

CHECKLIST AND DIVERSITY OF WETLAND FLORA (PTERIDOPHYTA AND SPERMATOPHYTA) FROM THE MEDITERRANEAN MOROCCO

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Resumen. Los humedales mediterráneos de Marruecos están desapareciendo especialmente debido al drenaje y la contaminación, que afectan claramente a la flora hidrófila. Se ha establecido en un inventario de las *Pteridophyta* y *Spermatophyta* de los humedales del Marruecos mediterráneo basado en 129 estaciones. Este inventario comprende 141 géneros y 232 especies correspondientes a 70 familias. A nivel infraspecífico, se han reconocido 12 subespecies y 2 variedades. Se indica la distribución y el tipo de hábitat de cada taxón. Se dan varias citas nuevas para diversas regiones naturales del N de Marruecos.

Summary. The Mediterranean wetlands of Morocco are regressing mainly because of draining and pollution, which obviously affect wetland flora. A checklist of wetland *Pteridophyta* and *Spermatophyta* of the Mediterranean Morocco was established on base of 129 studied sites. It comprises 141 genera and 232 species corresponding to 70 families. At infraspecific level, 12 subspecies and 2 varieties are recognised. The present paper underlines also site distribution and habitat type of each identified taxon. New records for several natural areas of N Morocco are given.

INTRODUCTION

Wetlands are of ecological, scientific, socio-economic and ethic interests (TACCONI & BENNETT, 1995). In addition to some continental sites, Mediterranean wetlands of Morocco (Moulouya river mouth, sebkha of Bou Areg, Tahaddarte river, cirque of Al Jebha, Ghomara coast, lagoon and barrage of Smir) form part of the National SIB (sites of biological and ecological interest) network essentially for migratory birds (e.g. BEAUBRUN & THEVENOT, 1984; BCEOM-SECA, 1994).

Contrary to Atlantic wetlands, only some general studies have been undertaken on Mediterranean macrophytes or wetland plants (DE LA TORRE, 1956; BENABID 1983, 1984; BOUKIL, 1986). The aim of this paper is to present a reviewed and completed Mediterranean Morocco wetland flora (*Pteridophyta* and *Spermatophyta*) here understood as the plants adapted to environments as defined in the convention of RAMSAR (1971) and amended by the protocol of Paris (1982), which French version is: "Les zones humides sont les étendues de marais, de fagnes, de tourbières ou d'eaux naturelles ou artificielles, permanentes ou temporaires, où l'eau est stagnante ou courante, douce, saumâtre ou salée, y compris des étendues d'eau marine dont la profondeur à marée basse n'excède pas six mètres". The paper includes also plants which occurs in areas accidentally or exceptionally immersed, such as *Ruscus hypophyllum*, *Agrostis stolonifera*, *Briza maxima*, etc., which are indicated in the checklist as sometimes emergent.

STUDY AREA

The study area falls between 34,5°-36° N and 2°-7° W including 11 chief towns of the Mediterranean Morocco (Fig. 1). All Mediterranean bioclimatic stages, except the Saharian, are represented in the area. The arid bioclimate predominates in the Eastern part of the study area, which is dryer than the Western part. The Thermo-mediterranean vegetation stage dominates, followed successively by Meso-, Supra-, Mountain- and Oro-Mediterranean ones (Achhal & al., 1980; Benabid, 1983, 1984). Soils of the studied wetlands studied have mainly clay, clay-sandy, sandy or sludgy textures. The substratum of upstream banks and sources is formed mainly by sandstones, pelites, schistes, limestones, conglomerates or peridotites.

The natural and/or disturbed wetlands of the study area represent lakes, lagoons, marshes, sebkhas, sources, peat bogs and wadis, while the artificial wetlands include mainly barrages, sewage farms and irrigated zones.

MATERIAL AND METHODS

Plant material was regularly collected from 1994 to 1998 in 129 sampling localities (see Fig. 1).

Plants were identified with the help of MAIRE (1952-1980), NÈGRE (1961), QUEZEL & SANTA (1962-63), FOURNIER (1977) and FENNANE & al. (1999). Plant material is kept in the herbarium of the Department of Biology of the Faculty of Sciences, Abdelmalek Essaâdi University.

For the arrangement of families, TUTIN & al. (1993) has been followed for *Pteridophyta*, and CRONQUIST (1981) for Angiosperms. Within each family, genera and species are arranged alphabetically.

Nomenclature for the species and subspecies follows VALDÉS & al. (2002). Each recognised taxon is followed by some indications on the habitat where it occurs and the numbers of the localities where it has been collected which names and locations are indicated in fig. 1.

In order to indicate type of habitat the following abbreviations have been used:

F, floating macrophyte;

FS, floating-submerged macrophyte wholly submerged and generally rooted in the bottom;

SE, sub-emergent macrophyte with the above ground part partially submerged;

E, emergent macrophyte with the above ground part wholly emerged;

I, introduced and/or naturalised macrophyte;

PT, tolerance of pollution by nitrates, wastes or wastewater;

S, macrophyte adapted to shade circumstances;

ST, saltiness tolerance.

RESULTS

1. SELAGINELLACEAE

Selaginella denticulata (L.) Spring; E, S; 89, 94.

2. EQUISETACEAE

Equisetum ramosissimum Desf. subsp. *ramosissimum*; E; 5, 12, 69-70, 88, 103-106, 121.

E. telmateia Ehrh.; E; permanent brooks; 19, 87.

3. OPHIGLOSSACEAE

Ophioglossum lusitanicum L.; E; temporary pools of sandy grounds; 35, 60.

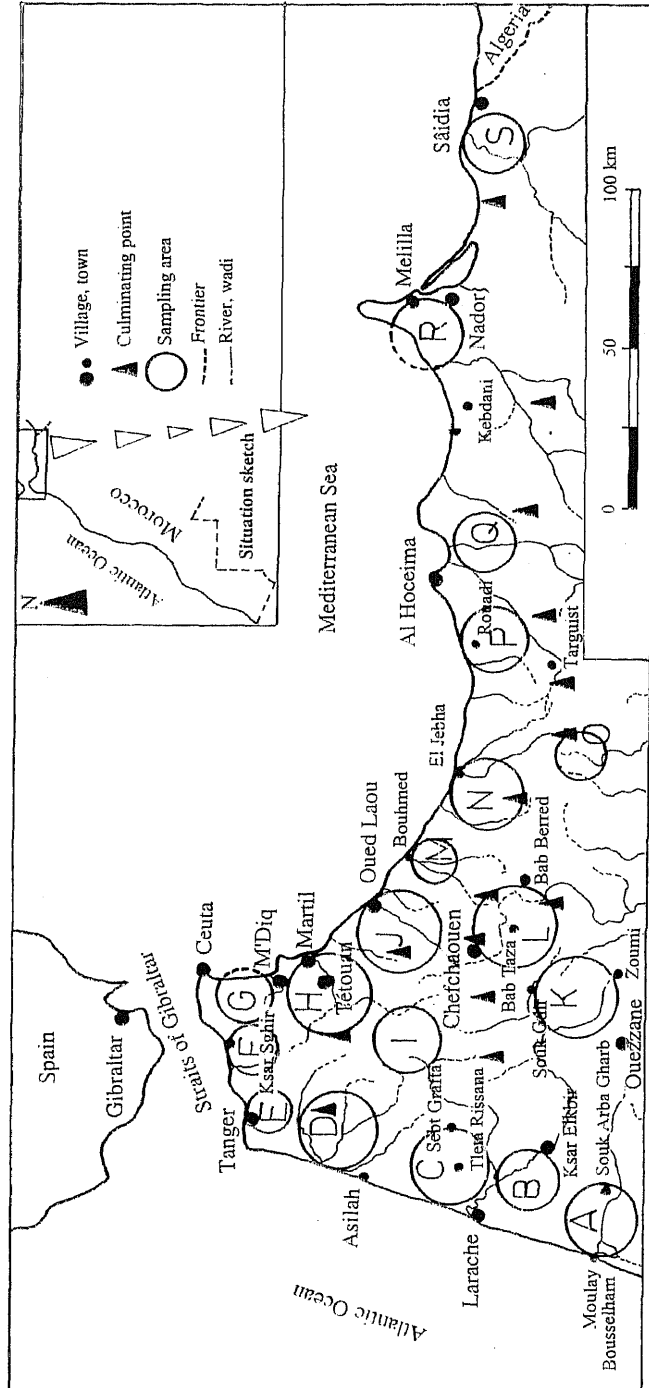
4. OSMUNDACEAE

Osmunda regalis var. *plumieri* (Tausch) Milde; E, S; especially siliceous grounds; 13, 19, 35, 75.

5. ADIANTACEAE

Adiantum capillus-veneris L.; E, S; oozing rocks; 47, 66, 78, 83, 87, 94, 102, 108.

Anogramma leptophylla (L.) Link (= *Gymnogramma leptophylla* (L.) Desv.); E; rocks; 61.



6. PTERIDACEAE

Pteris vittata L. ; E; littoral; 50.

7. POLYPODIACEAE

Polypodium cambricum L. (= *P. vulgare* L.); E, often S, xerophilous; on *Quercus faginea* trees; 47, 75.

8. HYPOLEPIDACEAE

Pteridium aquilinum (L.) Kuhn; E; sometimes on calcareous grounds, forests; 5, 8-11, 39, 47, 75, 79-80, 87-88, 114.

9. ASPLENIACEAE

Asplenium adiantum-nigrum L.; E, S; often non-calcareous rocks; 47, 49, 68, 75.

A. ceterach L.; E, xerophilous; rocks, old walls; 47, 68.

A. hemionitis L.; E; non-calcareous rocks; 47, 49.

A. trichomanes subsp. *quadrivalens* D.E. Meyer; E, S; rocks, old walls; 47.

10. DRYOPTERIDACEAE

Polystichum aculeatum (L.) Roth; E; rocks, forests; 75.

Dryopteris filix-mas (L.) Schott; E; siliceous mountains; 47.

11. DAVALLIACEAE

Davallia canariensis (L.) Sm.; E; on *Olea europaea* and *Quercus suber* trees, sandy rocks, from littoral to sublittoral; 47-48, 60.

Fig. 1. Study area. Toponomy of studied sites. (A) : 1. Merja Zerga, 2. Mghitiine Zwawka, 3. Aïn Tisswat Zawia, 4. Dekhla Moulay Bousselham, 5. Sidi Boubker El Haj, 6. Oulad Ammar Zwiten, 7. Ouled Mesbah, 8. Sebt Lalla Mimouna. (B) : 9. Tawra, 10. Ouled Sbih, 11. Ouled Abid, 12. Aïn Chouk, 13. Dhira, 14. Lâwamra, 15. wadi El Ma, 16. Boucharene, 17. Sidi Messâoud. (C) : 18. mouth of wadi Loukkos, 19. cork-oak forest of Khmis Sahel, 20. wadi Nehma, 21. Marj Hlal, 22. Tleta Rissana, 23. Sebt El Grafta, 24. Lahra. (D) : 25. mouth of wadi Ghrifa, 26. Tleta Jbel H'Bib, 27. Nâimyine, 28. Had El Gharbia, 29. mouth of wadi Tahaddarte, 30. Daya Sghira. (E) : 31. Charf, 32. Malabata, 33. Gzinnaya, 34. Cap Spartel, 35. diplomatic forest, 36. wadi Msabene Sania. (F) : 37. wadi Lediane, 38. Ksar Sghir. (G) : 39. Aazfa, 40. Rifiine, 41. Negro, 42. Frassou, 43. El Jerf, 44. Fersiwa, 45. Restinga, 46. Allyine, 47. El Hawz, 48. El Kouf, 49. Belwazene, 50. El Bayine, 51. Dhar Boukar, 52. Beni Salem, 53. wadi Ellile, 54. Lâonçar, 55. Rmali, 56. Jâabak, 57. Bouzaghla, 58. Smir, 59. M'Diq, 60. Jbel Zemzem, 61 SW of Smir barrage. (H) : Cabo Negro, 63. wadi Malah, 64. wadi Martil, 65. Koudiat Taïfour, 66. suburbs of Tetouan city, 67. Koelma, 68. Jbel Ghorghiz, 69. M'Hannech, 70. Bouânane, 71. El Fendek, 72. M'Hajrate, 73. wadi Amsa. (I) : 74. wadi El Kbir, 75. Jbel Alam. (J) : 76. Azib Merja wadi Law, 77. Zoco Sebt Beni Sâïd, 78. Wadi Law, 79. Targha, 80. wadi Tirines, 81. Talambote barrage. (K) : 82. Zoumi, 83. Alma, 84. wadi Abdallah, 85. Aniçar Messous, 86. L'Tawa, 87. Metmoura, 88. Outa El Messari, 89. Chebtal, 90. Tizgane. (L) : 91. Sifillaw, 92. Grankha, 93. Aïn Errami, 94. Zourak, 95. Ressana, 96. Moulay Bouchta Dara Kobaâ, 97. Souk El Gdir, 98. Bab Taza, 99. Bab Berred, 100. Tiriwane. (M) : 101. Bouhmed, 102. wadi Kannar Icheritene, 103. wadi Kannar Souk El Had, 104. wadi Tihissas, 105. Sihat, 106. Chmaïla, 107. wadi Ichendirene, 108. wadi Sidi Arabene. (N) : 109. El Jebha, 110. wadi Amter, 111. Jnane Niche, 112. mouth of wadi Ouringa, 113. wadi Tazemmort, 114. Ouzaghar. (O) : 118. Kétama, 119. Issaguene. (P) : 115. Ras Alkala, 116. wadi Beni Boufrah, 117. Bakywa. (Q) : 120. wadi Tazarien, 121. wadi Nekor Tamellaht, 122. M.A. El Khattabi barrage. (R) : 123. wadi Kert Hammam, 124. Kariat Akermane, 125. Idouhdouhane. (S) : 126. Ras Elma, 127. Sâïda, 128. Aïn Beïda, 129. wadi Moulouya Chararba.

12. BLECHNACEAE

Blechnum spicant (L.) Roth; E, S; forests of siliceous mountains; 75, 95.

13. LAURACEAE

Laurus nobilis L.; E; often near sources of low and medium altitudes; 49, 89-90, 95, 102.

14. NYMPHAEACEAE

Nymphaea alba L.; FS; calm or dormant waters; 13, 16.

15. RANUNCULACEAE

Clematis vitalba L.; sometimes E; wet ravines of mountains, fresh forests; 102.

Ranunculus peltatus Schrank (= *R. aquatilis* auct.); FS; fresh or brackish waters; 47, 58.

R. arvensis L.; E; 58, 69-70.

R. ficaria subsp. *ficariiformis* Rouy & Fouc.; E; 47, 49.

R. macrophyllus Desf.; E; fresh places; 58, 60.

R. muricatus L.; E; 58.

R. trilobus Desf.; E; stagnant fresh waters; 36, 41, 58.

16. CORIARIACEAE

Coriaria myrtifolia L.; E; 78, 94, 102, 104.

17. MORACEAE

Ficus carica L.; sometimes E; spontaneous or cultivated; 78, 83.

18. BETULACEAE

Alnus glutinosa (L.) Gaertn.; E; especially siliceous wet valleys; 75, 91-95, 118.

19. CHENOPODIACEAE

Halimione portulacoides (L.) Aellen (= *Atriplex portulacoides* L.); E, ST; 18, 29.

Chenopodium chenopodioides (L.) Aellen; E, ST; 104.

Sarcocornia fruticosa (L.) A. J. Schott (= *Arthrocnemum fruticosum* (L.) Moq.); E, ST; 23, 29, 58, 63-64, 124, 129.

Sarcocornia perennis (Mill.) A. J. Schott (= *Arthrocnemum perenne* (Mill.) Moss); E, ST; 29, 36, 41, 46, 58, 64.

Suaeda albescens Lázaro Ibiza (= *S. maritima* auct.); E, ST; 18, 29.

20. CARYOPHYLLACEAE

Corrigiola litoralis L.; E; sandy sites; 19.

Illecebrum verticillatum L.; E; siliceous sites; 19.

21. POLYGONACEAE

Polygonum equisetiforme Sm.; sometimes E; pasture lands, fields; 29, 41, 58, 80.

P. lapathifolium L.; E, PT; 58, 63-64, 78, 93, 104-106, 121.

P. persicaria L.; E; 75, 103.

- Rumex bucephalophorus* L.; E; 41, 46, 58-59.
R. conglomeratus Murray; E; 36, 58, 78, 91, 103.
R. crispus L.; E; 41, 46, 58, 114.
R. palustris Sm.; E; 58.
R. pulcher L.; E; 19, 41, 58.

22. PLUMBAGINACEAE

- Limoniastrum monopetalum* (L.) Boiss.; sometimes E, ST; 29.
Limonium cymuliferum (Boiss.) Sauvage & Vindt; sometimes E, ST; 29.
L. ferulaceum (L.) Chaz.; sometimes E, ST; littoral; 18, 25, 29, 36, 41, 46, 58, 63-64.
L. gummiferum (Durieu ex Boiss. & Reut.) Kuntze; sometimes E, ST; 121, 129.

23. MALVACEAE

- Lavatera trimestris* L.; E; 78.

24. TAMARICACEAE

- Tamarix africana* Poir.; E, PT; fresh or brackish places; 36, 41, 58, 69, 78, 91-94, 97, 121, 123.
T. canariensis Willd.; E; 104.
T. gallica L.; E, PT; fresh or brackish places; 37, 41, 58, 64, 67, 69, 72, 78-80, 91, 93-94, 97, 104, 123, 125-127, 129.

25. SALICACEAE

- Populus alba* L.; E, I, PT; water edges; 69-70, 73, 78, 83, 94, 120-121.
P. euphratica Oliver; E, sometimes ST; riverbeds; 129.
P. nigra L.; E, I, PT; fresh water edges; 17, 69, 73, 78, 102, 104, 107-108, 121.
Salix alba L.; E; fresh water edges; 17, 41-42, 69-70, 75, 87-88.
S. atrocinerea Brot.; E; 100, 118-119.
S. pedicellata Desf.; E, especially river beds within forest areas; 15, 19, 21, 41-42, 48, 57, 70, 75, 78, 91, 93-94, 86-87, 107, 114.
S. purpurea L.; E, PT; 37, 57, 69-70, 91, 102.

26. CRUCIFERAE

- Rorippa nasturtium-aquaticum* (L.) Hayek (= *Nasturtium officinale* R. Br.); FS, SE; common in low and medium altitudes; 47, 49, 89-90, 104, 107-108.

27. ERICACEAE

- Erica ciliaris* L.; E; particularly in peat bogs, non-calcareous sites; 19, 60.

28. PRIMULACEAE

- Anagallis crassifolia* Thore; E; 19, 58, 75, 78, 91-95.
Samolus valerandi L.; E; sometimes brackish sites; 58, 87-89, 102-108, 121, 125.

29. ROSACEAE

- Crataegus laciniata* Ucria; E; medium and high altitudes; 114.
C. monogyna Jacq.; sometimes E; submountainous brushwood, forests; 19, 37, 55, 69-70, 75, 87, 94, 107.
Potentilla erecta (L.) Räsch.; E, sometimes SE; lawns, heather, peat bogs; 19.
P. micrantha Ramond ex DC.; E, S; 114.
P. reptans L.; E; sources, brooks; 47.
P. lusitanica L.; E; siliceous wet valleys; 75, 95.
Rosa sempervirens L.; E; brushwood; 19, 44, 55, 74, 78, 87, 93-94, 102.
Rubus ulmifolius Schott; E; especially brushwood of wadi beds; 15, 17, 33, 36, 43, 52-53, 55, 69-70, 75, 78-80, 83, 86-87, 93-94, 99, 102, 108, 110-111, 114, 121.

30. LEGUMINOSAE

- Dorycnium rectum* (L.) Ser.; E; riparian forests; 36, 91.
Lotus palustris Willd.; E; 114.
L. hispidus DC.; E; 41, 58.
Trifolium isthmocarpum Brot.; E; 30, 41, 58.

31. LYTHRACEAE

- Lythrum borysthenicum* (Schrank) Litv.; E; 47.
L. hyssopifolia L.; flooded and disturbed zones; E; 47.
L. junceum Banks & Sol.; E; 19, 27-28, 36, 41, 43, 58, 60, 65-66, 69-70, 78, 84, 87-88, 92, 98, 104, 121.
L. portula (L.) D.A. Webb; E, sometimes SE; shallow waters, non-calcareous sites; 19.
L. salicaria L.; E; 58.
L. tribracteatum Salzm. ex Spreng.; E; flooded sites; 13-14, 75, 91.

32. THYMELAEACEAE

- Daphne laureola* L.; sometimes E; wet forests; 114.

33. ONAGRACEAE

- Epilobium parviflorum* Schreb.; E; 41-42, 78, 104-106.
E. tetragonum subsp. *lamyi* (F. W. Schultz) Nyman; E; 89, 94.
Ludwigia palustris (L.) Elliott; FS, SE; 75.

34. AQUIFOLIACEAE

- Ilex aquifolium* L.; E; wet valleys; 75.

35. EUPHORBIACEAE

- Euphorbia hirsuta* L. (= *E. pubescens* Vahl); E; 58, 121.

36. RHAMNACEAE

- Frangula alnus* Mill.; E; forests; 13, 19, 75.

37. VITACEAE

Vitis vinifera subsp. *sylvestris* (C.C. Gmelin) Hegi; E; riparian forests, brushwood; 19, 44, 55, 75, 78.

38. GERANIACEAE

Geranium dissectum L.; E; 117.

39. UMBELLIFERAE

Apium nodiflorum (L.) Lag.; PT, SE; fresh or brackish waters; 19, 36, 58, 75, 78, 84, 87-88, 91, 95, 102-104, 107-108, 125.

Daucus carota L. subsp. *carota*; E; 36.

Eryngium corniculatum Lam.; SE; temporary pools; 46.

Smyrniolum olusatrum L.; sometimes E, PT, S; edges, rocks, ruins; 69-70.

40. GENTIANACEAE

Blackstonia perfoliata L.; sometimes E; 87, 89-90.

Centaurium maritimum (L.) Fritsch; sometimes E; 61.

C. pulchellum (Sw.) Druce; E; 19, 36, 41, 58, 69-70, 78-80, 87-88, 121, 129.

C. spicatum (L.) Fritsch.; E; 36, 41, 58-59, 69-70, 78, 85, 104-106, 121, 129.

41. APOCYNACEAE

Nerium oleander L.; E, PT; fresh places; 22, 24, 26-27, 36-37, 44, 48, 55, 57, 69-72, 74-75, 78-79, 86-89, 93-94, 101-109, 112-113, 115-116, 121, 125.

42. ASCLEPIADACEAE

Gomphocarpus fruticosus (L.) Aiton f.; E, introduced; 47, 52, 55, 69-70, 78, 102.

43. CONVULVULACEAE

Cressa cretica L.; E, ST; 41.

44. BORAGINACEAE

Myosotis laxa subsp. *caespitosa* (C.F. Schultz) Hyl. ex Nordh.; 19.

45. VERBENACEAE

Phyla nodiflora (L.) Greene (= *Lippia nodiflora* (L.) Michx.); E; 78, 104.

Verbena officinalis L.; sometimes E; fields, alleys; 41-42, 58, 78.

Vitex agnus-castus L.; E; especially in permanent-wadi beds; 40, 86.

46. LABIATAE

Lycopus europaeus L.; E; 19, 36, 41-42, 58, 75, 78.

M. pulegium L.; E; 19, 30, 41-42, 46, 58-59, 75, 78-80, 84-85, 87-89, 91, 93-94, 97, 103-106, 114.

Mentha suaveolens Ehrh. (= *M. rotundifolia* auct., non (L.) Huds.); E; 58-59, 75, 78, 87-88, 91-94, 102-108, 114, 121, 125.

47. CALLITRICHACEAE

Callitriche butria Petagna (= *C. palustris* subsp. *pedunculata* (DC.) Maire); FS; fresh waters of plains; 58.

C. stagnalis Scop.; FS; 60.

48. PLANTAGINACEAE

Plantago major subsp. *intermedia* (Gilib.) Batt.; 41-42, 58-59, 66, 69-70, 103-104.

49. OLEACEAE

Fraxinus angustifolia Vahl; E; riparian forests; 15, 19, 22, 26, 28, 38, 41-42, 49, 51, 57, 75, 82, 85, 87, 91, 96-97.

50. SCROPHULARIACEAE

Scrophularia sambucifolia L.; E; 114.

Veronica anagallis-aquatica subsp. *aquatica* (Bernh.) Maire; FS, PT, SE; 77, 91, 102-104.

V. beccabunga L.; E; 78.

51. LENTIBULARIACEAE

Utricularia australis R. Br. (= *V. vulgaris* auct., non L.); FS; 78.

52. CAMPANULACEAE

Campanula rapunculus L.; E; 19.

Solenopsis laurentia C. Presl; E, SE; 19, 61; (= *Laurentia gasparrinii* (Tineo) Strobl.).

Trachelium caeruleum L.; E; rocks; 87, 89, 94, 102.

53. CAPRIFOLIACEAE

Lonicera biflora Desf.; E; 121.

54. DIPSACACEAE

Dipsacus fullonum L.; E; 36.

55. COMPOSITAE

Achillea santolinoides Lag.; E; 17, 58-59.

Bidens pilosa L.; sometimes E; fields alleys; 66, 103.

Centaurea diluta Aiton; E; clay sites; 63-64.

Chamaemelum fuscatum (Brot.) Vasc.; E; farming, lawns; 69-70, 87-89.

Cotula coronopifolia L.; E, SE; fresh or brackish waters; 36, 41, 58, 59.

Eupatorium cannabinum L.; E; 87-88, 102.

Inula crithmoides L.; E, ST; 58, 63, 129.

Leontodon maroccanus (Pers.) Ball; E; clay-sandy-pasture lands; 70.

Pulicaria paludosa Link (= *P. arabica* auct., non (L.) Cass.); E; 7, 19, 41-42, 46, 89, 103, 123, 125.

P. dysenterica (L.) Bernh.; E; especially salt grounds and charcoal kilns; 19.

P. sicula (L.) Moris; sometimes E; ditches, marshes, farming, disturbed sites; 58, 63, 69-70.

Sonchus maritimus L.; E; 103, 105.

S. oleraceus L.; sometimes E; farming; 58, 105.

56. ALISMATACEAE

Alisma plantago-aquatica L.; SE; shallow fresh waters; 36, 58-59, 78.

Baldellia ranunculoides (L.) Parl.; SE; low altitudes; 19, 70, 75, 95.

Damasonium alisma subsp. *bourgaei* (Coss.) Maire; SE; deep sludge; 36, 41-42, 46, 58-59, 66.

57. JUNCAGINACEAE

Triglochin laxiflora Guss. (= *T. bulbosa* auct., non L.); E, especially ST; 58.

58. POTAMOGETONACEAE

Potamogeton fluviatilis Roth (= *P. nodosus* Poir.); FS; deep running waters; 19, 64, 76, 78, 86, 104-106, 128-129.

P. pectinatus L.; FS, PT; 41, 63-64, 122, 128-129.

P. polygonifolius Pourr.; FS; slow-flowing streams; 95.

P. pusillus L.; FS; common; 58.

59. RUPPIACEAE

Ruppia cirrhosa (Petagna) Grande; FS; common; 41.

R. maritima L.; FS, PT; common; 41, 58, 63-64.

60. ZANNICHELLIACEAE

Zannichellia palustris L.; FS; fresh or brackish waters; 58.

61. ZOSTERACEAE

Zostera noltii Hornem.; FS, ST; sandy shores; 29.

62. ARACEAE

Arum italicum Mill.; sometimes E; 58, 66.

63. LEMNACEAE

Lemna gibba L.; F, PT; stagnant fresh waters; 58-59, 66, 77-78, 125.

L. minor L.; F, PT; stagnant fresh waters; 41, 45, 58-60, 66, 104.

Spirodela polyrhiza (L.) Schleiden; F; stagnant fresh waters; 13, 16.

64. JUNCACEAE

Juncus acutiflorus Ehrh. ex Hoffm.; E; 36.

J. acutus L.; E; sandy-brackish grounds; 1-3, 36, 41, 55, 58, 63-64, 78, 85, 104-106, 117, 121, 123, 125, 129.

J. articulatus L.; SE; fresh waters; 46.

J. bufonius L.; E; 36, 55-56, 58, 89, 94, 95, 97.

J. foliosus Desf. (= *J. bufonius* subsp. *foliosus* (Desf.) Maire & Weiller); 36, 58.

J. bulbosus L.; SE; 19, 75, 95, 103-106.

J. capitatus Weigel; E; sandy-pasture lands; 19, 61.

J. effusus L.; E; 19, 75, 93, 114.

J. inflexus L.; E; 36, 41-42, 49, 55, 69-70, 92.

J. rigidus Desf. (= *J. maritimus* auct., non Lam.); E, PT; especially brackish sites; 1-3, 29-30, 36, 41, 58, 63-64, 85.

J. striatus Schousboe ex E.H.F. Meyer; E; fresh sites; 19, 47, 75, 78, 89, 95, 103, 114, 121.

J. subulatus Forssk.; SE; fresh or brackish waters; 41, 58, 85, 121.

J. tenageia Ehrh.; E, SE; siliceous grounds; 19.

J. sphaerocarpus Nees (= *J. tenageia* subsp. *sphaerocarpus* (Nees) Trabut); 19.

J. tingitanus Maire & Weiller; E; sandy depressions; 19.

65. CYPERACEAE

Bolboschoenus maritimus (L.) Palla (= *Scirpus maritimus* L.); PT, SE; fresh or brackish waters; 36, 41, 58.

Carex acuta L.; E; 19, 87, 91, 94, 108, 118.

C. distachya Desf.; E; brushwood, forests; 29, 36, 41, 58.

C. distans L.; E; fresh sites; 58, 69-70, 114.

C. divisa Hudson; E; 30, 36, 58, 69-70.

C. echinata Murray; E; siliceous peaty marshes; 92.

C. extensa Good.; sometimes E, often ST; sandy pasture lands; 60, 65.

C. laevigata Sm (= *C. helodes* Link.); E; siliceous zones; 70.

C. muricata L.; E; 47, 54, 78.

C. serotina Merat; E; 63-64.

C. otrubae Podp. (= *C. vulpina* auct., non L.); E; 19, 58.

Cladium mariscus (L.) Pohl; E; fresh sites; 16.

Cyperus fuscus L.; E; 77.

C. laevigatus L.; E; 19, 62, 65, 104, 121.

C. longus L. (= *C. longus* L. subsp. *badius* (Desf.) Murb.); SE; fresh waters; 19, 36, 42, 55, 58-59, 93, 95.

C. michelianus (L.) Link (= *C. michelianus* subsp. *pygmaeus* (Rottb.) Aschers. & Graebner); E; 16.

C. rotundus L.; E, SE; 75, 91-93, 104.

Eleocharis multicaulis (Sm.) Desv.; E, sometimes SE; particularly in peat bogs; 19.

E. palustris (L.) Roem. & Schult.; E, SE; littoral; 36, 41, 46, 58-59, 78.

E. quinqueflora (Hartm.) O. Schwarz; E, SE; 19, 58, 95.

Fimbristylis bisumbellata (Forss.) Bubani; E; sand, gravel; 16.

Fuirena pubescens (Poir.) Kunth; E, sometimes SE; generally in peaty marshes of the sublittoral plains and low mountains; 19.

Isolepis cernua (Vahl.) Roem. & Schult. (= *Scirpus cernuus* Vahl.); E; 41, 58, 61, 103.

Pycneus flavescens (L.) P. Beauv. ex Rchb. (= *Cyperus flavescens* L.); E; 13, 75, 87, 95.

- P. mudtii* Ness (= *Cyperus mundtii* (Nees) Kunth); SE; non-calcareous sites; 19, 41-42, 75-76, 78, 104.
- P. polystachyos* (Rottb.) P. Beauv. (= *Cyperus polystachyos* Rottb.); E; sandy plains of the sublittoral; 19.
- Rhynchospora rugosa* (Vahl) S. Gale; E; little acid marshes; 19.
- Schoenus nigricans* L.; E; fresh or brackish sites; 19, 34, 41, 46, 58, 60, 102.
- Scirpoides holoschoenus* (L.) Soják (= *Scirpus holoschoenus* L.); E; 3, 29, 36, 41, 46, 55, 58, 78, 82-83, 93-94, 102, 104-108, 121.
- Schoenoplectus lacustris* (L.) Palla (= *Scirpus lacustris* L.); SE; fresh or brackish waters; 3, 6-7, 10-11.
- S. tabernaemontani* (C.C. Gmelin) Palla (= *Scirpus lacustris* subsp. *tabernaemontani* (C.C. Gmelin) Syme); 3.
- S. litoralis* (Schrad.) Palla (= *Scirpus litoralis* Schrad.); PT, SE; fresh or brackish waters; 41-42, 46, 58-59, 128-129.

66. GRAMINAE

- Aeluropus littoralis* (Gouan.) Parl.; E, ST; salt places; 41.
- Agrostis reuteri* Boiss. (= *A. capillaris* sensu Desf., non L.); E; pasture lands, forests; 36, 69-70, 91, 102.
- A. pourretii* Willd.; E; 19.
- A. stolonifera* L.; sometimes E; pasture lands, brushwood, forests; 19.
- Arundo donax* L.; E, I, PT; 37-38, 48, 58-59, 66, 69-70, 78, 82-83, 87-88, 102-103, 121.
- Briza maxima* L.; sometimes E; common within brushwood and forests; 91.
- B. minor* L.; E; 20, 89, 95.
- Catabrosa aquatica* (L.) Beauv.; E; 70.
- Crypsis aculeata* (L.) Aiton; E; brackish sites; 41, 58, 85.
- Cynodon dactylon* (L.) Pers.; sometimes E; common within fields and pasture lands; 41, 46, 58, 66-67, 69-70, 85, 93, 104-108, 117, 121, 123.
- Echinochloa crus-galli* (L.) Beauv.; E, PT; common within farming, 41-42.
- Eragrostis atrovirens* var. *fontanesiana* Maire; E; non-calcareous lands; 19.
- Hainardia cylindrica* (Willd.) Greuter; E; pasture lands; 36.
- Holcus lanatus* L.; sometimes E; brushwood, forests; 95.
- Hordeum geniculatum* All. (= *H. hystrix* Roth); E; fresh places; 36.
- H. murinum* L.; E; fresh places; 58-59.
- Leersia oryzoides* (L.) Swartz; plain swamps of the sublittoral; E, SE; 19.

- Lolium multiflorum* Lam.; sometimes E; pasture lands, brushwood, forests; 36, 41, 58.
- Panicum repens* L.; E; sometimes-brackish places; 19, 29, 41-42, 46, 58-59, 69-70, 103-106.
- Paspalum distichum* L. (= *P. paspalodes* (Michx.) Scribn.); E, SE; especially coastal marshes; 19, 41, 58-59, 70, 91, 104, 129.
- P. vaginatum* Sw.; E, SE; maritime sands, plain fields; 42, 58, 91-93, 103, 125, 128.
- Parapholis incurva* (L.) C.E. Hubb. (= *Pholiurus incurvus* (L.) Schinz & Thell.); E; 58.
- P. filiformis* (Roth) Trin. (= *Parapholis incurva* subsp. *filiformis* (Roth) A. Camus); pasture lands even salt ones; 58.
- Phragmites australis* (Cav.) Trin. ex Steud.; E, PT, SE; sometimes xeric, common; 37, 41, 45, 58, 69-70, 76, 78, 85, 123-124, 128-129.
- Polygonum monspeliensis* (L.) Desf.; E; 29, 36, 41, 46, 58-59, 69-70, 78, 91-93, 85, 107, 121, 123.
- P. viridis* (Gouan) Breistr.; E; common; 19.
- Setaria pumila* (L.) Beauv.; E; irrigated zones; 70.
- Spartina densiflora* Brongn.; E, ST; 4.
- S. maritima* (Curt.) Fernald; E, SE, ST; 18, 29.
- 67. SPARGANIACEAE**
- Sparganium erectum* L. subsp. *erectum*; PT, SE; 3, 13, 17, 41-42, 58-59.
- S. erectum* subsp. *neglectum* (Beeby) Schinz & Thell.; 41-42, 58.
- 68. TYPHACEAE**
- Typha angustifolia* L.; PT, SE; 8, 17, 31-33, 36-37, 41, 45, 58, 67, 75-76, 78, 92-93, 103-106, 121, 125, 128-129.
- 69. LILIACEAE**
- Ruscus hypophyllum* L.; sometimes E, S; forests; 47, 49, 68, 87.
- 70. IRIDACEAE**
- Iris pseudacorus* L.; SE; slow-flowing waters; 41-42, 47, 49.

DISCUSSION

The identified taxa represent 70 families, 141 genera, 232 species and 13 subspecies. *Angiospermae* (*Monocotyledones* and *Dicotyledones*) constitutes 92'2% of global species number (vs. 7'8% of *Pteridophyta*). *Cyperaceae*, *Gramineae*, *Juncaceae* *Compositae*, *Polygonaceae*, *Rosaceae* *Ranunculaceae* and *Salicaceae* are the best represented families in the studied wetlands since they represent c. 51'3% of the species.

Dycotyledones and *Monocotyledones* characterise emergent and subemergent vegetation, while *Pteridophyta* occurs in shady and emergent places.

The generic coefficient of Jaccard (1929), defined as the ratio of genera to species numbers is about 61%. CHNINIGUE (1990) obtained a similar value (59%) when studying the flora of Benslimane (Morocco) pools. This highlights a low diversity of the habitats, i.e. ecological conditions in wetlands, which strongly contrast with the values of c. 21 and 13 when considering respectively the National or European flora (GEM, 1986/89; CHNINIGUE, 1990; TUTIN & al., 1964/93).

The low rate of species tolerating saltiness and/or submersion conditions explains the wetlands changes of the Mediterranean of Morocco which are highly affected mainly by draining processes. Riparian species distribution, namely *Vitex agnus-castus*, *Fraxinus angustifolia*, *Prunus lusitanica*, *Ilex aquifolium* and *Alnus glutinosa* have strongly regressed. Several species tolerating pollution, due largely to wastewater, are locally used in artificial wetlands for wastewater treatment in the Experimental Centre of M'Diq (studied site 59, Fig. 1).

In addition to the identified species, there are three marine *Spermatophyta* recorded by GONZÁLEZ-GARCÍA (1994) and GONZÁLEZ-GARCÍA & CONDE POYALES (1995) along the Saïdia-al Hoceima coast: *Zostera marina* L., *Cymodocea nodosa* (Ucria) Asch., *Posidonia oceanica* (L.) Delile and a *Malvaceae* (*Modiola caroliniana* (L.) G. Don) recorded by VALDÉS (1996) in Barrage Smir-M'Diq.

But we did not find some species such as *Salix elaeagnos* Scop. and *Tamarix speciosa* Ball. & Maire quoted by DE LA TORRE (1955) nor some mentioned by BENABID (1983, 1984) and SAUVAGE (1971) such as *Betula celtiberica* (= *B. pubescens* subsp. *celtiberica* (Rothm. & Vasc.) Rivas-Martinez) and *Betula alba* (= *B. pendula* Roth.). This shows the huge impact of the over-exploitation of riverbanks and/or their localised repartition.

There are many factors, which affect indirectly wetland plants diversity. MERIAUX (1982), STEVENSON (1988) and TACCONI & BENNETT (1995) have enumerated drainage, excessive water table exploitation, barrage construction, pollution, habitat fragmentation and over-harvesting. In fact, the Mediterranean wetlands seem to be the most modified habitats since the Antiquity (RAMADE, 1989). During the Spanish protectorate in Northern Morocco, wetlands like El Mers, exceeding 300 ha, and Beni Madan (Tétouan) were drained and transformed into cultivable grounds or planted by *Eucalyptus* spp. (MARTIN-CANTARINO & al., 1995). Nowadays, mobilisation and excessive exploitation of water, barrage construction, draining, waste and wastewater evacuation constitute the major factors altering the regional wetland-plant diversity.

Posidonia oceanica, a Mediterranean endemic species, is disappearing from the Bou Areg lagoon (Nador) following competition by *Caulerpa prolifera* (GONZALEZ-GARCIA, 1994; GONZALEZ-GARCIA & CONDE POYALES, 1995), a process observed in other areas by DEN HARTOG (1994). The clearing of riparian forests could lead indirectly to the regression of wetland-plant diversity by changing of microclimate (in SAUNDERS & al., 1991).

The native wetland macrophytes include also species having medicinal, aromatic or pasture interest and/or impacts on biological quality of water bodies and are used in the native craftsmen and wastewater treatment (CHERGUI & OUARTINI, 1995; ENNABILI, 1999; ENNABILI & al., 2001). Indirectly, riparian forests contribute to suspended matter and nitrate retention (in DUTARTRE, 1991; CIEPP, 1994). The paleo-botanical value of wetland species had been mentioned in *Equisetum telmateia*, *Alisma* spp., *Iris pseudacorus*, *Sparganium erectum*, *Salix purpurea*, *S. pedicellata*, *Populus* spp., *Tamarix gallica*, *Laurus nobilis* and *Alnus glutinosa* by CHEVASSUT (1956), IONESCO & STEFANESCO (1967), VETVICHA & KRJCOVA (1981) and REJDALI (1996).

Under the floristic point of view, this paper contributes to the general knowledge of the Flora of N Morocco, by adding many new records to the recently published *Catalogue des Plantes Vasculaires du Nord du Maroc* (VALDÉS & al., 2002).

Carex trinervis Degl. is new for the flora of Morocco, and many species are first records for one of more of the natural areas recognized by Valdés & al. (2002) for N Morocco, as follows:

New records for Tanger Area: *Polygonum equisetiforme*, *Sarcocornia fruticosa*, *S. perennis*, *Halimione portulacoides*, *Suaeda albescens*, *Limonium cymuliferum*, *Cotula coronopifolia*, *Hordeum geniculatum*, *Phragmites australis*, *Spartina maritima* and *Schoenus nigricans*.

New for W Rif: *Ophioglossum lusitanicum*, *Polystichum aculeatum*, *Dryopteris filix-mas*, *Blechnum spicant*, *Lythrum hyssopifolia*, *L. tribracteatum*, *Epilobium tetragonum* subsp. *lamyi*, *Erica ciliaris*, *Cressa cretica*, *Achillea santolinoides*, *Eupatorium cannabinum*, *Ruppia cirrhosa*, *R. maritima*, *Zannichellia palustris*, *Juncus effusus*, *Catabrosa aquatica*, *Crypsis aculeata*, *Sparganium erectum* subsp. *neglectum*, *Carex acuta*, *C. serotina* and *Eleocharis quinqueflora*.

New record for Gareb area: *Paspalum vaginatum*.

New records for Loukkos: *Equisetum ramosissimum*, *E. telmateia*, *Sarcocornia fruticosa*, *Nymphaea alba*, *Potentilla erecta*, *Crataegus monogyna*, *Rubus ulmifolius*, *Frangula alnus*, *Vitis vinifera* subsp. *sylvestris*, *Lythrum junceum*, *L. portula*, *L. tribracteatum*, *Erica ciliaris*, *Solenopsis laurentia*, *Trachelium caeruleum*, *Achillea santolinoides*, *Juncus bulbosus*, *J. effusus*, *J. striatus*, *J. tanageia*, *J. sphaerocarpus*, *J. tingitanus*, *Agrostis stolonifera*,

Paspalum distichum, *Spartina maritima*, *Typha angustifolia*, *Carex acuta*, *Cladium mariscus*, *Pycreus flavescens*, *P. mundtii*, *Cyperus laevigatus*, *C. longus*, *C. michelianus*, *Eleocharis multicaulis*, *E. quinquefolia*, *Fimbristylis bisumbellata*, *Schoenus nigricans* and *Schoenoplectus lacustris*.

New records for the Atlantic Coast: *Juncus rigidus* and *Sparganium erectum*.

New records for Ouezzane: *Equisetum ramosissimum*, *Adiantum capillus-veneris*, *Pteridium aquilinum*, *Populus alba*, *Salix alba*, *Laurus nobilis*, *Epilobium tetragonum* subsp. *lamyi*, *Leontodon maroccanus*, *Ruscus hypophyllum*, *Juncus acutus*, *J. striatus*, *J. subulatus*, *Arundo donax*, *Crypsis aculeata*, *Phragmites australis* and *Carex acuta*.

New records for Imzorène: *Equisetum ramosissimum*, *Populus nigra*, *Polygonum lapathifolium*, *Rubus ulmifolius*, *Centaurium spicatum*, *Trachelium caeruleum* and *Arundo donax*.

New records for Targuist Area: *Rumex crispus*, *Epilobium parviflorum*, *Centaurium spicatum*, *Scrophularia sambucifolia*, *Juncus effusus*, *J. striatus* and *Carex acuta*.

New to the Beni-Snassen Mountains: *Populus euphratica*, *Sarcocornia fruticosa*, *Limonium gummiferum*, *Centaurium spicatum*, *Inula crithmoides*, *Potamogeton pectinatus*, *Paspalum vaginatum* and *Schoenoplectus litoralis*.

The main conclusion derived from this study is that wetlands of the Mediterranean Morocco shelter a rich *Pteridophyta* and *Spermatophyta* flora which needs more evaluation studies, especially in forest areas of high altitudes as it can be deduced, by instance, from the checklist of Talasemtane reserve (RAYNAUD & SAUVAGE, 1974, 1975). Although Morocco ratified the convention on wetlands protection and adhered to the convention on protection of cultural and natural world inheritance, few efforts have been made in order to preserve wetlands of the Mediterranean coast. The National measures to protect the biodiversity focus mainly on fauna, and should be extended to the vulnerable wetlands-plant species.

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REFERENCES

- ACHHAL, A., M. BARBERO, C. PEYRE, P. QUEZEL & S. RIVAS-MARTINEZ (1980). A propos de la valeur bioclimatique et dynamique de quelques essences forestières au Maroc. *Ecol. Méditer.* **5**: 211-249.
- BCEOM-SECA (1994). *Projet Étude et Plans de Gestion des Aires Protégées du Maroc*.
- BEAUBRUN, P. & M. THEVENOT (1984). Recensement hivernal d'oiseaux d'eau au Maroc (Janvier 1984). *Doc. Inst. Sci.(Rabat)* **8**: 1-29.

- BENABID, A. (1983). Études biogéographique et dynamique des peuplements forestiers du Rif (Maroc). *Ann. Rech. Forestière au Maroc* **23**: 49-129.
- (1984). Étude phytoécologique des peuplements forestiers et préforestiers du Rif Centro-Occidental (Maroc). *Trav. Inst. Sc. Série Bot. (Rabat)* **34**: 1-64.
- BOUKIL, A. (1986). *Étude et cartographie des groupements végétaux et des possibilités de reboisement dans la lagune de Oued Smir dans un but d'aménagement touristique*. Centre Régional Etudes et Aménagement, Tétouan (Maroc).
- CHERGUI, H. & Z. OUARTINI (1995). *Impact des produits de lessivage des feuilles de Salix babylonica et de Populus nigra sur la qualité biologique des milieux aquatiques récepteurs*. In Les milieux aquatiques continentaux. Structure, fonctionnement et Gestion, 1er Congrès National de l'AML, Fès, (Maroc).
- CHEVASSUT, G. (1956). Les groupements végétaux du marais de la Rassautat. *Ann. Inst. Agri. Algérie*, **10(4)**: 1-96.
- CHNINIGUE, J. (1990). *Étude floristique des mares temporaires (dayas) de la province de Ben-Slimane et de leurs potentialités agro-pastorales*. Thèse D.E.S. Univ. MdV, Fac. Sc. (Rabat).
- CIOPP (Comité Interministériel de l'Evaluation des Politiques Publiques) (1994). *Les zones humides*. Rapport d'évaluation. Commissariat Général du Plan, Documentation Française, (Paris).
- CRONQUIST, A. (1981). An integrated system of classification of flowering plants. New York.
- DE LA TORRE, J. R. (1955). *El matorral en Yebala (Marruecos español). Estudio de las formaciones de matorral en la región de Yebala, su tratamiento y aprovechamiento en relación con la defensa y protección del suelo contra la erosión*. Instituto de Estudios Africanos, CSIC, Madrid.
- (1956). *La vegetación natural del norte de Marruecos y la elección de especies para su repoblación forestal*. Servicio de Montes, Centro de Investigaciones y Experiencias Forestales, Artes Graficas Boscá, Larache.
- DEN HARTOG, C. (1994). Suffocation of a littoral *Zostera* bed by *Enteromorpha radiata*. *Aquatic Botany* **47**: 21-28.
- DUTARTRE (1991). *Protocole d'examen rapide des ripisylves des cours d'eau destiné à prévoir les modalités pratiques de leur gestion : application sur quelques cours d'eau du Sud-Ouest de la France*. In "Impacts liés aux travaux d'aménagement sur les cours d'eau : Evaluation, Méthodologie, Aide à la gestion", Colloque International, Septembre 1991, B-Wepion: 311-328.
- ENNABILI, A. (1999). *Végétation hygrophile du Maroc Méditerranéen: écologie, socio-économie et rôle potentiel dans l'épuration des eaux usées*. Ph-D Thesis; Fondation Universitaire Luxembourgeoise. Arlon (Belgique).
- , N. GHARNIT & E.M. EL HAMDOUNI (2001). Inventory and social interest of medicinal, aromatic and honey-plants from Mokrisset (NW of Morocco). *Stud. Bot.* **19**: 57-74.
- FENNANE, M., M. IBN TATTOU, J. MATHEZ, A. OUYAHYA & J. EL OUALIDI (1999). Flore pratique du Maroc. Pteridophyta, Gymnospermae, Angiospermae (Lauraceae-Nauradaceae). *Trav. Inst. Sc. Série Bot. (Rabat)* **36**: 1-558.
- FOURNIER, P. (1977). *Les quatre flores de la France (Générale, Alpine, Méditerranéenne, Littorale)*. Lechevalier, Paris.
- GEM (La Grande Encyclopédie du Maroc) (1986/89). GEI, Cremona, (Italie): 8-14.

- GONZÁLEZ GARCÍA, J. A. (1994). La flora marina de Melilla. *Ensayos Melillensis, Melilla 2*: 1-212.
- & F. CONDE POYALES (1995). Études comparatives sur le macrophytobenthos de trois lagunes côtières de la Méditerranée occidentale. *Nova Hedwigia, Stuttgart 61(3-4)*: 377-390.
- IONESCO, T. & E. STEFANESCO (1967). La cartographie de la végétation de la région de Tanger. *Al Awamia, (Rabat), 22*: 17-147.
- MAIRE, R. (1952/1980). *Flore de l'Afrique du nord*. Lechevalier, Paris.
- MARTIN CANTARINO, C., E. SEVA ROMAN & A. PASTOR LOPEZ (1995). *Transformaciones en el paisaje natural de la región de Tetuán durante la época del protectorado español en Marruecos (1912-1956). Repoblación forestal en dunas y espacios costeros, Política de desecación de espacios húmedos litorales*. In "Marais Smir-Restinga. Ecologie et Propositions d'Aménagement", Poster, Fac. Sc. Tétouan (Maroc).
- MERIAUX, J. L. (1982). *Espèces rares ou menacées des biotopes lacustres et fluviales du Nord de la France*. In "J.-J. SYMOENS, S.-S. HOOPER & P. COMPÈRE (eds.). Studies on Aquatic Vascular Plants", Roy. Bot. Soc. Belgium: 398-402.
- NÈGRE, R. (1961). *Petite flore des régions arides du Maroc occidental*. CNRS, Paris.
- QUEZEL, P. & S. SANTA (1962/63). *Nouvelle flore de l'Algérie et des régions désertiques méridionales*. CNRS, Paris.
- RAMADE, F. (1989). *Eléments d'écologie, écologie appliquée*. McGraw-Hill, Paris.
- RAYNAUD, C. & C. SAUVAGE (1974). Catalogue des végétaux vasculaires de Talassemantane (Rif occidental). 1^{ière} partie. *Travaux de la R. C. P.*, **249(2)**: 209-230.
- & C. SAUVAGE (1975). Catalogue des végétaux vasculaires de Talassemantane (Rif occidental). 2^{ème} partie. *Travaux de la R. C. P.*, **249(3)**: 143-178.
- REJDALI, M. (1996). *La flore du Maroc: Etat actuel et perspectives de conservation*. In M. REJDALI & A. BIROUK (eds). Diversité biologique et valorisation des plantes médicinales. Actes Editions, Rabat: 17-22.
- SAUNDERS, D.A., R.J. HOBBS & C.R. MARGULES (1991). Biological consequences of ecosystem fragmentation. A review. *Conservation Biology*, **5(1)**: 18-32.
- SAUVAGE, C. (1971). Présentation botanique du Maroc. *Al Awamia, (Rabat) 40/41*: 29-214.
- STEVENSON, J.C. (1988). Comparative ecology of submersed grass beds in freshwater, estuarine and environments. *Limnol. Oceanogr.* **33 (4, part 2)**: 867-893.
- TACCONI, L. & J. BENNETT (1995). Economic implications of intergenerational equity for biodiversity conservation. *Ecological Economics*, **12**: 209-223.
- TUTIN, T.G., N.A. BURGESS, A.O. CHATER, J.R. EDMONDSON, V.H. HEYWOOD, D.M. MOORE, D.H. VALENTINE, S.M. WAITERS & D.A. WEBB (1964-1980, 1993). *Flora europaea, 1-5; 1, ed. 2*. Cambridge University Press, UK.
- VALDÉS, B. (1996). Nuevas citas para la flora de Marruecos. *Lagascalia 18*: 224-227.
- , M. REJDALI, A. ACHHAL EL KADMIRI, S. L. JURY & J. M. MONTERRAT (2002). Catalogue des plantes Vasculaires du Nord du Maroc, incluant des clés d'identification. C.S.I.C., Madrid.
- VETVICH, V. & Z. KRJCOVA (1981). *Plantes du bord de l'eau et des prairies*. Gründ, Paris.