*C. m. var. maroccana* (Batt.) Dobignard, *C. m. subsp. maroccana* (Coss. ex Batt.) Maire]; HA-MA; MAR-DZA.
 388. *Dipsacus fullonum* L. [*D. sylvestris* Huds]; Mam-Man-R.

ASTERALES

Asteraceae

(Ennabili & Ater, 1996; Ennabili, 1999; Ennabili et al., 2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Euro+Med, 2006; Hammada, 2007; Molina et al., 2009; Chambouleyron, 2012; Khabbach et al., 2011-2012; Rhazi et al., 2012; Libiad, 2013; Khabbach, 2013; Rankou et al., 2013; Valdés, 2013; Fennane et al., 2014; Libiad et al., 2015; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

389. *Achillea ageratum* L.; MA-Mam.
 390. *Achillea ligustica* All.; HA-LM-MA-Man-Om-Op-R.
 391. *Achillea maura* Humbert; LM-Man-R; MAR.
 392. *Achillea santolinoides* Lag.; AA-HA-LM-MA-Mam-Man-Om-Op-R.

393. *Bellis coerulescens* Coss. ex Ball; AA-HA-MA; MAR; Sc.
 394. *Bellis perennis* L.; MA-R.
 395. *Bellis prostrata* Pomel; Man; MAR-DZA-TUN; Nt-U.
 396. *Bidens tripartitus* L.; Man-R; Lc-S.
 397. *Carthamus caeruleus* L.; AA-HA-LM-MA-Mam-Man-Op-R.
 398. *Centaurea benedicta* (L.) L.; Man-Ms.
 399. *Centaurea bimorpha* Viv. [*C. dimorpha* Viv.]; As-Man-Ms.
 400. *Centaurea diluta* Aiton; LM-Man-Op-R; MAR-DZA-TUN-ESP.PRT-ESP.CN.
 401. *Centaurea jacea* subsp. *gaudinii* (Boiss. & Reuter) Greml; Om-Op.
 402. *Centaurea melitensis* L.; AA-HA-LM-MA-Mam-Man-Ms-Om-Op-R.
 403. *Centaurea nigra* subsp. *gueryi* (Maire) Maire; HA-MA; MAR.
 404. *Chamaemelum fuscum* (Brot.) Vasc. [*Anthemis praecox* Link., *Ormenis fuscata* B., *O. praecox* (Link) Briq.]; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Eu.
 405. *Cirsium chrysacanthum* (Ball) Jah.; AA-HA; MAR; Nt-U.
 406. *Cirsium ducellieri* Maire; MA-Man; MAR; V-U.
 407. *Cirsium pyrenaicum* (Jacq.) All.; HA-MA-Man-Op-R.
 408. *Conyza gouanii* (L.) Willd.; HA; MAR-ESP.CN.
 409. *Cotula anthemoides* L.; Man-Ms; In-N.
 410. *Cotula coronopifolia* L.; Mam-Man-R; In-N-Hm.
 411. *Dittrichia viscosa* (L.) Greuter [*Inula viscosa* (L.) Aiton]; AA-As-HA-LM-MA-Mam-Man-Om-Op-R; Ha.
 412. *Eclipta prostrata* (L.) L.; MA-Mam-Man-Ms-R; Lc-S; In-N.
 413. *Eupatorium cannabinum* subsp. *cannabinum*; MA-Man-Op-R.
 414. *Helminthotheca echioides* (L.) Holub [*Picris echioides* L.]; AA-As-HA-LM-MA-Mam-Man-Om-Op-R.

415. *Hypochaeris angustifolia* (Litard. & Maire) Maire; HA-MA-Mam-Ms-Op; MAR; Lc-S.
416. *Laphangium luteoalbum* (L.) Tzvelev [*Gnaphalium luteoalbum* L.]; LM-MA-Man-Ms-Om-Op-R.
417. *Leontodon maroccanus* (Pers.) Ball; Man-R; MAR-DZA-ESP.PRT.
418. *Leontodon saxatilis* subsp. *mesorhynchus* (Maire) Maire; MA-Man-R; MAR; Eu.
419. *Leontodon saxatilis* subsp. *rothii* Maire [*L. s.* subsp. *longirostris* (Finch & P. D. Sell) P. Silva]; LM-MA-Man-Op-R; Eu.
420. *Lifago dielsii* Schweinf. & Muschl.; Ms; MAR-DZA-MRT.
421. *Limbarda crithmoides* (L.) Dumort. [*Inula crithmoides* L.]; LM-Mam-Man-Op-R; Ha.
422. *Pluchea ovalis* (Pers.) DC.; Mam-Ms.
- *Pulicaria arabica* (L.) Cass.; AA-HA-LM-MA-Mam-Man-Ms-Op-R; Lc-U; Eu. It includes:
423. *P. arabica* subsp. *hispanica* (Boiss.) Murb. [*P. paludosa* Link.]; AA-LM-MA-Mam-Man-Ms-Op-R; MAR-ESP.PRT; Lc-U; Eu.
424. *Pulicaria dysenterica* (L.) Bernh.; Man-R; Eu-Ha.
425. *Pulicaria filaginoides* Pomel; Man-R; MAR-DZA; CE-U.
426. *Pulicaria inuloides* (Poir.) DC.; All Morocco; Lc-S.
427. *Pulicaria vulgaris* Gaertn.; MA; Lc-S.
428. *Rhaponticum longifolium* subsp. *ericeticola* (Font Quer) Greuter; R; MAR.
429. *Scorzoneroide atlantica* (Ball) Holub; AA-HA-MA; MAR; Lc-U.
430. *Senecio massaicus* (Maire) Maire; Mam-Ms; MAR-DZA-ESP.CN; Hm.
- *Sonchus maritimus* L.; R. It includes:
431. *S. maritimus* subsp. *aquatilis* (Pourr.) Nyman; All Morocco.
432. *Taraxacum atlanticum* Pomel; AA-HA-MA-Mam-Op-R; MAR-DZA.
433. *Taraxacum atlantis-majoris* H. Lindb.; HA; MAR.
434. *Taraxacum pycnodes* H. Lindb.; HA; MAR.
435. *Taraxacum ribii* D. P Petit; MA; MAR.
436. *Tripolium pannonicum* (Jacq.) Dobrocz.; R; Ha.
437. *Tussilago farfara* L.; HA-MA-Op.
438. *Vogtia annua* (L.) Oberpr. & Sonboli [*Tanacetum annuum* L.]; MA; R.
- Campanulaceae**
(Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Euro+Med, 2006-; Rhazi et al., 2012; Valdés, 2013; Fennane et al., 2014; El Madihi et al., 2017; IUCN, 2017; APB, 2020).
439. *Campanula rapunculus* L.; LM-MA-Man-Om-Op-R.
440. *Lobelia urens* L.; Man-R.
441. *Solenopsis bicolor* (Batt.) Greuter & Burdet [*Laurentia bicolor* (Batt.) M. & Steph.]; Man; MAR-DZA-TUN; Nt-U.
442. *Solenopsis laurentia* (L.) C. Presl [*Laurentia michelii* A. DC., *L. gasparrinii* (Tineo) Strobl.]; AA-MA-Mam-Man-R; Eu.
443. *Trachelium caeruleum* L.; All Morocco.
- Menyanthaceae**
(Valdés et al., 2002; Fennane et al., 2007; IUCN, 2017; APB, 2020).
444. *Menyanthes trifoliata* L.; Man-R; Lc-S.
- NAJADALES**
- Najadaceae**
(Ozenda, 2004; Fennane et al., 2014; IUCN, 2017; APB, 2020).
445. *Najas marina* subsp. *armata* (H. Lindb.) Horn; Mam-Ms; Eu-Hm.
446. *Najas minor* All.; Man-Ms; Lc-U; Eu.
- Zannichelliaceae**
(Ennabili, 1999; Valdés et al., 2002; Hammada et al., 2004; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Molero Briones & Montserrat Martí, 2006; Hammada, 2007; Fennane et al., 2014; IUCN, 2017; APB, 2020).
447. *Althenia filiformis* F. Petit; Ms.

448. *Althenia orientalis* (Tzvelev) Garcia Mur. & Talavera; Man-Ms; Ha.
 449. *Posidonia oceanica* (L.) Delile; LM-R; Lc-D; Ha.
 450. *Zannichellia obtusifolia* Talavera, Garcia Mur. & Smit; HA-LM-MA-Mam-Man-Ms-R; Nt-D; Hm.
 451. *Zannichellia palustris* subsp. *pedicellata* (Wahlenb. & Rosen) Arcang. [Z. p. var. *pedicellata* Wahlenb. & Rosén, Z. p. subsp. *pedunculata* (Rchb) Murb., Z. *pedunculata* Rchb.]; HA-Ms-R; Eu-Hm.
 452. *Zannichellia palustris* subsp. *palustris* [Z. p. subsp. *genuina* Asch.]; R; Hm.
 453. *Zannichellia peltata* Bertol.; HA-LM-MA-Mam-Man- Ms-Op-R; Lc-S; Hm.

ALISMATALES

Alismataceae

(Ennabili, 1999; Ennabili & Ater, 1996; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada, 2007; Molina et al., 2009; Rhazi et al., 2012; Valdés, 2013; Fennane et al., 2014; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).

454. *Alisma lanceolatum* With. [A. *plantago-aquatica* subsp. *michaletii* With. var. *lanceolatum* Asch. & Gr]; HA-LM-MA-Mam-Man-Op-R; Lc-S.
 455. *Alisma plantago-aquatica* L.; LM-Mam-Man-Om-Op-R; Lc-S; Eu.
 - *Baldellia ranunculoides* (L.) Parl. [*Echinodorus ranunculoides* (L.) Engelm. ex Asch., *Alisma ranunculoides* L.]; LM-MA-Mam-Man-Op-R; Nt-D; Eu. It includes:
 456. *B. ranunculoides* subsp. *ranunculoides*; MA-Man.
 457. *B. ranunculoides* subsp. *repens* (Lam.) Á Löve & D. Löve [*B. repens* (Lam.) Ooststr. ex Lawalrée]; Man-R.
 - *Damasonium alisma* Mill.; MA-Mam-Man-R; V-D; Eu. It includes:
 458. *D. alisma* subsp. *bourgaei* (Coss.) Maire [*D. bourgaei* Coss.]; MA-Mam-Man-R; Lc-D; Eu.

459. *D. alisma* subsp. *polyspermum* (Coss.) Maire [*D. polyspermum* Coss.]; MA-Mam-Man-R; V-D; Eu.

Araceae

(Ennabili, 1999; Ennabili et al., 1998; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Ennabili & Radoux, 2006; Hammada, 2007; Fennane et al., 2014; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Khabbach et al., 2019; Unpublished data).

460. *Lemna gibba* L.; AA-HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-S; Eu-Hm-Pl.
 461. *Lemna minor* L.; All Morocco; Lc-S; Eu-Pl.
 462. *Lemna trisulca* L.; MA-Man; Lc-S; Eu-Hm.
 463. *Pistia stratiotes* L.; Man; Lc-I; In-Iv-Eu-Pl.
 464. *Spirodela polyrrhiza* (L.) Schleid.; Mam-Man; Lc-S; Eu.
 465. *Wolffia arrhiza* (L.) Horkel ex Wimm.; Man; Lc-S; Eu.

Butomaceae

(Fennane et al., 2014; IUCN, 2017; APB, 2020).

466. *Butomus umbellatus* L.; MA-Man; Lc-S; Eu.

Cymodoceaceae

(Valdés et al., 2002; Ennabili & Gharnit, 2003a; Ozenda, 2004; Hammada, 2007; Fennane et al., 2014; IUCN, 2017; APB, 2020).

467. *Cymodocea nodosa* (Ucria) Asch.; LM-Mam-Man-Ms-R; Lc-S; Ha.

Hydrocharitaceae

(Hammada, 2007; Fennane et al., 2014; IUCN, 2017; APB, 2020).

468. *Elodea canadensis* Michaux; Man; Lc-U.
 469. *Hydrocharis morsus-ranae* L.; Man; Lc-S; Eu-Hm.

Juncaginaceae

(Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ennabili & Ater, 2005; Hammada, 2007; Fennane et al., 2014; IUCN, 2017; APB, 2020).

470. *Triglochin barrelieri* Loisel.; LM-Mam-Man-R; Hm.
 471. *Triglochin bulbosa* L.; R; Lc-S; Hm.

472. *Triglochin laxiflora* Guss. [*T. bulbosa* subsp. *laxiflora* (Guss.) Rouy]; Mam-Man-R; Hm.
 473. *Triglochin maritima* L.; Man; Lc-U; Ha (Figure 15).



Figure 15. *Triglochin maritima* L., Aïn Tisswat-Moulay Bousselham (1996).

474. *Triglochin palustris* L.; HA-MA-R; Lc-S.
 475. *Triglochin striata* Ruiz & Pav.; Man; In-N-Eu-Ha.

Potamogetonaceae

(Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada et al., 2004; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Hammada, 2007; Molina et al., 2009; Valdés, 2013; Fennane et al., 2014; IUCN, 2017; APB, 2020).

476. *Groenlandia densa* (L.) Four.; As-HA-MA-Man-Ms-Op; Lc-S.
 477. *Potamogeton coloratus* Hornem.; Ms; Lc-S.
 478. *Potamogeton lucens* L.; MA-Man; Lc-S.
 479. *Potamogeton natans* L.; MA-Mam-Man-R; Lc-S; Hm-Pl.
 480. *Potamogeton nodosus* Poir.; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-U; Eu.
 481. *Potamogeton polygonifolius* Pourr. [*P. oblongus* Viv., *P. o.* var. *amphibius* Fr.]; LM-Man-R; Lc-U; Eu.
 482. *Potamogeton pusillus* L.; LM-Mam-Man-Ms-Om-Op-R; Lc-S.
 483. *Potamogeton trichoides* Cham. & Schltdl.; Mam-Man-Om-R; Lc-S.

484. *Stuckenia pectinata* (L.) Börner [*Potamogeton pectinatus* L.]; HA-LM-MA-Mam-Man-Ms-R; Lc-U; Eu.

Ruppiaceae

(Ennabili, 1999; Ennabili et al., 2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Ennabili & Ater, 1996-2005; Ennabili & Radoux, 2006; Hammada, 2007; Fennane et al., 2014; IUCN, 2017; APB, 2020).

485. *Ruppia maritima* L. [*R. m.* subsp. *rostellata* (Koch) Asch. & Gr., *R. cirrhosa* (Petagna) Grande]; LM-Mam-Man-Ms-R; Lc-S; Eu (Figure 16).
 486. *Ruppia spiralis* L. ex Dumort. [*R. maritima* subsp. *spiralis* (L. ex Dumort.) Asch. & Graebn.]; Man-R; Lc-S; Ha (Figure 16).



Figure 16. *Ruppia maritima* L. (left) and *R. spiralis* L. ex Dumort. (right), Negro-Wadi mouth, F'nideq-M'diq (1994).

Zosteraceae

(Ennabili & Ater, 1996; Ennabili, 1999; Ennabili & Gharnit, 2003b; Hammada et al., 2004; Ozenda, 2004; Ennabili & Radoux, 2006; Hammada, 2007; Fennane et al., 2014; IUCN, 2017; APB, 2020).

487. *Halodule wrightii* Asch. [*Zostera nana* auct.]; Ms; Lc-I; Ha.
 488. *Zostera marina* L.; LM-Mam-Man-Ms-R; Lc-D; Ha.
 489. *Zostera noltii* Hornem [*Z. nana* Roth]; LM-Mam-Man-Ms-R; Lc-D; Ha (Figure 17).

POALES

Cyperaceae

(Ennabili, 1999; Ennabili et al., 1996-2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Carine et al., 2006; Molero Briones & Montserrat Martí, 2006; Euro+Med, 2006; Hammada, 2007; Jiménez-Mejías et al.,

2007; Molina *et al.*, 2009; Chambouleyron, 2012; Rhazi *et al.*, 2012; Libiad, 2013; Rankou *et al.*, 2013; Valdés, 2013; Fennane *et al.*, 2014; Libiad *et al.*, 2012-2015; El Madihi *et al.*, 2017; IUCN, 2017; APB, 2020; Unpublished data).



Figure 17. Exposed *Zostera noltii* Hornem, Tahaddarte-Wadi mouth, Asila-Tangier (1995). Exposed close-up view (upper left) and flooded one (upper right).

490. *Blysmus compressus* (L.) Link; HA; Lc-U.
 491. *Bolboschoenus glaucus* (Lam.) S. G. Sm.; Mam; Lc-U.
 492. *Bolboschoenus maritimus* subsp. *maritimus* [*Scirpus maritimus* L.]; LM-MA-Mam-Man-Ms-Op-R; Lc-S; Hm-Eu-Pl.
 493. *Bulbostylis cioniana* (Savi) Lye; Man.
 494. *Carex acuta* L. [*C. gracilis* Curtis]; Man-R; Lc-S (Figure 18).



Figure 18. *Carex acuta* L., diffuse water-source, Khmiss Sahel-Larache (1997).

495. *Carex acutiformis* Ehrh.; MA-Op; Lc-S.
 496. *Carex capillaris* L.; HA.

497. *Carex cuprina* (Heuff.) A. Kern. [*C. vulpina* auct., non L., *C. v.* subsp. *nemorosa* (Rebent.) Maire, *C. otrubae* Podp.]; Man-R; Eu.
 498. *Carex demissa* Hornem; Man-R.
 499. *Carex distachya* Desf.; LM-MA-Man-Om-Op-R; Lc-S.
 500. *Carex distans* L.; AA-As-HA-LM-MA-Mam-Man-Op-R; Lc-S.
 501. *Carex divisa* Huds.; AA-As-HA-LM-MA-Mam-Man-Op-R; Lc-S; Eu.
 502. *Carex echinata* Murray; Man-R; Lc-S; Eu.
 503. *Carex fissirostris* Ball; HA-R; MAR; E-U.
 - *Carex flacca* Schreb.; MA-Man-R. It includes:
 504. *C. flacca* subsp. *serrulata* (Biv. ex Spreng.) Greuter; AA-HA-MA-Man-R.
 505. *Carex flava* L. [*C. f.* subsp. *oederi* (Retz) Syme, *C. serotina* subsp. *serotina*]; R; Lc-U.
 506. *Carex glomerabilis* Krecz. [*C. vulpina* auct., non L.]; Man-R; Eu.
 507. *Carex hirta* L.; MA.
 508. *Carex hispida* Willd.; HA-LM-MA-Mam-Man-Om-Op-R; Lc-S; Eu.
 509. *Carex hordeistichos* Vill.; MA.
 510. *Carex laevigata* Sm [*C. helodes* Link, *C. h.* var. *maurusia* Font Quer & Maire]; R; E-D.
 511. *Carex leporina* L.; AA-HA-LM-Man-R.
 512. *Carex mairei* Coss. & Germain; AA-HA-Man-R; Eu.
 513. *Carex maritima* Gunnerus; HA.
 514. *Carex muricata* subsp. *lamprocarpa* Celak. [*C. m.* subsp. *pairae* (F. W. Schultz) Celak.]; LM-MA-Man-Op-R; Sc.
 515. *Carex nigra* (L.) Reichard; AA-HA-MA-Man-Ms-R; Lc-S; Eu.
 516. *Carex panicea* L.; MA.
 517. *Carex paniculata* subsp. *lusitanica* (Willd.) Maire; Man.
 518. *Carex paniculata* subsp. *paniculata*; MA.
 519. *Carex paulo-vargasii* Luceño & Marin; MA-Man-R; MAR.

520. *Carex pseudocyperus* L.; Man; Lc-S.
 521. *Carex punctata* Gaudin; Man-R; Lc-U.
 522. *Carex riparia* Curtis; MA; Lc-S; Eu.
 523. *Carex trinervis* Degl.; AA-HA-MA-Mam-Man-R; Eu.
 - *Carex viridula* Michx. [*C. serotina* Merat]; R. It includes:
 524. *C. viridula* subsp. *brachyrhyncha* (Celak.) B. Schmid [*C. lepidocarpa* Tausch]; AA-HA-Man-R.
 525. *Carex vulpina* L.; Man-R; Lc-S.
 526. *Cladium mariscus* (L.) Pohl. [*Mariscus serratus* Gilib.]; MA-Mam-Man-R; Lc-S; Eu (Figure 19).



Figure 19. *Cladium mariscus* (L.) Pohl., Dhirya, Laâwamra-Larache (1996). Inflorescence (lower right).

527. *Cyperus bulbosus* Vahl.; MA-Man; Lc-U.
 528. *Cyperus difformis* L.; LM-Op; Lc-S.
 529. *Cyperus eragrostis* Lam.; R; Lc-U; In-N-Iv.
 530. *Cyperus esculentus* L.; Man-Ms-R; Lc-U.
 531. *Cyperus fuscus* L. [*C. f.* var. *virescens* (Hoffm.) Coss. & Durieu]; LM-Man-Ms-Om-Op-R; Lc-U.
 - *Cyperus laevigatus* L.; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-U. It includes:
 532. *C. laevigatus* subsp. *distachyos* (All.) K. Richt. [*C. l.* subsp. *distachyos* (All.) Maire & Weiller]; HA-LM-MA-Mam-Man-Ms-Om-Op-R.
 - *Cyperus longus* L.; All Morocco; Lc-S; Eu. It includes:
 533. *C. longus* subsp. *badius* (Desf.) Murb.; Man.
 534. *Cyperus michelianus* subsp. *pygmaeus* (Rottb.) Asch. & Graebn.; Man; Eu.
 535. *Cyperus rotundus* L.; HA-LM-MA-Mam-Man-Ms-Op-R; Lc-S.
 536. *Eleocharis acicularis* (L.) Roem. & Schult.; HA-LM-MA-Man-R; Lc-U; Eu.
 537. *Eleocharis caduca* (Delile) Schult.; Ms; Lc-U.
 538. *Eleocharis multicaulis* (Sm.) Desv.; Man-R; Eu.
 539. *Eleocharis palustris* (L.) Roem. & Schult. subsp. *palustris*; As-HA-LM-MA-Mam-Man-Ms-Op-R; Eu.
 540. *Eleocharis quinqueflora* (Hartmann) O. Schwarz [*E. pauciflora* (Lightf.) Link]; HA-LM-MA-Man-R; Lc-S.
 541. *Eleocharis uniglumis* (Link) Schult.; HA-MA-Man; Lc-U.
 542. *Fimbristylis bisumbellata* (Forssk.) Bubani [*F. dichotoma* auct.]; LM-Mam-Man-R; Lc-S.
 543. *Fimbristylis dichotoma* L. Vahl; R; Lc-S; Eu.
 544. *Fuirena pubescens* (Poir.) Kunth; Man-R; Lc-U; Eu.
 545. *Isolepis cernua* (Vahl) Roem. & Schult. var. *cernua* [*Scirpus cernuus* Vahl.]; HA-LM-MA-Mam-Man-Op-R; Lc-S; Eu.
 546. *Isolepis pseudosetacea* (Daveau) Gand.; Man; Lc-U.
 547. *Isolepis setacea* (L.) R. Br.; HA-LM-MA-Mam-Man-Om-Op-R; Lc-U.
 548. *Mariscus hamulosus* (M. Bieb.) S. S. Hooper [*Cyperus hamulosus* M. Bieb.]; Mam-Man; Lc-U; Eu.
 549. *Pycnus flavescens* (L.) P. Beauv. ex Rchb. subsp. *flavescens* [*Cyperus flavescens* L.]; HA-LM-MA-Man-Om-Op-R.
 550. *Pycnus flavidus* (Retz.) T. Koyama; Man-R; Lc-U.
 551. *Pycnus mundtii* Nees [*Cyperus mundtii* (Nees) Kunth]; Mam-Man-Ms-R; Eu (Figure 20).
 552. *Pycnus polystachyos* (Rottb.) P. Beauv. var. *polystachyos* [*Cyperus polystachyos* Rottb.]; Man; Eu.



Figure 20. *Pycreus mundtii* Nees, Tihissass-Wadi, Chefchaouen (1995).

553. *Rhynchospora modesti-lucennoi* Castrov.; Man; MAR-DZA-TUN-ESP.PRT; E-D; Eu.
554. *Rhynchospora rugosa* subsp. *brownii* (Roem. & Schult.) T. Koyama [*R. brownii* Roem. & Schult., *R. glauca* Vahl, *R. rugosa* auct.]; Man; Lc-S; Eu.
555. *Schoenoplectiella supina* (L.) Lye; MA; Lc-U.
556. *Schoenoplectus corymbosus* (Roth ex Roem. & Schult.) J. Raynal; Man; Lc-U.
557. *Schoenoplectus lacustris* (L.) Palla [*Scirpus lacustris* L.]; HA-LM-MA-Mam-Man-Ms-R; Lc-S; Hm.
558. *Schoenoplectus subulatus* (Vahl) Lye [*S. litoralis* (Schrud.) Palla, *Scirpus litoralis* Schrad.]; LM-MA-Mam-Man-Ms-R; Lc-S; Hm-Pl (Figure 21).
559. *Schoenoplectus tabernaemontani* (C. C. Gmel.) Palla [*Scirpus lacustris* subsp. *glaucus* (Sm.) Hartm., *S. l.* subsp. *tabernaemontani* (C. C. Gmelin) Syme]; Man-R; Lc-S; Hm.
560. *Schoenus nigricans* L.; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-S; Eu-Hm.
- *Scirpoides holoschoenus* (L.) Soják [*Scirpus holoschoenus* L.]; All Morocco; Lc-U; Eu. It includes:
561. *S. holoschoenus* subsp. *australis* (Murray) Soják [*Scirpus holoschoenus* L. var. *australis* (Murray) Koch]; R.

Juncaceae

(Ennabili, 1999; Ennabili et al., 1996-1998-2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Ennabili &

Ater, 1996-1997-2005; Molero Briones & Montserrat Martí, 2006; Hammada, 2007; Molina et al., 2009; Chambouleyron, 2012; Rhazi et al., 2012; Libiad, 2013; Rankou et al., 2013; Valdés, 2013; Fennane et al., 2014; Libiad et al., 2012-2015; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).



Figure 21. *Schoenoplectus subulatus* (Vahl) Lye, Smir marsh, F'nideq-M'diq (1995). Close-up view of leaf blades in the former format "*Scirpus littoralis* Schrad. var. *genuinus* Maire f. *foliosus* Jah., Maire et Weiller", Moulouya river-mouth, Chararba-Sâidia (1994).

562. *Juncus* × *fallax* Trab.; R.
563. *Juncus acutiflorus* Ehrh. ex Hoffm.; LM-Man-Op-R.
- *Juncus acutus* L.; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-U; Hm. It includes:
564. *J. acutus* subsp. *acutus* [*J. acutus* Desf. subsp. *acutus*]; LM-Man-Om-Op-R; Hm.
565. *Juncus articulatus* L. [*J. lamprocarpus* Ehrh.]; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-S; Eu.
566. *Juncus bufonius* L. subsp. *bufonius*; LM-MA-Mam-Man-Ms-Op-R; Lc-S; Eu-Hm.
- *Juncus bulbosus* L.; Man-R; Lc-S. It includes:
567. *J. bulbosus* subsp. *kochii* (F. W. Schultz) Reichg.; Man.
568. *Juncus capitatus* Weigel; HA-LM-MA-Mam-Man-Ms-Op-R; Eu.
569. *Juncus conglomeratus* L.; Man-R; Lc-S; Eu.
570. *Juncus effusus* subsp. *effusus* [*J. effusus* var. *compactus* Lej. & Cout.]; MA-Man-Op-R.
571. *Juncus foliosus* Desf. [*J. bufonius* subsp. *foliosus* (Desf.) Maire &

- Weiller]; AA-LM-MA-Mam-Man-Op-R.
572. *Juncus fontanesii* J. Gay ex Laharpe; AA-HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-U; Eu.
- *Juncus gerardii* Loisel.; HA-MA; Eu-Hm. It includes:
573. *J. gerardii* subsp. *gerardii*; HA-MA; Eu-Hm.
574. *Juncus heterophyllus* Dufour; Mam-Man-R; Nt-D; Eu.
575. *Juncus hybridus* Brot.; LM-Man-Om-Op-R; Lc-U.
576. *Juncus inflexus* L.; AA-As-HA-LM-MA-Mam-Man-Op-R; Lc-U; Eu.
577. *Juncus maritimus* Lam.; Man-Ms; Eu-Hm.
578. *Juncus maroccanus* Kirschner; Man; MAR; CE-D.
579. *Juncus mogadorensis* (H. Lindb.) Förther & Podlech; Mam.
580. *Juncus punctorius* L. f.; As-HA-MA-Man-Ms-Op-R; Lc-U.
581. *Juncus pygmaeus* Rich.; HA-LM-MA-Mam-Man-R; Eu.
582. *Juncus rigidus* Desf. [*J. maritimus* auct. non Lam.]; All Morocco; Lc-U; Hm-Ha.
583. *Juncus sorrentinii* Parl.; Man-R; V-U.
584. *Juncus sphaerocarpus* Nees [*J. tenageia* subsp. *sphaerocarpus* (Nees) Trabut]; HA-MA-Mam-Man-R.
585. *Juncus squarrosus* L.; MA-Man-R.
586. *Juncus striatus* Schousb. ex E. Mey.; MA-Mam-Man-R; Lc-U.
587. *Juncus subnodulosus* Schrank [*J. obtusiflorus* Ehrh.]; HA-LM-MA-Ms-R; Lc-S; Eu.
588. *Juncus subulatus* Forssk [*J. subulatus* L.]; LM-Man-Ms-Op-R; Lc-S; Hm.
- *Juncus tenageia* L. f.; HA-LM-MA-Mam-Man-R; Lc-S; Eu. It includes:
589. *J. tenageia* L. f. subsp. *tenageia*; Man.
590. *Juncus tingitanus* Maire & Weiller; Man-R; MAR-ESP.PRT; E-D.
591. *Luzula forsteri* (Sm.) DC.; MA-Man-R.
592. *Luzula multiflora* (Ehrh.) Lej. subsp. *multiflora*; R.
- Poaceae**
(Ennabili, 1999; Ennabili et al., 1996-1998-2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Hammada et al., 2004; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Ennabili & Radoux, 2006; Euro+Med, 2006; Molero Briones & Montserrat Martí, 2006; Hammada, 2007; Molina et al., 2009; Chambouleyron, 2012; Khabbach et al., 2011-2012; Rhazi et al., 2012; Libiad, 2013; Valdés, 2013; Fennane et al., 2014; Libiad et al., 2011-2012-2015; El Madihi et al., 2017; IUCN, 2017; APB, 2020; Unpublished data).
593. *Aeluropus lagopoides* (L.) Trin. ex Thwaites; Ms; Ha.
594. *Aeluropus littoralis* (Gouan) Parl. [*A. l.* subsp. *vulgaris* (Coss. & Durieu) Maire, *A. littoralis* (Gouan.) Parl. var. *vulgaris* Coss. & Dur.]; LM-Mam-Man-Ms-Op-R; Ha.
595. *Agrostis canina* L.; R; Lc-S.
596. *Agrostis pourretii* Willd. [*A. salmantica* f. *pallida* (D. C.) Maire & Weiller, *A. perezii* Sennen, *A. salmantica* (Lag.) Kunth, *A. pallida* DC]; HA-LM-MA-Mam-Man-Om-Op-R; Eu.
597. *Agrostis rupestris* All.; HA.
598. *Agrostis schleicheri* Jord. & Verl.; HA.
599. *Alopecurus aequalis* Sobol.; LM-Man-R; Lc-U; Eu.
600. *Alopecurus arundinaceus* Poir.; AA-HA-MA-Man-Om-Op-R; Lc-U; Eu.
601. *Alopecurus liouvillianus* Braun-Blanq.; HA-MA; Eu.
602. *Antinoria agrostidea* (DC.) Parl.; Man; Lc-U; Eu.
603. *Arundo donax* L.; All Morocco; Lc-U; In.
604. *Arundo micrantha* Lam.; LM-Man-R.
605. *Briza media* L.; HA.
606. *Briza minor* L.; AA-HA-LM-MA-Mam-Man-Om-Op-R.
607. *Catabrosa aquatica* (L.) P. Beauv.; R; Lc-U.
608. *Chloris gayana* Kunth; LM-Mam.
609. *Crypsis aculeata* (L.) Aiton; LM-Mam-Man-Ms-Op-R; Hm.

610. *Crypsis alopecuroides* (Piller & Mitterp.) Schrad.; MA-Man; Lc-S.
611. *Echinochloa crus-galli* (L.) P. Beauv.; LM-Man-Op-R; Eu.
612. *Elytrigia embergeri* (Maire) Valdés & H. Scholz; HA; MAR.
613. *Eragrostis atrovirens* (Desf.) Trin. ex Steud. [*E. a.* var. *fontanesiana* Maire]; Man-R; MAR-DZA-MRT.
614. *Gaudinia fragilis* (L.) P. Beauv.; LM-MA-Man-Om-Op-R; Eu.
615. *Glyceria declinata* Bréb.; Man-R; Eu.
616. *Glyceria fluitans* (L.) R. Br.; Mam-Man-R; Lc-S; Eu.
617. *Glyceria notate* Chevall.; AA-HA-LM-MA-Mam-Man-Om-Op-R; Lc-S; Eu-Hm.
618. *Glyceria spicata* Guss.; LM-MA-Mam-Man-Op-R; Dd-U; Eu-Hm.
619. *Hemarthria altissima* (Poir.) Stapf & C. E. Hubb.; Man; Lc-S.
620. *Holcus annuus* C. A. Mey.; HA-MA-Man-R.
621. *Hordeum murinum* L.; LM-MA-Mam-Man-Om-Op-R; Lc-S.
622. *Lamarckia aurea* (L.) Moench; LM-MA-Mam-Man-Om-Op-R; Eu.
623. *Leersia hexandra* Sw.; Man-R; Eu.
624. *Leersia oryzoides* (L.) Sw. [*L. Hexandra* auct., *Oryza hexandra* Doell.]; Man-R; Lc-U; Eu.
625. *Linkagrostis juressii* (Link) Romero García & al.; Man-R; MAR-ESP.PRT; Eu.
626. *Lolium arundinaceum* (Schreb.) I. Darbysh. [*Schedonorus arundinaceus* (Schreb.) Dumort., *Festuca elatior* L., *F. arundinacea* Schreb.]; HA-LM-MA-Mam-Man-Om-Op-R.
627. *Lolium pratense* (Huds.) I. Darbysh. [*Schedonorus pratensis* (Huds.) P. Beauv., *Festuca pratensis* Hudson, *F. elatior* subsp. *pratensis* Hack., *F. pratensis* subsp. *pratensis*]; R.
628. *Micropyropsis tuberosa* Romero Zarco & Cabezudo; Man; MAR-ESP.PRT; E-D.
629. *Molinia caerulea* (L.) Moench; HA-Op-R; Eu.
630. *Nardus stricta* L.; HA-Man-R.
631. *Panicum repens* L. [*P. r. f. genuinum* Maire & Weiller, *P. r. L. f. glabrescens* Trabut]; LM-Man-Ms-Op-R; Lc-S; Eu-Hm.
632. *Parapholis filiformis* (Roth) C. E. Hubb. [*P. filiformis* (Roth) Trin., *Pholiurus incurvus* (L.) Schinz & Thell. subsp. *filiformis* (Roth.) A. Camus, *P. i.* subsp. *filiformis* (Roth.) A. Camus]; LM-Man-Op-R; Ha.
633. *Parapholis incurva* (L.) C. B. Hubb. [*Pholiurus incurvus* (L.) Schinz & Thell., *P. incurva* (L.) C. E. Hubbard]; Mam-Man-R.
634. *Paspalum dilatatum* Poir.; MA-Mam-Man-Op.
635. *Paspalum distichum* L. [*P. d.* subsp. *paspalodes* (Michaux) Thell, *P. paspalodes* (Michx.) Scribn.]; HA-LM-Mam-Man-Om-Op-R; Lc-U; In-N-Iv-Eu-Hm.
636. *Paspalum vaginatum* Sw. [*P. distichum* subsp. *vaginatum* (Swartz) Maire]; LM-Mam-Man-R; Lc-U; Hm.
637. *Phragmites australis* subsp. *altissimus* (Benth.) Clayton; Man.
638. *Phragmites australis* subsp. *australis* [*P. communis* Trin.]; LM-Ms-Op-R; Lc-S.
639. *Poa trivialis* L.; AA-HA-LM-MA-Mam-Man-Om-Op-R; Eu.
640. *Polypogon monspeliensis* (L.) Desf.; All Morocco; Lc-S; Eu.
- *Polypogon viridis* (Gouan) Breistr. [*Agrostis semiverticellata* (Forsk.) Christensen]; LM-MA-Man-Om-Op-R; Lc-S. It includes:
641. *P. viridis* subsp. *pauciflorus* H. Scholz & R. Otto; All Morocco; Eu.
642. *Pseudarrhenatherum longifolium* (Thore) Rouy; R.
643. *Puccinellia distans* (Jacq.) Parl.; R; Ha.
644. *Puccinellia fasciculata* (Torr.) E. P. Bicknell; AA-HA-LM-Mam-Man-Op-R; Ha.
645. *Puccinellia festuciformis* subsp. *convoluta* (Hornem.) W. E. Hughes

- [*P. expansa* (Crép.) Julià & J. M. Monts.]; LM-Man-R; Eu-Ha.
646. *Puccinellia festuciformis* subsp. *tenuifolia* (Boiss. & Reut.) W. E. Hughes [*P. stenophylla* Kerguelen, *P. tenuifolia* (Boiss. & Reuter) H. Lindb.]; Mam-Man-R; Eu-Ha.
647. *Puccinellia iberica* (Wolley-Dod) Tzvelev; Man; MAR-ESP.PRT; Ha.
648. *Puccinellia maritima* (Huds.) Parl.; Man; Ha.
649. *Setaria obtusifolia* (Delile) Morrone [*Paspalidium obtusifolium* (Delile) N. D. Simpson]; Mam; Eu.
650. *Setaria pumila* (Poir.) Roem. & Schult. [*S. lutescens* (Weig.) Hubbard]; LM-R.
651. *Sorghum halepense* (L.) Pers.; LM-Man-Op-R.
652. *Spartina densiflora* Brongn.; Man; Ha.
653. *Spartina maritima* (Curtis) Fernald [*S. m.* subsp. *stricta* (Ait) St-Yves, *S. stricta* (Aiton) Roth]; Man-R; Ha (Figure 22).



Figure 22. Exposed *Spartina maritima* (Curtis) Fernald, Tahaddarte-Wadi mouth, Asila-Tangier (1995). Exposed close-up view (upper left).

654. *Spartina versicolor* E. Fabre [*S. juncea* auct., *S. juncea* var *patens*]; Man-R; Ha.
655. *Sporobolus robustus* Kunth; AA-Ms; Hm.
656. *Tripidium ravennae* (L.) H. Scholz [*Erianthus ravennae* (L.) P. Beauv.]; HA-Mam-Man-Ms; Lc-S; Eu.
657. *Vulpia myuros* (L.) C. C. Gmel.; LM-MA-Man-Om-Op-R; Eu.

Typhaceae

(Ennabili, 1999; Ennabili et al., 1996-1998-2000; Valdés et al., 2002; Ennabili & Gharnit, 2003a-b; Ozenda, 2004; Ennabili & Ater, 1996-1997-2005; Ennabili & Radoux, 2006; Hammada, 2007; Khabbach et al., 2011-2012; Libiad, 2013; Fennane et al., 2014; Libiad et al., 2012-2015; IUCN, 2017; APB, 2020; Unpublished data).

658. *Sparganium erectum* subsp. *erectum*; Man-R.
659. *Sparganium erectum* subsp. *neglectum* (Beeby) K. Richt. [*S. e.* subsp. *neglectum* (Beeby) Schinz & Thell.]; Man-R; Pl (Figure 23).



Figure 23. *Sparganium erectum* subsp. *neglectum* (Beeby) K. Richt., Smir marsh, F'nideq-M'diq (1994). Inflorescence (upper right).

660. *Typha angustifolia* L.; LM-MA-Mam-Man-Om-Op-R; Lc-U; Hm-Pl.
661. *Typha domingensis* Pers. [*T. dominguensis* (Pers.) Steud., *T. angustifolia* subsp. *australis* (Schumach.) Graebn., *T. a.* subsp. *australis* Graebner]; HA-LM-MA-Mam-Man-Ms-Om-Op-R; Lc-S.
662. *Typha latifolia* L.; HA-LM-MA-Man-Ms-R; Lc-S; Eu-Hm.

LILIALES

Liliaceae

(Fennane et al., 2014; APB, 2020).

663. *Colchicum neapolitanum* (Ten.) Ten.; AA-HA-MA.

ASPARAGALES

Amaryllidaceae

(Valdés et al., 2002; Hammada, 2007; Fennane et al., 2014; APB, 2020).

664. *Narcissus viridiflorus* Schousb.;
Mam-Man-R; MAR-ESP.PRT; Nt-D;
Eu.

Iridaceae

(Ennabili & Ater, 1996; Ennabili et al., 1996; Ennabili, 1999; Valdés et al., 2002; Ennabili & Gharnit, 2003b; Hammada, 2007; Rankou et al., 2013; Fennane et al., 2014; IUCN, 2017; APB, 2020).

665. *Iris pseudacorus* L.; HA-LM-MA-Mam-Man-Om-R; Lc-S; Eu-Hm.
666. *Romulea antiatlantica* Maire; AA; MAR; CE-U.
667. *Romulea bifrons* Pau.; Mam-Man-R; MAR-ESP.PRT; Nt-D.

Discussion

The checklist of wetland vascular flora developed above includes 91 botanical families, 298 genera, 578 species, 89 subspecies, 4 varieties and one forma, i.e. 15.9% of the vascular flora of Morocco (Valdés et al. 2002) and 1.41 times more than the vascular flora of wetlands in Tunisia including transgressive species from terrestrial environments (Ghrabi-Gammar et al., 2009). Of the 17 introduced taxa (2.53% of the inventoried wetland flora), 6 are naturalized and 3 are invasive (Figure 24). Almost half of wetland plant taxa are represented by only 8 botanical families: Cyperaceae, Poaceae, Asteraceae, Fabaceae, Juncaceae, Ranunculaceae, Apiaceae, and Caryophyllaceae.

Some 109 endemic taxa (about 16.2% of the wetland vascular flora) were reported, from which 50.5% share endemism with the Iberian Peninsula, Algeria, Tunisia, Mauritania and/or the Canary Islands (Figure 24). Asteraceae, Brassicaceae, Apiaceae, Scrophulariaceae, Poaceae, Fabaceae, and Caryophyllaceae comprise 54.1% of endemic wetland-plant taxa.

In addition 301 taxa are on the IUCN Red List, of which Cyperaceae, Poaceae, Juncaceae, Ranunculaceae, Apiaceae, Asteraceae, Potamogetonaceae,

Orchidaceae

(Valdés et al., 2002; Chambouleyron, 2012; Valdés, 2013; Fennane et al., 2014; IUCN, 2017; APB, 2020).

668. *Dactylorhiza majalis* (Rchb.) P. F. Hunt & Summerh. [*D. elata* (Poir.) Soò]; AA-HA-MA-Mam-Man-Op-R; Lc-U; Eu.
669. *Dactylorhiza maurusia* (Emb. & Maire) Holub; LM-MA-R; MAR; E-U; Eu.
670. *Dactylorhiza vestita* (Lag. & Rodr.) Aver.; R.
671. *Platanthera algeriensis* Batt. & Trab.; HA-MA-Man-Op-R; Nt-U; Eu.
672. *Spiranthes aestivalis* (Poir.) Rich.; Man-R; Dd-D.

and Polygonaceae encompass more than 50%. Some 137 taxa on this Red List are almost at risk (population decreasing or with unknown status) in the absence of a specific conservation program for the taxon concerned. The taxa with critically endangered, endangered, near threatened and vulnerable status account for approximately 9.23% of the wetland flora enumerated above (Figure 24), and include about 25 strict-endemic taxa from Morocco and 16 regional-endemic ones.

Taxonomic richness, endemism of the wetland flora, and wetland plant taxa included in the IUCN Red List mark the North Atlantic Morocco and Rif areas. Referring to the taxa distribution, four floristic subdivision groups can be distinguished, “Man-R”, “MA-LM-Mam-HA-Op”, “Ms-Om-AA”, and “As” housing 68.5-69.6%, 33.0-43.2%, 13.2-16.5%, and 2.53% of the wetland inventoried per floristic region in the same order (Figure 24). Available data on wetland plant auto-ecology allowed identifying some 218 eutrophic taxa, followed by mesohalophilic, halophilic and sciaphile ones, and those tolerating polluted habitats (Figure 24), and consequently, constitutes real indicators of the changes undergone by local wetlands (Ennabili & Ater, 1997;

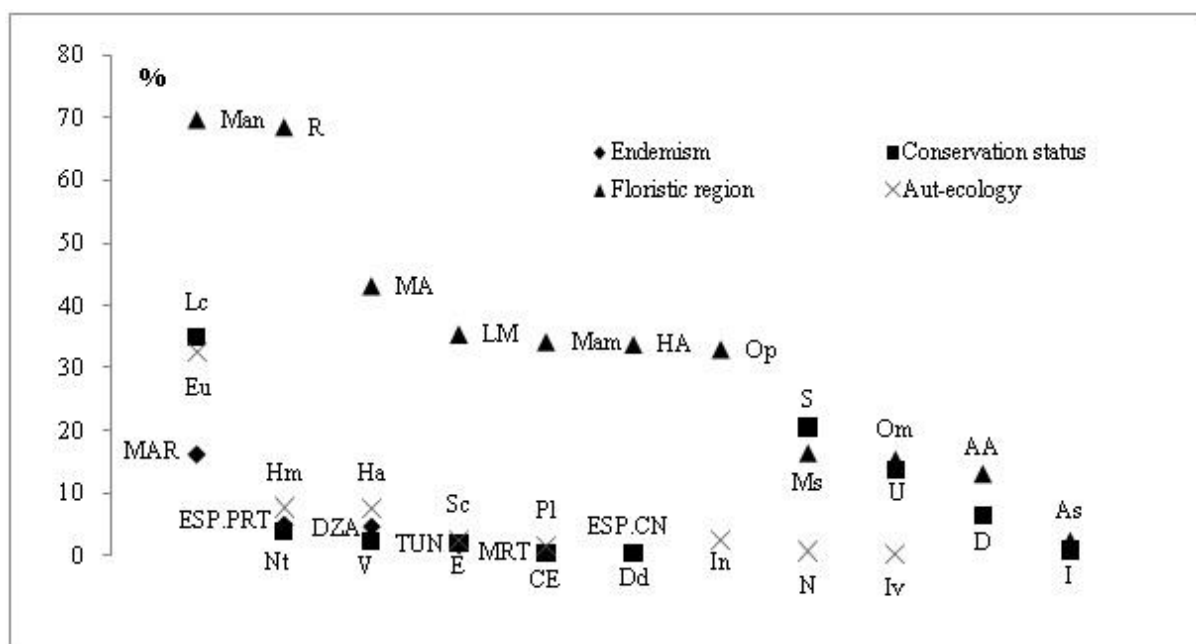


Figure 24. Descriptor importance of the wetland flora from Morocco. **Caption:** **Floristic divisions** - AA, Anti Atlas; As, Saharan Atlas; HA, High Atlas; LM, Mediterranean Coastline; MA, Middle Atlas; Mam, Middle Atlantic Morocco; Man, North Atlantic Morocco; Ms, Saharan Morocco; Om, Mountains of the Eastern Morocco; Op, Plateaus of the Eastern Morocco; R, Rif. **Taxa endemism** - MAR, Morocco; DZA, Algeria; ESP.CN, Canary Islands; ESP.PRT, Iberian Peninsula; MRT, Mauritania; TUN, Tunisia. **IUCN Red-List status** - CE, Critically endangered; E, endangered; Nt, near threatened; V, vulnerable; Lc, least concern; Dd, data deficient. **Population trend** - I, increasing; S, stable; D, decreasing; U, unknown. **Auto-ecology** - Eu, eutrophic; Hm, mesohalophilic; Ha, halophilic; In, introduced; Iv, invasive; Pl, tolerating polluted sites; Sc, sciaphile; N, naturalized.

Ennabili, 1999; Ennabili & Gharnit, 2003a; Libiad, 2013; Khabbach et al., 2019).

Additional data relating to the distribution, conservation status and / or autecology have been reported in species that have been represented by all their infra-specific taxa in the checklist above, namely:

- *Carex paniculata* L.; MA-Man-R; Lc-S.
- *Hypericum tomentosum* L.; LM-MA-Mam-Man-Op-R.
- *Montia fontana* L.; AA-LM-MA-Mam-Man; Lc-S.
- *Phragmites australis* (Cav.) Trin. ex Steud [*P. communis* var. *typicus* (Asch. & Gr.) Briquet]; All Morocco; Lc-S.
- *Plantago major* L.; HA-LM-Mam-Om-Op-R; Lc-U; Hm.
- *Ranunculus peltatus* Schrank; MA-Mam-Man-Op-R; Lc-S; Eu-Hm.
- *Sagina procumbens* L.; AA-Man-R.

- *Sisymbrella aspera* (L.) Spach; HA-Man-Om; Lc-S.
- *Sparganium erectum* L.; HA-MA; Lc-S; Eu-Pl.
- *Zannichellia palustris* L. [*Z. contorta* (Desf.) Cham. & Schltdl.]; HA-LM-MA-Mam-Man-Ms; Nt-D; Hm.

It was not possible to assign these data to one or the other respective infraspecific taxa, and clearly deserve verification of plant material. The following autonyms of the infraspecific taxa quoted are included in the IUCN Red List with least concern and stable population-trend status: *Cyperus michelianus* (L.) Link, *Juncus effusus* L., *Najas marina* L. [*N. major* All.], *Pycnus flavescent* (L.) P. Beauv. ex Rchb., and *P. polystachyos* (Rottb.) P. Beauv. It the same for *Eleocharis palustris* (L.) Roem. & Schult. [*E. palustris* (L.) R. Br., *Scirpus palustris* L.], which has least concern and unknown population-trend status.

Considering the 11 floristic divisions, the coverage of the wetland plant taxa on the IUCN Red List roughly shows an inverse proportionality of the degree of their threat of extinction, i.e. less threatened taxa mostly have a more limited distribution. However, more than a dozen

taxa strictly endemic to Morocco and covering only one phyto-geographical area out of 11 have not been qualified as 'at risk' taxa. These criteria could help on the definition of other hygrophytes threatened with extinction on a national scale.

Conclusion

According to the phytogeographical regions of Morocco, this work presents for the first time an updated list of the wetland vascular plants from Morocco accompanied, depending on data availability, by their status of endemism, conservation and autecology. It presents a decision support tool for any comprehensive environmental protection strategy by developing specific measures

for the conservation of wetland habitats of interest to plants.

This study highlighted also the significant phytodiversity of the Moroccan wetlands, increasing the need for their conservation. Endemic taxa of wetland flora and those on the IUCN red list in particular should be preserved in the short term through the urgent establishment of appropriate research and development programs and protective measures.

References

- APB (2020) African Plant Database (version 3. 4. 0). 'Conservatoire et Jardin botaniques de la Ville de Genève' and South African National Biodiversity Institute, Pretoria. <<http://www.ville-ge.ch/musinfo/bd/cjb/africa/>> "Accessed June 2020".
- Bagella S, Caria MC (2012) Diversity and ecological characteristics of vascular flora in Mediterranean temporary pools. *C. R. Biol.* **335**: 69–76. <https://doi.org/10.1016/j.crvi.2011.10.005>
- Benabid, A. (2000) Flore et écosystème du Maroc, évaluation et préservation de la biodiversité. Ibis Press & Editions Kalila Wa Dimna, Rabat.
- Bennig O (2004) Nouveaux matériaux pour la Flore du Maroc. *Bull. Inst. Sci. Rabat Sect. Sci. Vie* **26**: Fasc. 7.
- Benzyane M, Aafi A, Sbay H, El Antry S, Yassine M, Ilmen R, Ghailoule D (2010) Les écosystèmes naturels marocains et les changements climatiques, la résilience écologique à l'épreuve. Centre de la Recherche Forestière, Rabat.
- Carine MA, Rumsey FJ, Ait-Lafkih M, Rejdali M, Rutherford RW, Jury SL (2006) New plant collections from the north morocco checklist area. *Lagascalia* **26**: 196–218.
- Chambouleyron M (2012) Contribution a la connaissance de la flore de la péninsule tingitane (Maroc). *Lagascalia* **32**: 35–227.
- Douville C, Zambettakis C, François R, Dardillac A, Gourvil J, Filoche S, Millet J (2016) Livret d'accompagnement des deux recueils de fiches "flore" et "végétations" caractéristiques des zones humides du bassin Seine-Normandie. Agence de l'Eau Seine-Normandie, France.
- El Madihi M, Rhazi L, Van den Broeck M, Rhazi M, Waterkeyn A, Saber E, Bouahim S, Arahou M, Zouahri A, Guelmami A, Muller SD, Brendonck L, Grillas P (2017) Plant community patterns in Moroccan temporary ponds along latitudinal and anthropogenic disturbance gradients. *Plant Ecol. Divers.* **10(2-3)**: 197–215. <https://doi.org/10.1080/17550874.2017.1346716>
- Ennabili A, Ater M (1996) Flore (Pteridophyta et Spermatophyta) des zones humides du Maroc méditerranéen. Inventaire et écologie. *Acta Bot. Malacit.*

- 21:** 221–239. <https://doi.org/10.24310/abm.v21i0.8677>
- Ennabili A, Ater M (1997) Phytoécologie et productivité de quelques macrophytes du marais Smir (Tétouan, Maroc). *Trav. Inst. Sci. Rabat, Mém. Hors-sér.*: 27–37. <https://doi.org/10.6084/m9.figshare.13019474.v1>
- Ennabili A, Ater M (2005) Diversité floristique et production de biomasse des macrophytes des marais de Smir. *Trav. Inst. Sci. Rabat, Sér. Gén.* 5: 17–25. <https://doi.org/10.6084/m9.figshare.12943091.v1>
- Ennabili A, Gharnit N (2003a) Effets d'aménagements du littoral tétouanais (Nord-ouest du Maroc) sur la végétation hygrophile (Spermatophyta). *Acta Bot. Barc.* **48**: 199–216.
- Ennabili A, Gharnit N (2003b) Checklist and diversity of wetland flora (Pteridophyta and Spermatophyta) from the Mediterranean Morocco. *Lagascalia* **23**:7–25.
- Ennabili A, Radoux M (2006) Teneurs en Azote, Phosphore et Potassium (NPK) d'hygrophytes au Maroc Méditerranéen. *Acta Bot. Barc.* **50**: 459–464.
- Ennabili A (1999) Végétation hygrophile du Maroc Méditerranéen: écologie, socio-économie et rôle potentiel dans l'épuration des eaux usées. Dissertation, Université de Liège. <https://dx.doi.org/10.13140/RG.2.2.15553.79209>
- Ennabili A, Ater M, Radoux M (1998) Biomass production and NPK retention in macrophytes from wetlands of the Tingitan Peninsula. *Aquat. Bot.* **62**: 45–56. [http://dx.doi.org/10.1016/S0304-3770\(98\)00075-8](http://dx.doi.org/10.1016/S0304-3770(98)00075-8)
- Ennabili A, Ater M, Radoux M (2000) Biomasse et accumulation des NPK chez *Scirpus litoralis* Schrader et *Scirpus maritimus* L. aux marais Smir-Negro (NW du Maroc). *Acta Bot. Barc.* **46**: 239–250.
- Ennabili A, Nabil L, Ater M (1996) Importance socio-économique des hygrophytes au Nord-ouest du Maroc. *Al Biruniya* **12 (2)**: 95–120. <https://doi.org/10.6084/m9.figshare.12941951.v1>
- Euro+Med. (2006-) Euro+Med Plant Base, the information resource for Euro-Mediterranean plant diversity. <<http://www.bgbm.org/EuroPlusMed/>> “Accessed April 2018”.
- Ezzahri J, Ennabili A, Radoux M (2010) Artificial ecosystems for wastewaters treatment under Mediterranean conditions (Morocco). *Biol. Divers. Conserv.* **3(2)**: 145-150.
- Ezzahri J, Ennabili A, Ater M, Radoux M (2001) Epuration des eaux usées urbaines: Expérimentation sous climat méditerranéen (M'Diq, Nord-ouest du Maroc). *Annl. Chim. Sci. Mater.* **26**: S297–S311.
- Fennane M, Ibn Tattou M, El Oualidi J (Eds) (2014) Flore pratique du Maroc-Manuel de détermination des plantes vasculaires (Volume 3). *Trav. Inst. Sc., Sér. Bot.* N°40, Rabat.
- Fennane M, Ibn Tattou M, Mathez J, Ouyahya A, El Oualidi J (Eds) (1999) Flore pratique du Maroc-Manuel de détermination des plantes vasculaires (Volume 1). *Trav. Inst. Sc., Sér. Bot.* N°36, Rabat.
- Fennane M, Ibn Tattou M, Ouyahya A, El Oualidi J (Eds) (2007) Flore pratique du Maroc-Manuel de détermination des plantes vasculaires (Volume 2). *Trav. Inst. Sc., Sér. Bot.* N°38, Rabat.
- Ghrabi-Gammar Z, Daoud-Bouattour A, Ferchichi H, Mokhtar Gammar A, Muller SD, Rhazi L, Ben Saad-Limam S (2009) Flore vasculaire rare, endémique et menacée des zones humides de Tunisie. *Rev. Écol. (Terre Vie)* **64**: 19–40.
- Hammada S (2007) Etudes sur la végétation des zones humides du Maroc: Catalogue et analyse de la biodiversité floristique et identification des principaux groupements végétaux. Dissertation, Université Mohammed V, Rabat.
- Hammada S, Dakki M, Ibn Tattou M, Ouyahya A, Fennane M (2004) Analyse de la biodiversité floristique des zones

- humides du Maroc. Flore rare, menacée et halophile. *Acta Bot. Malacit.* **29**: 43–66. <https://doi.org/10.24310/abm.v29i0.7226>
- HCP (2006) Gestion durable des ressources naturelles et de la biodiversité au Maroc, Prospective "Maroc 2030". HautCommissariat au Plan, Maroc. <www.hcp.ma/file/111439/> "Accessed April 2012".
- IUCN (2017) The IUCN (International Union for Conservation of Nature) Red List of Threatened Species. Version 2017-3. <<http://www.iucnredlist.org>> "Accessed April 2018".
- Jiménez-Mejías P, Luceño M, Castroviejo S (2007) *Schoenoplectus corymbosus*: A tropical Old-World sedge (Cyperaceae) discovered in Spain and Morocco. *Nord. J. Bot.* **25**(1-2): 70–74. https://doi.org/10.1111/j.0107-055X.2007.00007_26.x
- Khabbach A (2013) Valeurs et services de la phytodiversité (Spermatophyta) dans la zone pré-Rifaine, Province de Taza (Nord-ouest du Maroc). Dissertation, Université Sidi Mohamed Ben Abdellah, Fès.
- Khabbach A, Libiad M, Ennabili A (2011) Plant Resources Use in the Province of Taza (North of Morocco). *ProEnviron.* **4**(8): 347–356.
- Khabbach A, Libiad M, Ennabili A (2019) Invasion increasing risk of Al Jawahir Wadi lentic habitats by *Pistiastratiotes* L. (North-Central Morocco). *Bot. Complut.* **43**: 97-107. <https://orcid.org/0000-0003-0133-1920>
- Khabbach A, Libiad M, Ennabili A, Bousta D (2012) Medicinal and cosmetic use of plants from the Province of Taza, Northern Morocco. *Bol. Latinoam. Caribe Plants Med. Aromat.* **11**(1): 46–60.
- Libiad M (2013) Intégration de la phytodiversité dans la gestion des eaux de surface. Cas du bassin versant de l'oued Inaouène et environs (Nord-ouest du Maroc). Dissertation, Université Sidi Mohamed Ben Abdellah, Fès.
- Libiad M, Khabbach A, Ennabili A (2011) Exploitation of plants from upstream of the Sebou-wadi watershed (province of Taounate, North of Morocco). *Biol. Divers. Conserv.* **4**(2): 81–91.
- Libiad M, Khabbach A, Ennabili A (2012) Végétation ripicole et gestion des eaux de surface, cas du bassin versant de l'Oued Inaouène (NO du Maroc). *Rev. Associ. Nord Maroc* **6-8**: 35–63. <https://doi.org/10.6084/m9.figshare.12941873.v1>
- Libiad M, Khabbach A, Ennabili A (2015) Etat de la végétation riveraine des cours d'eau du bassin versant de l'oued Inaouène (NO du Maroc). *J. Mater. Environ. Sci.* **6**(1): 34–45. <https://doi.org/10.6084/m9.figshare.12939611.v1>
- Maman L, Laurent V (2010) Les zones humides, un patrimoine remarquable. *Geosci.* <**hal-00663290**>: 68-77.
- Molero Briones J, Montserrat Martí JM (2006) Novedades corológicas y taxonómicas selectas para el catálogo de la flora vascular del norte de marruecos. *Lagascalia* **26**: 83–110.
- Molina JA, Tahiri H, Agostinelli E, El Alaoui-Faris FE, Lumbreras A, Pardo C, Silva V, Pinto-Cruz C, Castoldi E, Campoamor JN (2009) Contribución al conocimiento de la flora y vegetación de los humedales temporales del NO de Marruecos. *Lazaroa* **30**: 251–259.
- Ozenda P (2004) Flore et végétation du Sahara. : CNRS, Paris. 670 pp.
- Rankou H, Culham A, Jury SL, Christenhusz MJM (2013) The endemic flora of Morocco. *Phytotaxa* **78**(1): 1–69. <http://dx.doi.org/10.11646/phytotaxa.78.1.1>
- Rhazi L, Grillas P, Saber E, Rhazi M, Brendonk L, Waterkeyn A (2012) Vegetation of Mediterranean temporary pools: a fading jewel? *Hydrobiol.* **689**: 23–36. <https://doi.org/10.1007/s10750-011-0679-3>
- Shine C, de Klemm C (1999) Wetlands, water and the law. Using law to advance wetland conservation and wise use. IUCN, Gland, Switzerland, Cambridge, UK and Bonn, Germany.

Valdés B (2013) Checklist of the vascular plants collected during the fifth “Iter Mediterraneum” in Morocco, 8-27 June, 1992. *Bocconeia* **26**: 13–132. doi: 10.7320/Bocc26.013

Valdés B, Rejdali M, Achhal El kadmiri A, Jury JMSL, Montserrat M (Eds) (2002) Checklist of vascular plants of N Morocco with identification keys. CSIC, Madrid.