Bocconea 26: 133-143
doi: 10.7320/Bocc26.133
Version of Record published online on 7 September 2013

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# The contribution of the "Iter Mediterraneum V" to the chorological knowledge of N Moroccan vascular plants

**Abstract**

Valdés, B. & Melero, D.: The contribution of the "Iter Mediterraneum V" to the chorological knowledge of N Moroccan vascular plants. — Bocconea 26: 133-143. 2013. — ISSN 1120-4060 (print), 2280-3882 (online).

Of the 65 sites visited during "Iter Mediterraneum V" in Morocco, 47 are located in 13 of the 20 natural areas, which for chorological purposes, have been recognized in N Morocco. A total of 1689 gatherings was collected in these 13 areas. Study thereof resulted in the incorporation of four new taxa for the catalogue of N Morocco: *Adenocarpus complicatus* subsp. *nainii* (Maire) P. Gibbs, *Erodium stellatum* Delile, *Lotus weilleri* Maire and *Schedonorus mairei* (St.-Yves) Dobignard. Several taxa constitute new records for one or more of the 13 areas visited. The percentage of new records varies from 0,3 % in W Rif, the best known natural area of N Morocco, to 38 % (24 new records out of 63 taxa collected) in Tsoul, which is the least known natural area of N Morocco, followed by Ouezzane, with 28 new records out of 153 taxa collected (18,3 %).

*Keywords*: N Morocco, Moroccan flora, new records.

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## Introduction

The preparation of the *Catalogue des plantes vascularies du nord du Maroc* (Valdés & al. 2002) was preceeded by a series of collecting trips by members of the Institute Agronomigne et Veterinaire Hasan II of Rabat, the University of Seville's Department of Plant Biology and Ecology, the Plant Science Laboratories of the University of Reading and the Botanical Institute of Barcelona, particularly from 1992 to 1996. This resulted in the collection of over 30,000 gatherings in this period, which constituted the base for preparation of the *Catalogue*. But this material was supplemented by the study of other plant material from N Morocco, kept in several herbaria, particularly BC, SEV and RDG, and to a lesser extent, in MPV, BM, K and EDBG (Valdés & al. 2002: 5-7)

For chorological purposes the territory covered by the *Catalogue* was divided into 20 natural areas and the distribution of each recognized species or subspecies was given by the natural areas in which it was known.

New explorations in N Morocco following the publication of the *Catalogue* have in-

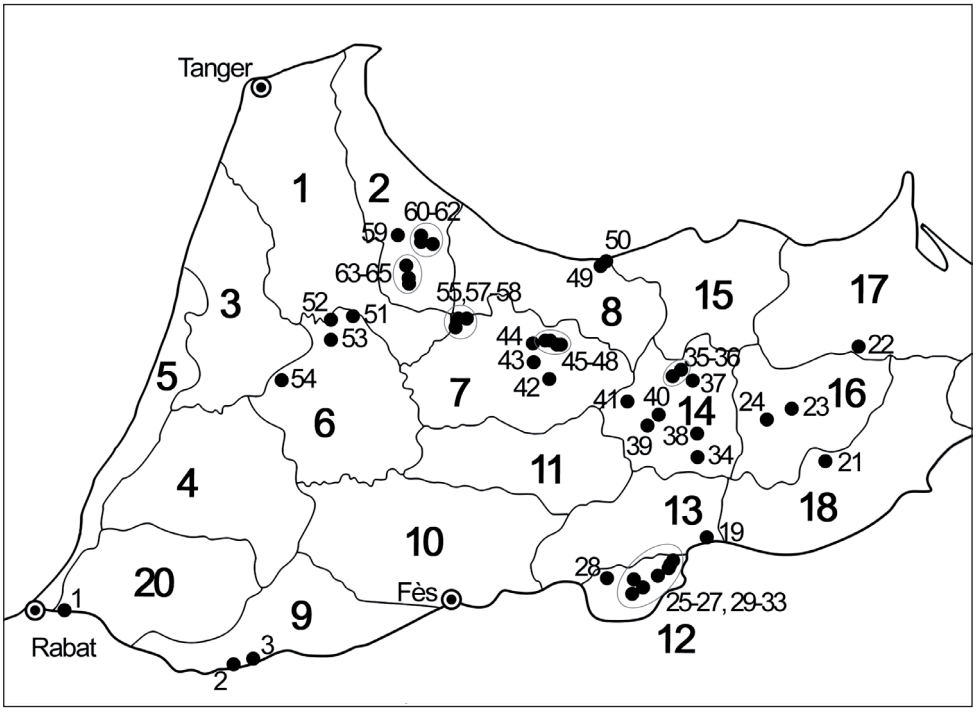


Fig. 1. Natural areas of N. Morocco and collecting sites. 1, Tangier; 2, West Rif; 3, Loukkos; 4, Gharb; 5, Atlantic coast; 6, Ouezzane; 7, Central Rif; 8, Targuist; 9, Zerhoun; 10, Central Pre-Rif; 11, High Ouerrha; 12, Tazekka; 13, Tsoul; 14, Aknoul; 15, Imzorène; 16, Kert Ganc; 17, Gareb; 18, Guercif; 20, Forêt de la Maâmora (according Valdés & al. 2002).

creased the number of records of the different taxa for the different chorological areas. These new records have been published mainly by Aafi & al. (2005), Ajbilou & al. (2007), Benning (2004), Carine & al. (2006), Chambouleyron (2012), Ennabili & Gharnit (2003), Hammada & al. (2004), Luceño & Escudero (2006), Luceño & Marín (2002), Mateos & Valdés (2003a-d, 2004), Molero & Montserrat (2006a-c), Montserrat & al. (2006), Navarro & al. (2002), Ortega-Olivencia & Devesa (2004), Pinto & al. (2011), Pyke & al. (2008, 2009), Romero Zarco (2009), Romo & Soriano (2004, 2005), Soriano & Ibañez (2008), Soriano & Romero (2008), Talavera & al. (2003a, b, 2004, 2008), Terrab & al. (2006a, b), Valdés (2005, 2011), Valdés & al. (2004a, b, 2005a, b, 2006a, b), and particularly by Dobignard (2009), who assigned to the different natural areas recognized in the *Catalogue* new records coming from his rich collections of N African plant material. Consequently, the floristical knowledge of N Morocco is now much more complete than in 2002.

Unfortunately, with some exceptions, the material collected during Iter Mediterraneum V of OPTIMA in 1992 was unavailable to the authors contributing to the *Catalogue*, as the material collected was labelled and incorporated into the herbaria only in Berlin (B) and Reading (RDG), and remained unlabeled in the different centres of the participants in the

*Iter*. Study of this material would have increased the chorological knowledge of many of the taxa, as many plants were collected in areas not frequently visited by botanists. Of the 65 sites visited, 47 were located in 13 of the 20 natural areas recognized in the *Catalogue*, with a total of 1749 gatherings collected.

The aim of the present paper is to indicate which of the 1749 gatherings collected in N Morocco constitute new records for each of the natural areas visited during the expedition. As is to be expected, there are few additions for the best known areas, such as Maâmora Forest, Central Rif, West Rif, Gareb or Jbel Tazekka, which have traditionally attracted botanists, whereas for the poorly studied or rarely visited areas, such as Ouazzane or Tsoul, many of the taxa collected constitute new records.

## Material and methods

The material used for this study comprised the 1689 gatherings collected during *Iter Mediterraneum V* in the area covered by the *Catalogue*.

A working table with 3303 lines and 13 columns was created. Each line includes the name of the species and subspecies recognized in the *Catalogue* for N Morocco, plus the taxa subsequently recorded and published in the 41 sources indicated in the introduction. Each column includes presence or absence of these taxa in the 13 different natural areas of the ones recognized in the *Catalogue* and visited during *Iter V*.

The presence in the different columns of the taxa collected during *Iter V* was then tested. This has shown that some of the species or subspecies collected constitute new records for N Morocco or for one or more of the 13 natural areas visited.

## Results

New records are given below. The number in brackets after the name of each species or subspecies is the serial collecting number of *Iter Mediterraneum V*; the first or first two digits indicate the locality (see fig. 1), and the two, three or four digits which follow the dot indicate the correlative collecting number (see the preceeding *Checklist of Vascular Plants*.)

### *New records for N Morocco*

*Adenocarpus complicatus* subsp. *nainii* (Maire) P. Gibbs (27.963), *Erodium stellatum* Delile (19.751), *Lotus weilleri* Maire (3.106) and *Schedonorus mairei* (St.-Yves) Dobignard (19.767).

Another species collected during *Iter V*, *Allium neapolitanum* Cirillo (44.1522), and not included in the *Catalogue* or indicated for Morocco, by Dobignard & Chatelain (2010:66), was already recorded in Rabat, Melilla and Tangiers by Ibn Tattou & Fennane (2009:131).

### *New records for the natural areas visited during Iter Mediterraneum V.*

*West Rif Mountains* (n. 2 in fig. 1)

This area covers the eastern part of the Tangiers peninsula. Seven sites were visited and

a total of 288 gatherings collected, with only one new record for the area: *Epilobium lanceolatum* Sebast. & Mauri (60.2036), which is also a new record for Morocco.

*Ouezzane* (n. 6 in fig. 1)

It is a poorly known area, and although only visited during one day with four collecting sites, out of the 153 taxa collected (163 gatherings) the following are new records: *Agrimonia eupatoria* L. (51.1729, 53.1752), *Astragalus cymbicarpos* Brot. (54.1807), *Allium paniculatum* L. (51.1721), *Bituminaria bituminosa* (L.) C.H. Stirt (51.1733), *Campanula rapunculus* L. (53.1772), *Carex nigra* (L.) Rchb. (51.1720), *Carduncellus caeruleus* (L.) C. Presl. (51.1682), *Clematis flammula* L. (52.1747), *Crataegus monogyna* Jacq. (52.1761), *Dorycnium rectum* (L.) Ser. (51.1735), *Genista clavata* Poir. (54.1810), *Hypericum tomentosum* L. (51.1727), *Lomelosia simplex* subsp. *dentata* (Jor. & Fourr.) Greuter & Burdet (51.1660b), *Lotus palustris* Willd. (51.1728), *Ononis reclinata* subsp. *mollis* (Savi) Bég. (54.1815), *Ononis viscosa* subsp. *subcordata* (Cav.) Sirj. (51.1723, 54.1813), *Polypodium cambricum* L. (52.1737), *Potamogeton fluitans* Roth (52.1759), *Potentilla reptans* L. (51.1730), *Polypogon maritimus* Willd. subsp. *maritimus* (53.1781), *Pulicaria arabica* subsp. *hispanica* (Boiss.) Murb. (51.1719), *Rosa andegavensis* Bastard (51.1687), *Rumex pulcher* L. (54.1803), *Scolymus maculatus* L. (54.1795), *Sonchus asper* (L.) Hill subsp. *asper* (52.1756), *Sorghum halepense* (L.) Pers. (51.1692), *Trachellium caeruleum* L. subsp. *caeruleum* (51.1714) and *Verbascum sinuatum* L. (51.1661, 54.1796).

*Central Rif Mountains* (n. 7 in fig. 1)

This is one of the most interesting areas of N Morocco and together with the West Rif Mountains, one of the most frequently visited by botanists, who are especially attracted by Jbel Tidighine, the highest point in the Rif mountains (2.448 m.s.m). Out of the 423 gatherings collected in this area, the following records are new ones: *Allium baeticum* Boiss. (43.1478), *Allium neapolitanum* Cyr. (44.1522), *Anacyclus radiatus* Loisel. subsp. *radiatus* (42.1418), *Anagallis crassifolia* Thore (58.1917), *Anchusa azurea* Mill. (43.1475), *Arabis pubescens* subsp. *leucanthemifolia* (Pau & Font Quer) Maire (45.1580), *Argyrocytisus battandieri* (Maire) Raynaud (57.1847), *Arrhenatherum elatius* subsp. *bulbosum* (Willd.) Schübl. & Martens (44.1524), *Bromus hordeaceus* subsp. *divaricatus* (Bonnier & Layens) Kérguelen (44.1528), *Carex viridula* Michx. (58.1941), *Chenopodium opulifolium* W.D.J. Koch & Ziz (42.1422), *Crepis vesicaria* subsp. *taraxacifolia* (Thuill.) Thell. (57.1888), *Cuscuta epithymum* subsp. *kotschyi* (Demoulins) Arcangeli (42.1423), *Cytinus hypocistis* subsp. *macranthus* Wettst. (57.1855), *Erodium cicutarium* (L.) L´Her. (57.1872), *Filago pyramidata* L. (43.1477, 57.1892), *Helictochloa bromoides* (Gouan) Romero Zarco (55.1816b), *Limodorum abortivum* (L.) Schwatz (57.1841), *Lythrum borysthenicum* (Schrenk) Litv. (57.1841), *Myosotis decumbens* subsp. *rifana* (Maire) Greuter & Burdet (57.1908), *Ochlopoa maroccana* (Nannf.) H. Scholz (58.1962), *Paronychia echinulata* A.O. Chater (43.1502), *Piptatherum coerulescens* (Desf.) Beauv. (43.1487), *Paeonia coriacea* Boiss. (57.1842), *Pulicaria arabica* subsp. *hispanica* (Boiss.) Murb. (42.1401), *Silene cuatrecasasii* Pau & Font Quer (57.1907), *Spergularia purpurea* (Pers.) G. Don f. (42.1405), *Trifolium fragiferum* L. (42.1419), *Trifolium stellatum* L. (58.1929) and *Utricularia australis* R. Br. (58.1933).

The following three species collected during the *Iter* were not included in the *Catalogue* by Valdés & al. (2002), but records their presence in this area already existed. *Andryala*

*intergrifolia* L. (57. 1909, 58.1940) had already been recorded by Más Guindal (1931: 265) in three localities, and *Erophaca baetica* (L.) Boiss (42.1416) and *Legousia falcata* (Ten.) Janchen (44.1510) were recorded by Sennen & Mauricio (1933: 75).

*Targuist area* (n. 8 in fig. 1)

This is a coastal area running from the Mediterranean sea to the Rif mountains, limited to the West by the river Bouchia and by the Bokkoya mountains to the East. Only 15 gatherings were collected, of which the following taxa are new records: *Fumana laevipes* (L.) Spach (49.1645) and *Rhus pentaphylla* (Jacq.) Desf. (49.1656).

*Launaea arborescens* (Batt.) Murb. (49.1644), which was not included for this area in Valdés & al. (2002), or in subsequent papers, was already recorded in Beni-bu-Frah by Sennen & Mauricio (1933: 73).

*Zerhoun* (n. 9 in fig. 1)

This area extends from the north of the Rabat-Fes road to the Zerhoun mountains. Two sites were visited and a total of 99 gatherings collected. The following are new records for this area: *Aristida caerulescens* Desf. (2.48, 3.102), *Bituminaria bituminosa* (L.) C.H. Stirt (3.11), *Caralluma europaea* (Guss.) N.E. Br. (3.128), *Ephedra fragilis* Desf. subsp. *fragilis* (3.138), *Erodium laciniatum* subsp. *pulverulentum* (Boiss.) Batt. (3.129), *Helianthemum ledifolium* (L.) Mill. (2.73), *Lotus weilleri* Maire (3.106), *Matthiola parviflora* (Schousb.) R. Br. (3.92), *Plantago mauritanica* Boiss. & Reut. (3.82), *Scorpiurus sulcatus* L. (3.127) and *Silene inaperta* L. subsp. *inaperta* (3.132).

Another four species collected during *Iter V* and not included in the *Catalogue* or indicated for this area in subsequent papers, were already recorded by Braun-Blanquet & Maire (1924): *Convolvulus siculus* L. (3.111), *Limonium lobatum* (L. f.) Chaz. (2.65), *Paronychia argentea* Lam. (3.137) and *Peganum harmala* L. (3.124).

*Tazekka* (n. 12 in fig. 1)

Mt. Tazekka constitutes the north-eastern zone of the Middle Atlas, from which it is clearly separated by the river Oued-bou-Hellow, the tributary or river Inaouene and by the river Haddar, a tributary of the river Moulouya. Declared a National Park, it has often been visited by botanists. A total of 320 gatherings was collected in the nine sites visited. The following are new records: *Acinos alpinus* subsp. *meridionalis* (Nyman) P.W. Ball (29.1287), *Aira uniaristata* Lag. & Rodr. (27.983b), *Arabis verna* (L.) R. Br. (26.938b), *Astragalus sesameus* L. (32.1110), *Bunium alpinum* subsp. *atlanticum* Maire (32.1101), *Calamintha baborensis* Batt. (29.1300), *Calamintha nepeta* (L.) Savi subsp. *nepeta* (28.1019), *Calendula maroccana* (Ball.) B.D. Jacks. (28.1014), *Carthamus calvus* (Boiss. & Reut.) Batt. (33.1123), *Cynoglossum dioscoridis* Vill. (29.1034), *Festuca triflora* Desf. (27.960), *Filago minima* (Sm.) Pers. (30.1085), *Gagea cossoniana* Pascher (29.1036), *Lomelosia stellata* (L.) Raf. (25.900), *Ononis hispida* subsp. *arborescens* (Desf.) Sirj. (25.899), *Ononis ramosissima* Desf. (33.1128), *Patzkea paniculata* subsp. *baetica* (Hack.) Scholz (27.950), *Petrorahagia dubia* (Raf.) G. López & Romo (27.990), *Polystichum setiferum* (Forssk.) Woynar (27.962), *Scleranthus polycarpos* L. (29.1049), *Scorpiurus sulcatus* L. (33.1112), *Stellaria pallida* (Dumort.) Piré (26.922), *Taraxacum pachypodum* H. Lindb. (30.1084), *Teucrium joannis* (Sauvage & Vind) El Oualidi, T. Navarro & A. Martín (25.889), *Trifolium arvense*

L. (30.1060), *Trifolium glomeratum* L. (30.1069), *Trifolium phleoides* Willd. (30.1056), *Trifolium suffocatum* L. (26.915), *Trisetum flavescens* subsp. *africanus* (H. Lindb.) Dobignard (32.1093, 33.1122), *Tuberaria macrosepala* (Boiss.) Willk. (27.984), *Valerianella locusta* (L.) Laterr. subsp. *locusta* (29.1293), *Veronica hederifolia* L. subsp. *hederifolia* (30.1061) and *Vulpia sicula* (Presl) Link (30.1058).

One more species collected during *Iter V* was not given for this area in the *Catalogue* or in latter papers, but was recorded in Taza by Braun-Blanquet & Maire (1924): *Astragalus glaux* L. (32.1102).

*Tsoul* (n. 13 in fig. 1)

This area extends from the Rif Mountains to the Tazekka area, and covers part of the basins of the river Inaouene and its northern tributaries. Only one site was visited and 63 gatherings recorded. Almost half of the plants collected constitute new records for this area: *Allium pallens* L. (19.802b), *Atractylis serratuloides* (Cass.) DC. (19.789), *Atriplex glauca* L. (19.777), *Calendula arvensis* (Vaill.) L. (19.797), *Centaurea eriophora* L. (19.798), *Centaurea sicula* L. (19.790), *Chamaesyce canescens* (L.) Prokh. subsp. *canescens* (19.780), *Citrullus colocynthis* (L.) Schrader (19.802), *Cordylocarpus muricatus* Desf. (19.768), *Coronilla scorpioides* (L.) Koch (19.749), *Erodium malacoides* subsp. *longirostris* (Maire & Samuels.) Guitt. (19.752), *Erodium stellatum* Delile (19.751), *Eryngium campestre* L. (19.753), *Eryngium ilicifolium* Lam. (19.757), *Hordeum murinum* subsp. *glaucum* (Steud.) Tvelev (19.772), *Hypecoum pendulum* L. (19.754), *Lygeum spartum* L. (19.782), *Matthiola lunata* DC. (19.774), *Marrubium alyssoides* Pomel (19.776), *Pallenis maritima* (L.) Greuter (19.800), *Pallenis spinosa* (L.) Cass. subsp. *spinosa* (19.796), *Rhodalsine geniculata* (Poir) F.N. Williams (19.788), *Schedonorus mairei* (St.-Yves) Dobignard (19.767) and *Schimus barbatus* (L.) Thell. (19.775).

*Paronychia argentea* Lam. (19.783), not included for this area in the *Catalogue*, or in subsequent papers, had already been recorded in Sidi Abd-el-Jellil by Braun-Blanquet & Marie (1924: 183).

*Aknoul* (n. 14 in fig. 1)

This rather mountainous area constitutes the eastern part of the Rifian dorsal. It borders to the west with the Central Rif area and the Teirara Mountains. The area borders to the north with the divide separating the basins of the rivers Rhis and Ouerrha and with the river Timerzga and the river Neckor as far as Arbaa de Taorit. The eastern boundary is formed by the river Tiakhenat, the divide separating the rivers Larbaa and Irhâne, continuing to the river Mesoun. It borders to the south with the Tsoul area. Eight sites were visited in this interesting area, and 217 gatherings collected. The following taxa are new records: *Achillea maura* Humbert (39.1349), *Allium subvillosum* Schult. & Schult. f. (36.1238), *Carthamus caeruleus* L. (41.1390), *Carex divisa* Hudson (37.1257), *Cynara cardunculus* subsp. *flavescens* Wiklund (34.1152), *Echinops strigosus* L. (34.1154), *Epipactis tremolsii* Pau (35.1198), *Galium molugo* subsp. *erectum* Syme (35.1178, 36.1244), *Hedypnois rhagadioloides* (L.) F.W. Schmidt (40.1372), *Juncus articulatus* L. (39.1341), *Linum munbyanum* Boiss. & Reut. (35.1180), *Lycium barbarum* L. (36.1227), *Ononis mitissima* L. (41.1392), *Ononis pubescens* L. (41.1381), *Phillyrea angustifolia* L. (38.1271), *Rosa sempervirens* L. (40.1352), *Rupicapnos africana* subsp. *mairei* (Pugsley) Maire (40.1364), *Sedum sediforme* (Jacq.) Pau (39.1320), *Silene martyi* Emb. & Maire (39.1316), *Teucrium rotundifolium*

Schreb. (35.1195, 40.1375), *Teucrium resupinatum* Desf. (41.1393) and *Urtica pilufera* L. (36.1234).

Four species collected during *Iter V*, which were not included in the *Catalogue* for this area, had already been recorded: *Sedum dasyphyllum* L. (36.1249) by Emberger & Maire (1927: 9), *Psychine stylosa* Desf. (34.1166) by Sennen & Mauricio (1933: 8), and *Gladiolus italicus* Mill. (41.1398), *Pinus halepensis* L. (38.1266) and *Phillyrea latifolia* L. (40.1369) by Emberger & Maire (1928).

*Kert Ganc* (n. 16 in fig. 1)

This is one of the most arid areas in N Morocco, and one of the least frequently visited. It encompasses some high mountains, such as Jbel Sebbar and Jbel Masgout and some depressed arid areas, such as the Saka Basin.

Only 47 gatherings were collected in this area, of which the following taxa are new records: *Asplenium hispanicum* (Coss.) Greuter & Burdet (23.842), *Dianthus sylvestris* subsp. *longibracteatus* (Maire) Greuter & Burdet (23.877), *Helianthemum apenninum* (L.) Mill. (23.849), *Olea europaea* var. *sylvestris* (Mill.) Lehr (23. 836) and *Solanum alatum* Moench (23.878).

Another two species collected during *Iter V*: *Cheilanthes hispanica* Mett. (23.842) and *Macrochloa tenacissima* L. (23.875) are not given for this area in the *Catalogue* neither in latter papers, but had already been recorded by Sennen & Mauricio (1933).

*Gareb area* (n. 17 in fig. 1)

This is an arid, relatively low (its higher altitudes do not reach 1000 m.) coastal area extending from Cape Ras-Afrou to the mouth of the river Moulouya. Only one site was visited in this area, this being sufficient to collect 20 taxa, two of which are new records: *Asplenium hispanicum* (Coss.) Greuter & Burdet (22.829), *Caralluma munbyana* (Decaisne) N.E. Br. (22.834).

Another species collected, *Carlina lanata* L. (22.822), not given for this area in the *Catalogue* neither in latte papers, had already been recorded in several localities by Sennen & Mauricio (1933: 63).

*Guercif area* (n. 18 in fig. 1)

Only one species was collected in this arid area during one stop for afternoon tea: *Asparagus albus* L. (n. 21.815), already recorded in the *Catalogue.*

*Forêt de la Maâmora* (n. 20 in fig. 1)

Considered to be the biggest *Quercus suber* L. forest in the world, it originally covered over 134,000 ha (Aafi & al. 2005: 127), although it is undergoing a gradual decrease in area due to anthropogenic influence. Its proximity to Rabat makes this one of the most visited areas in N Morocco. A total of 46 taxa was collected, the following of which are new records: *Astragalus hamosus* L. (1.41), *Biscutella didyma* L. (1.32), *Capsella bursa-pastoris* (L.) Medicus (1.26) and *Cuscuta campestris* Yunck (1.27).

Another species collected: *Paronychia echinulata* A.O. Chater (1.3) not given in the Catalogue had already been recorded for this area by Pittard (1912: 166, as *P. echinata* (Desf.) Lam.).

**Discussion**

The new records for the different areas of N Morocco visited during the *Fifth Iter Mediterraneum* reflect, in a certain way, our botanical knowledge of these areas. The percentage of new records for the Forêt de Maâmora, W Rif, C Rif, Tazekka and Gareb is lower than for the remaining areas. These five areas are or have been frequently visited by botanists and hence the representation of plant material in different herbaria; more bibliographical information is available than for other areas, such as Ouezzane, for where there were no records previous to the publication of the *Catalogue*.

The best known natural area in N Morocco is West Rif, with 1965 taxa recorded in the literature. This area is covered by two recent detailed checklists by Mateos & Valdés (2009, 2010a, 2010b) and Chambouleyron (2012). This is why, of the 288 gatherings collected during the *Iter*, there is only one new record: *Epilobium lanceolatum* Sebast. & Mauti (60.2036), a gathering that was in fact erroneously identified for this area as *E. parviflorum* Schreb. by Mateos & Valdés (2010a: 103). It is a new record for Morocco.

After W Rif, the Central Rif is the best known area in N Morocco, with 1071 taxa recorded in the literature. Of the 408 taxa (423 gatherings) collected in the Central Rif during *Iter V*, 30 taxa, that is 7.3 %, are new records for this area.

Gareb is another well known area in N Morocco, particularly as a result of the botanical exploration of E Rif by F. Sennen and co-workers (see Sennen & Mauricio, 1933; Sennen, 1936). Even in this case, one single stop during the *Iter*, which resulted in the collection of only 20 taxa, added two new records, 10 % of the taxa collected.

The Forêt de la Maâmora is one of the most frequently visited areas. There are even several monographic studies for this area, particularly Metro & Sauvage (1953) and Aafi & al. (2005), as well as a study of the Moroccan *Quercus suber* forests by Sauvage (1961), covering the whole area. However, only 796 taxa have been recorded in the literature for this area, a fact that indicates that it is rather uniform with regard both to flora and to vegetation. In spite of this, of the 46 taxa collected at one single site 4 of them ( 9 %) constitute new records.

Targuist, an area extending from C Rif to the Mediterranean, is the next best known area of the Rif region, with 1070 taxa recorded to date therein. Only 15 taxa were collected in this area, two of which (13 %) are new records.

Aknoul and Kert Gank constitute the eastern part of the Rifian dorsal, Aknoul being more mountainous and Kert Gank more arid. They are less known botanically than the aforementioned areas, with only 765 taxa indicated to date for the former and 812 for the latter. Aknoul is one of the most interesting areas of N Morocco, and it shares with W and C Rif a series of endemic species. However, it has not been frequently visited and hence, of the 196 taxa collected (217 gatherings) in eight sites, 22 (10 %) are new for this area. Aknoul is as rich in flora as C. Rif; the number of taxa recorded therein, including these new records, is 777, while in C. Rif, the list of known vascular plants, including the new records, totals 1101. The Kert Gank natural area is not particularly attractive to botanists. A total of 47 taxa was collected during *Iter V*, five of which (10.6 %) are new records. So far, 818 taxa are known for this area, including these new records.

Zerhoun, Tsoul and Ouezzane are the least known of the areas visited. Although only 92 taxa (99 gatherings) were collected in Zerhoun, 10 constitute new records. This means that

this area, on the road from Forêt de la Maâmora to Middel Atlas and the Central Rif, has not attracted the attention of botanists. Tsoul is, in a certain manner, one of the least attractive chorological units in N Morocco and hence, one of the least visited by botanists. Only 62 taxa (63 gatherings) were collected there. The fact that 24 constitute new records, i.e., 38.7 % of the collected taxa, clearly indicates how poorly known this area is, and that there is still need for further botanical exploration. The same occurs with Ouezzane. Only 463 vascular plants were previously know from this area. During *Iter V*, 153 taxa (163 gatherings) were collected in the four sites visited, 28 of which constitute new records, i.e., 18.3 % of the collected taxa. Indeed, no records from this area existed prior to the publication of the *Catalogue*, which indicates once again that this is also an area much in need of botanical exploration.

Finally, Jbel Tazekka is one of the most interesting areas of N Morocco. A total of 933 taxa had heretofore been indicated for this area. The fact that, of the 288 taxa (320 gatherings) collected during *Iter V* in the 9 sites visited, 33 are new records (11.4 % of the collected taxa) clearly indicates that greater attention ought to be paid to this interesting area, which geographically belongs to the Middle Atlas, but is clearly isolated from the rest of the Atlas system and is floristically linked to the Rif mountains (Jahandiez & Maire, 1931; Emberger, 1939). With the contribution of *Iter V*, the vascular flora described for this mountain accounts for 966 taxa.

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Bocconea 26: 145-149
doi: 10.7320/Bocc26.145
Version of Record published online on 7 September 2013

Stephen L. Jury

# Lichens collected during the fifth "Iter Mediterraneum" in Morocco, 8-27 June, 1992

**Abstract**

Jury, S. L.: Lichens collected during the fifth "Iter Mediterraneum" in Morocco, 8-27 June, 1992. — Bocconea 26: 145-149. 2013. — ISSN 1120-4060 (print), 2280-3882 (online).

The Lichens collected by S.L. Jury and R. Wilson during *Iter Mediterraneum V* are listed, together with the indication of the institutions where the material is deposited.

*Key words*: Flora of Morocco, Lichens, Itinera Mediterranea, OPTIMA.

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Throughout *Iter V* (8-27th June, 1992), Stephen Jury and Rupert Wilson collected 314 gatherings of bryophytes and 195 of lichens. These were included in one series of S.L. Jury's personal collection numbers (10452—10970) which also contained a few seed gatherings without voucher specimens. A number of the cryptogams proved to be identical, and if they came from the same habitat at the same site location, they were amalgamated, while some others were split into two or more as they proved to be mixed collections. These were designated by adding a lower case letter after the number.

Records in the University of Reading Herbarium show that a lot of duplicates were distributed in summer 1992 in order to obtain identifications. They were all sent out in packets with collection details and a spare label included to be returned to Reading with any determination and the name of the identifier. In fact, none of these were returned, though Dr H. Sipman, Berlin, sent a list of determinations he made the same summer. A visit to Reading by the distinguished lichenologist, Professor Per Magnus Jørgensen, enabled further lichen specimens to be determined.

The main set of lichens was repatriated to the herbarium IAV at the Institut Agronomique et Vétérinaire Hassan II, Rabat, whilst other sets were distributed as follows:

SEV 245 (85 lichens [set 4] and 160 bryophytes [set 5]).

PAL 322 (63 lichens [set 5], 257 bryophytes [set 3] and 2 fungi.

B 146 (46 lichens [set 6] and 100 bryophytes [set 7]).

LIV 250 (30 lichens [set 7] and 220 bryophytes [set 4]).

CAME 155 (30 lichens [set 8] and 125 bryophytes [set 6]).

**Lichen identifications**

The Lichens which have been identified at generic or specific level are listed below for each collecting locality. The numbers in square brackets at the end of each location are the numbers of the vascular collecting sites as given in detail in the preceding *Checklist of vascular plants.*

Many of the determinations are provisional, and any corrections and additions are welcomed.

C. 12 km from Rabat on road to Meknès, Forêt de la Maâmora, 9 June [1]

10454 Cladonia rangiformis Hoffm.

C. 15 km from El Hajeb on road to Ifrane, Forêt de Jaaba, 9 June [4]

10464 Parmelia tiliacea (Hoffm.) Ach.
10465 Anaptychia ciliaris (L.) Koerb.
10466 Physconia venusta (Ach.) Poelt
10467 Usnea
10469 Evernia prunastri (L.) Ach.
10470 Parmelia carporrhizans (Taylor) Poelt & Vezda
10472 Pertusaria
10473 Leproloma
10474 Physconia distorta (With.) Laund.
10475 Parmelia tiliacea (Hoffm.) Ach.

High Atlas, *c*. 15 km from Midelt to Cirque du Jaffar, Jbel Ayachi, 10 June [7]

10478 Lecanora
10481a Caloplaca
10481b Candelariella

Middle Atlas, 22 km to Ain Leuh from Azrou—Midelt road, 11 June [10]

10493 Anaptychia ciliaris (L.) Koerb.
10494 Parmelia tiliacea (Hoffm.) Ach.
10495 Physconia perisidiosa (Erichsen) Moberg
10496 Physconia venusta (Ach.) Poelt

Middle Atlas, 14 km from Azrou on road to Ain Leuh, 11 June [12]

10500 Pseudevernia furfuracea (L.) Zopf

Middle Atlas, 7 km from Azrou along road to Midelt, 12 June [14]

10502 Anaptychia ciliaris (L.) Koerb.
10504 Ramalina fraxinea (L.) Ach.
10506 Xanthoria parietina (L.) Th. Fr.
10507 Usnea
10508 Melanohalea exasperate (De Not.) O.Blanco & al.

10509 Lecidella elaeochroma (Ach.) Choisy
10510a Physcia aipolia (Humb.) Fuernr.
10510b Lecanora carpinia (L.) Vain.
Middle Atlas, 34 km from Azrou on road to Midelt, 12 June [17]
10520 Caloplaca schistidii Anzi
10521 Dermatocarpon
10523 Physconia perisidiosa (Erichsen) Moberg
C. 25 km S of Saka on road from Guercif to Nador, 14 June [21]
10533 Aspicilia
10534 Acarospora sulphurata (Arnold) Arnold

C. 55 km from Nador on road to Guercif, 14 June [22]
10539a Collema
10539b Gloeoheppia turgida (Ach.) Gyein.
10541 Fulgensia
10545 Squamarina lentigera (Web.) Poelt
C. 4 km from village of Ain Zorah on road from Saka, 14 June [23]
10549 Cladonia
10555a Fulgensia
10555b Squamarina
10556 Diploschistes
Middle Atlas, 18 km from Taza along minor road to Gouffre de Friouato and Jbel Tazekka, 15 June [26]
10570 Parmelia pulla Ach.
10571 Lepraria
10574 Cladonia pocillum (Ach.) Grognot
Middle Atlas, 42 km from Taza on minor road, 15 June [27]
10576 Cladonia fimbriata (L.) Fr.
10577 Parmelia tiliacea (Hoffm.) Ach.
10578 Physconia pulverulacea Moberg
10579 Cladonia foliacea (Huds.) Willd.
10580 Anaptychia ciliaris (L.) Koerb.
10581 Lecidea
10582 Aspicilia
10583 Bacidia rubella (Hoffm.) A.Massal.
Middle Atlas, around summit of Jbel Tazekka, 16 June [29]
10591 Platismatia glauca (L.) Culb. & Culb.
10592 Anaptychia ciliaris (L.) Koerb.
10593 Pertusaria
10594 Caloplaca
10596 Parmelia saxatilis (L.) Ach.
10597 Rhizocarpon

10598a ?Aspicilia
10598b Parmelia pulla Ach.
10599 Rhizocarpon

Middle Atlas, c. 13 km SSW of Taza on minor rd to Bab-Bou-Idir, 16 June [33]
10605 Anaptychia ciliaris (L.) Koerb.
10606 Ramalina fraxinea (L.) Ach.
10607 Xanthoria parietina (L.) Th. Fr.

C. 37 km from Taza on rd to Nador, S of Dar Caïd-Medboh, 17 June [34]
10608 Lecanora crenulata (Dicks.) Hook.
10609a ?Aspicilia
10609b Diploschistes

Junction on Taza—Aknoul road with turning to Mesquitem, 17 June [38]
10616 Xanthoria parietina (L.) Th. Fr.

C. 15 km SW of Ketama along road to Taounate and Fès, 19 June [43]
10631 Toninia

C. 4 km along track to Jbel Tidirhine, 9 km from Ketama, 20 June [44]
10641 Cladonia
10642 Ramalina farinacea (L.) Ach.
10643 Pseudevernia furfuracea (L.) Zopf
10644 Platismatia glauca (L.) Culb. & Culb.
10645 Anaptychia ciliaris (L.) Koerb.
10646 Parmelia saxatilis (L.) Ach.
10647 Platismatia glauca (L.) Culb. & Culb.
10648 Physcia leptalea (Ach.) DC.
10649 Physconia venusta (Ach.) Poelt
10650 Pertusaria
10651 Pertusaria
10652 Nephroma lusitanicum Schaerer
10653 Hypogymnia
10654 Caloplaca
10671 Cladonia fimbriata (L.) Fr.

C. 12 km along track to Jbel Tidirhine, 20 June [45]
10672 Letharia vulpina (L.) Hue

C. 14 km along track to Jbel Tidirhine, 20 June [46]
10683 Cladonia fimbriata (L.) Fr.
10684 Lecanora
10685a Aspicilia
10685b Rhizocarpon

C. 9 km along track to Jbel Tidirhine, 20 June [47]
10699 Perusaria albescens (Huds.) Choisy & Werner
10700 Nephroma laevigatum Ach.

C. 23 km from Ouazzane on road to Chefchaouèn, 23 June [52]

10742 Evernia prunastri (L.) Ach.
10744 Cladonia rangiformis Hoffm.

C. 5 km up track to Jbel Tizirane, 74 km from Chefchaouèn 24 June [57]
10813 Pseudevernia furfuracea (L.) Zopf
10820 Platismatia glauca (L.) Culb. & Culb.
10822 Parmelia quercina (Willd.) Vain.
10823 Lobaria scrobiculata (Scop.) DC.
10825 Anaptychia ciliaris (L.) Koerb.
10826 Lobaria pulmonaria (L.) Hoffm. var. meridionalis (Vain.) Zahlbr.
10830 Degelia plumbea (Lightf.) Jøerg.& James
10831 Ochrolechia pallescens (L.) A. Massal.
10832 Rhizocarpon geographicum (L.) DC.

C. 44 km from Chefchaouèn, 14 km above Talembote on track to Jbel Tassaout 25June [60]
10914 Evernia prunastri (L.) Ach.
10915 Perusaria amara (Ach.) Nyl.

C. 38 km from Chefchaouèn, 14 km above Bab Taza on track on Jbel Talassemtane, by forest house, 26 June [64]
10951 Caloplaca ferruginea (Ach.) Branth
10954 Lecidella elaeochroma (Ach.) Choisy
10955 Pertusaria
10956 Squamarina cartilaginea (With.) P. James

Bocconea 26: 151-172
doi: 10.7320/Bocc26.151
Version of Record published online on 7 September 2013

Zoila Díaz Lifante & Raquel Parra Martín

# Chromosome numbers of plants collected during *Iter Mediterraneum V* in Morocco

**Abstract**

Díaz Lifante, Z., Parra Martín, R.: Chromosome numbers are reported for plants collected during OPTIMA's *Iter Mediterraneum* V to Morocco in 1992. — Bocconea 26: 151-172. 2013. — ISSN 1120-4060 (print), 2280-3882 (online).

They represent 111 taxa belonging to 79 genera of 25 families. Twelve taxa have not previously been studied. In seven taxa the chromosome number found differs from previous reports.

*Keywords*: Chromosome number, karyology, cytotaxonomy, cytogenetics, Morocco, North Africa.

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## Introduction

The OPTIMA expeditions (*Itinera Mediterranea*) constitute a good opportunity for improving the karyological knowledge of taxa distributed in geographical areas little known in the Mediterranean region. The chromosome number of many gatherings collected during different expeditions was counted and published in several papers (Luque & Díaz Lifante 1991; Díaz Lifante & al. 1992; Vogt & Aparicio 1999; Vogt & Oberprieler 2012). During the fifth OPTIMA expedition in Morocco in June 1992 (*Iter Mediterraneum V*), 2366 gatherings were collected, belonging to 1418 taxa. Seeds from 143 gatherings were germinated and chromosome number counted. These specimens belong to 111 different taxa, 79 genera and 25 families.

## Material and Methods

In Table 1 the geographic origin of the plants here studied is indicated. Vouchers are kept in the Herbarium of the Departamento de Biología Vegetal y Ecología of the University of Seville (SEV).

Seeds were taken from the herbarium material and germinated in Petri dishes with filter paper moisturized with distillate water at room temperature in autumn 1992. Metaphase root plates were treated with 0.002 M-hydroxyquinoline for 4 hours, then fixed in Farmer's fluid (Löve & Löve 1975) and kept at 4 ºC. Alcoholic hydrochloric acid carmine solu-

tion (Snow 1963) was used for staining roots for 24-48 hours. Plates were squashed and mounted in 45 % glacial acetic acid. Photographs of metaphase plates for some taxa were obtained with a Zeiss Axioscope photomicroscope.

## Results

The diploid chromosome numbers found are indicated in Table 2 in which families, genera and species are arranged alphabetically. The number of the gathering given in the *Iter V* collection is indicated for each plant. The previous chromosome counts for each taxa are referred by the cytogenetic databases where they are included. For simplicity, in Table 2 these databases are represented by one or two letters as follows: A, ANTHOS (2013); B, Bolkhovskikh & al. (1969); BI, BSBI (2013); Ch, CHROBASE (2013); Cr, CROMOCAT (2013); I, IPCN (2013) (see References section). Taxa marked with an asterisk are counted presumably for the first time in this study.

## Discussion

The results here included are complementary with the accounts already published by Vogt & Oberprieler (2012) on plants collected during the fifth *Iter Mediterraneum*. According to the bibliographic references consulted, the counts made in 91 taxa agree with previous numbers reported by different authors. In 25 of these taxa the somatic chromosome number found confirms the range of ploidy levels known to date. The counts obtained in three taxa amplify the ploidy level range and those found in seven taxa are not in agreement with previous reports. For 16 taxa the counts here presented seem to be the first accounts on Moroccan plants. For 12 taxa these are presumably the first accounts

Some comments for 64 taxa are following in relation to the chromosome numbers here presented which are deviating from previous studies or constitute a new count or are remarkable for other reasons. Taxa for each family are arranged alphabetically.

### *Alliaceae*

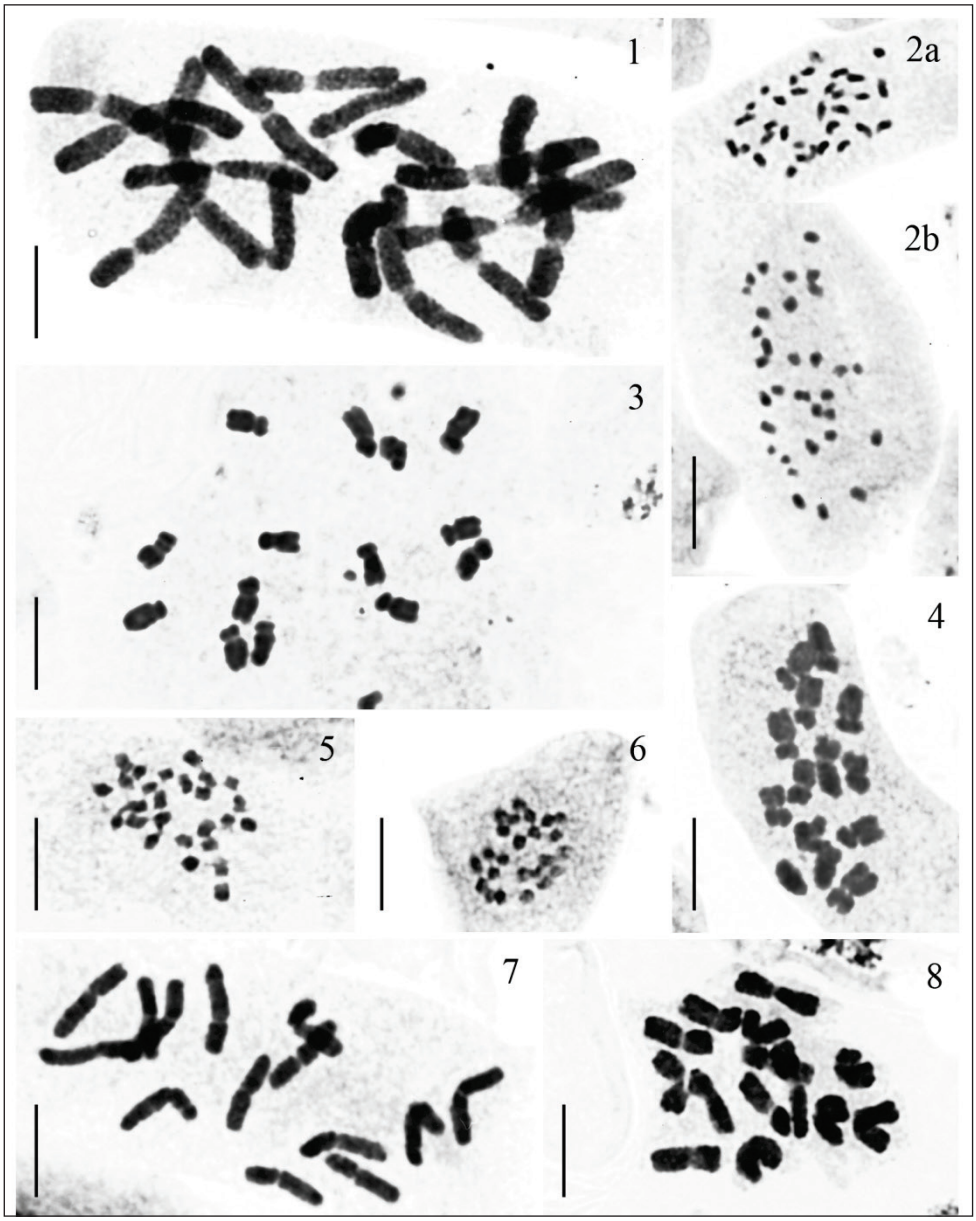
*Allium pallens* Lam. subsp. *pallens* *2n*=16 (fig. 1)

The chromosome number found for the first time in plants from two locations of Morocco supports the distribution of diploids in populations from the Iberian Peninsula, N Africa and Anatolia, as Fiorini & Raffaelli (1996) suggested, whereas the 4x level distributes by the central Mediterranean area.

### *Brassicaceae*

*Alyssum simplex* Rudolphi (= *A. parviflorum* Fisch.) *2n*=32

This tetraploid level has also been found by Ghaffari & Chariat-Panahi (1985) and Vogt & Oberprieler (2009, 2012: gathering nº 3.91) in plants from Iran and Morocco, respectively, whereas the diploids (*2n*=16) have been found in Portugal (Queirós 1973), Italy (Raimondo




**Figures 1-8.** Somatic metaphases. 1: *Allium pallens* Lam. subsp. *pallens* (3.83), 2n=16. 2a, 2b: *Ononis mitissima* L. (54.1808), 2n=30-32. 3: *Vicia lecomtei* Humbert & Maire subsp. *lecomtei* (29.1285), 2n=14. 4: *Vicia pubescens* (DC.) Link (43.1475), 2n= 14. 5: *Geranium purpureum* Vill. (25.892bis), 2n=26. 6: *Luzula forsteri* (Sm.) DC. (60.2065), 2n=24. 7: *Hordeum murinum* subsp. *glaucum* (Steud.) Tzvelev (7.322), 2n=14. 8: *Patzkea patula* (Desf.) H. Scholz (10.455), 2n= 14. Scale bar for all the figures: 5 μm.

& al. 1983), Spain (Löve & Kjellqvist 1974a, Luque & Díaz Lifante 1991) and Greece (Runemark 2000).

*Diplotaxis tenuisiliqua* Delile *2n*=18

This is, presumably, the first count made for this north African endemism.

*Jonopsidium prolongoi* (Boiss.) Batt. *2n*=36

The count here included differs from *n*=11 by Fernández Casas (1975) and *2n*= 22 by Chiarugi (1945, sec. Bolkhovskikh & al. 1969). Nevertheless *2n*=36 has also been found by Luque & Díaz Lifante (1991) in plants from Sierra de la Sagra (SE Spain). This population is located at a high altitude, 1400-1700 m, as the Moroccan population here studied, at 1765-1900 m.

*Lepidium heterophyllum* Benth. subsp. *riphanum* (Emb. & Maire) J.M. Monts. Martí *2n*=16

This seems to be the first time that the somatic chromosome number has been counted in this Rif endemic subspecies. It agrees with the counts from N European and Portuguese plants attributed to the species without subspecific designation (ANTHOS 2013; Bolkovskikh & al. 1969; CROMOCAT 2013; IPCN 2013).

*Lepidium hirtum* (L.) Sm. subsp. *dhayense* (Munby) Thell. *2n*=32

The account here presented for this north African endemism was obtained in plants from the Middle Atlas growing at 1400 m. The octoploid level (2n=32) found disagrees with the 2n=16 given by Favarger & al. (1979) in plants from several populations of High Atlas at 3350 m altitude. So far, all accounts on this W Mediterranean species (Bolkhovskikh & al. 1969; Morales Torres & al. 1988) yelded diploid and tetraploid level (*2n*=8 and *2n*=16).

*Malcolmia triloba* (L.) Sprengel subsp. *broussonetii* (DC.) Asensi & Díaz Garretas *2n*=20

This is the first count for the subspecies. It differs from the *2n*=24 found by Diosdado & al. (1994) in plants from Sevilla (Spain) without indication of subspecies.

*Psychine stylosa* Desf. *2n*=30

In this endemic north African species, the gametic number *n*=15 has been found also in Moroccan plants identified as the var. *maroccana* Murb. (Marrakech, Gómez Campo 1980) and var. *typica* Maire (Fès, Ruíz de Clavijo 1991), but it disagrees with that of *2n*=16 found by Arista & Ortiz (1994) in plants from Taza (Morocco).

*Sisymbrium erysimoides* Desf. *2n*=14

This is the third count in this species, which is in accordance with that found by Jonsell (1976) in plants from tropical Africa and by Díaz Lifante & al. (1992) in plants from Israel.

*Cariophyllaceae*

*Arenaria pomelii* Munby *2n*=20

The somatic chromosome number found in this western Mediterranean species agrees with

the only previous count, *n*=10, by Aparicio (1993) in plants of Sierra de Grazalema (S Spain).

*Arenaria serpyllifolia* L. *2n*=40

The somatic chromosome number *2n*=40 has been found in plants of two locations (Table 1). The polymorphic species *A. serpyllifolia* shows two ploidy levels, with *2n*=20 and *2n*=40, both found in Moroccan plants, by Favarger & al. (1979) and Galland (1988) respectively, although other rare counts are recorded in cytogenetic databases. According Verlaque & al. (1995) the tetraploid level *2n*=40 occurs in the Eurasian and cosmopolitan subsp. *serpyllifolia*.

*Cerastium brachypetalum* Pers. subsp. *brachypetalum* *2n*=72

The number *2n*=72 found does not agree with the *n*=38, 44-45, 45±1 counts for plants from Moroccan mountains given by Favarger & al. (1979), Galland (1988) and Çelebioglu & Favarger (1993). Nevertheless it is in accordance with the numbers *n*=36 and *2n*=72 indicated by Pogan & al. (1986) for this species in Polish plants.

*Cerastium pumilum* Curtis *2n*=54

This is the first time that *2n*=54 has been found in this species for which previous counts indicate *2n*=72, 90, 95 (Table 2).

*Cerastium ramosissimum* Boiss. *2n*=54

The number *2n*=54 agrees with the gametic number given by Favarger & al. (1979) in Moroccan and Spanish plants and with the somatic number reported by Luque & Díaz Lifante (1991) in plants from Israel. It differs from 2n=44-46 indicated by Sollner (1954) in this species.

*Cerastium semidecandrum* L. *2n*=36

In this species the most frequent count is *2n*=36 (Table 2), which agrees with that here found in Moroccan plants.

*Minuartia hybrida* (Vill.) Schischkin *2n*=42

This is a new chromosome number to add to the diverse somatic and gametic numbers found in this species (Table 2).

*Polycarpon tetraphyllum* (L.) L. subsp. *tetraphyllum* *2n*=16

In this study two different numbers, *2n*=16 and *2n*=48, have been found in plants from Taza and Alhoceima regions, respectively. Several previous counts indicating 4x, 6x and 8x ploidy levels are recorded in the literature (Table 2). The first count here given agrees with the only previous diploid *2n*=16 indicated by Dalgaard (1986) in plants from Madeira. The second with the hexaploid level found by Runemark (1996) in plants from Greece.

*Scleranthus polycarpos* L. *2n*=44

Galland (1988) for Moroccan plants from High Atlas, and Fernandes & Leitão (1971) for Portuguese plants, reported *n*=22 and *2n*=44 in this subspecies, which are corroborated by the counts here given for plants from two populations at high altitude (Table 1).

*Silene mekinensis* Coss. *2n*=24

It seems to be the second record for this species, the first for Moroccan plants, which is in accordance with that reported by Blackburn (1928, sec. Bolkhovskikh & al. 1969).

*Silene martyi* Emb. & Maire *2n*=24

As far as the authors are aware, this is the first karyologic study for this species. It corroborates the more frequent chromosome number of genus *Silene*.

*Silene vulgaris* (Moench) Garke subsp. *vulgaris* *2n*=48 (fig. 2)

The most frequent somatic chromosome for this taxon is *2n*=24 although *2n*=48 has also been recorted in the literature (Table 2) for plants of Portugal, Finland and Turkey.

*Chenopodiaceae*

*Chenopodium opulifolium* W.D.J. Koch & Ziz *2n*=18

The result obtained in this study is in agreement with the *2n*=18 of Kawatani & Ohno (1956) and *n*=9 of Crompton & Bassett (1976). Nevertheless *2n*=36 and the most frequent *2n*=54 are also reported for the same species in the literature (Table 2). It seems to be the first count in Moroccan plants.

*Cistaceae*

*Cistus ladanifer* L. subsp. *mauritianus* Pau & Sennen *2n*=18

The somatic number *2n*=18 constitutes the first count in this subspecies, as far as the authors are aware. It agrees with the number found in the species for different authors (Table 2).

*Cyperaceae*

*Carex pendula* Huds. *2n*=40

The somatic number here presented deviates from the most frequent *2n*=58 as well as from *2n*=60, 62 also previously cited (Table 2).

*Dipsacaceae*

*Lomeliosa stellata* (L.) Raf. (= *Scabiosa stellata* L.) *2n*=18

The count *2n*=18 obtained in plants from Taineste (Taza) meets with that found by Vogt & Oberprieler (2012) in plants of this species belonging to the gathering 25.900 of the *Iter V*, collected near of Taza city. Nevertheless other different somatic numbers are reported in the literature (Table 2).

*Euphorbiaceae*

*Euphorbia dracunculoides* Lam. subsp. *inconspicua* (Ball) Maire *2n*=40

It seems to be the first count in this subspecies of *Euphorbia dracunculoides*. It agrees with the *2n*=40 indicated in the species without designation of subspecies for western Mediter-

ranean plants from Morocco by Vicens & Molero (1992) and Humphries & al. (1978). However the latter authors also reported *2n*=16 from Biskra (Algeria).

*Mercurialis annua* L. *2n*=48

Plants of gathering 22.825 have been identified as *M. annua* L. in accordance to characters indicated by Güemes (1997). Nevertheless the hexaploid level found (*2n*=48) does not correspond with the expected diploid level of this species (Güemes 1997; Krähenbühl & al. 2002). In Morocco *2n*=48 has been found in plants identified as *M. ambigua* L. fil. from Rabat (El Alaoui-Faris & al. 2009) and from Ketama (Vogt & Oberprieler 2012, gathering nº 43.1476 of *Iter V*).

*Fabaceae*

*Lotus longisiliquosus* R. Roem. *2n*=28

This account seems to be the first in the species according to the databases consulted (Table 2).

*Onobrychis humilis* (Loefl.) G. López subsp. *jahandiezii* (Sirj.) Greuter & Burdet *2n*=14

This is the first karyologic study for this Moroccan endemic subspecies, obtained in plants from two different locations. It is in accordance with counts by Ruíz de Clavijo (1993) and Elena Roselló & al. (1984) who indicated *n*=7 and *2n*=14, respectively, in Spanish plants identified as *O. peduncularis* (Cav.) DC (= *O. humilis* (Loefl.) G. López), but it disagrees with the *n*=16 found by Humphries & al. (1978) in Moroccan plants from High Atlas at 1700 m.

*Ononis mitissima* L. *2n*=30-32 (fig. 2)

Many former counts indicate *2n*=30 for this species (Table 2). In plants here studied from two locations 30-32 chromosomes have been counted in somatic mitosis. As it can be observed in the two cells photographed (fig. 2), an accurate count is really difficult. The large difference in size among chromosomes allows interpreting the smallest chromosomes as chromosomes B or satellites released from the chromosomes.

*Vicia lecomtei* Humb. & Maire subsp. *lecomtei* *2n*=14 (fig. 3)

According to the databases consulted (Table 2), this is, presumably, the first count for this Moroccan endemic species.

*Geraniaceae*

*Erodium malacoides* (L.) L´Hèr subsp. *brevirrostris* (Maire & Samuels.) Guittonn. *2n*=36

It seems to be the first count in this subspecies of *Erodium malacoides*. It disagrees with the *2n*=40 indicated by many authors for the species without designation of subspecies (ANTHOS 2013; Bolkovskikh & al. 1969; CROMOCAT 2013; IPCN 2013).

*Geranium purpureum* Vill. *2n*=26 (fig. 5)

In this species two different somatic chromosome numbers have been indicated: *2n*=32 (many counts, see Table 2) and *2n*=64 (Luque & Díaz Lifante 1991) in plants from SE

Spain, but never *2n*=26. Therefore it would be desirable a research on the cytotaxonomic nature of these plants collected around Jbel Tazzeka.

*Lamiaceae*

*Salvia barrelieri* Etl. *2n*=32

The only existing report in the species is *2n*=38 (Benoist 1937, sec. Bolkhovskikh & al. 1969).

*Linaceae*

*Linum tenue* Desf. *2n*=20

This somatic number agrees with the only count found in this species by Pastor & al. (1990) who indicated *2n*=20 for Spanish plants from Fuenteheridos (Huelva province). It seems to be the first karyological study in Moroccan plants.

*Poaceae*

*Anisantha diandra* (Roth) Tutin (= *Bromus diandrus* Roth.) *2n*=56

Many numbers representing different ploidy leves (4x, 6x, 8x, 10x, 16x) can be found in the species (Table 2). The number *2n*=56 represents the hexaploid level, which is the more frequent somatic number, and confirms the cytogenetic hypothesis for the species proposed by Oja & Laarmann (2002).

*Anisantha sterilis* (L.) Nevski (= *Bromus sterilis* L.) *2n*=14

Two ploidy leves have been found in Mediterranean plants, diploid (*2n*=14) and tetraploid (*2n*=28) (Table 2). The new count for Moroccan plants represents another diploid population that confirms the hypothesis proposed by Oja & Laarmann (2002) on the diploid nature for *A. sterilis* within the complex *A. sterilis, A. diandrus* and *A. rigidus*. They found an autopolyploid nature for the tetraploid cytotypes (*2n*=28) based in the isoenzymatic pattern found and proposed to recognize this cytorace as *A. sterilis* with which it shares the shape of the scar of rachilla segments in the floret.

*Anisantha tectorum* (L.) Nevski (= *Bromus tectorum* L.) *2n*=14

This chromosome number is in agreement with other reports (Table 2). This diploid level was found in Morocco by Galland (1988) and Humphries & al. (1978) in the High Atlas, but these latter authors also found tetraploids (2n=28) in two populations at similar altitude than diploids, also from High Atlas. Another tetraploid counts were found in Spanish plants from Extremadura region (Devesa & al. 1990a, 1990b), where also plants with *2n*=14 were registered (Devesa & al. 1991).

*Aristida adscensionis* subsp. *coerulescens* (Desf.) Auquier & J. Dubign. *2n*=22

The record here presented seems to be the first for Moroccan plants. It is in agreement with previous counts in plants identified as *Aristida adscensionis* L. subsp. *coerulescens* (Desf.) Bourreil & Trouin ex Auquier et J. Vuvig. by Ferchichi & al. (1994), Peruzzi & Cesca

(2004) and Talavera (1978) in plants from Tunisia, Italy (Calabria), and Spain (Murcia), respectively.

*Melica humilis* Boiss. *2n*=18

The count here found for plants from two locations agrees with the only report found for Moroccan plants by Favarger & al. (1979, as *M. cupani* Guss.).

*Melica minuta* L. subsp. *minuta* *2n*=18

This is the first report for Moroccan plants, corresponding to the diploid level cited for the species. Diploid and tetraploid levels have been reported by many authors in Iberian and Balearic plants of this species (Table 2).

*Patzkea patula* (Desf.) H. Scholz *2n*=14 (fig. 7)

As far as the authors are aware this count is the second obtained for Mediterranean plants. The first was reported by Devesa & al. (1990a, as *Festuca triflora* Desf.) in Spanish plants from Extremadura.

*Piptatherum coerulescens* (Desf.) P. Beauv. *2n*=24

The only count reported in the literature consulted (Table 2) is that of Kerguelen (1975, as *Oryzopsis coerulescens* (Desf.) Hackel) who indicated also *2n*=24 in French plants.

*Stipa capensis* Thunb. *2n*=36

This count is in accordance with the most frequent chromosome numbers reported for Mediterranean plants (Iberian Peninsula, Balearic Islands and Tunisia) (Table 2), which corresponds with a tetraploid level. For Morocco the count here presented agrees with that by Scholz & al. (1998) for plants from Figuig and Monts des Beni-Snassen. The diploid level (*2n*=18) was indicated in the species only by Borgen (1970) in Macaronesian plants.

*Vulpia geniculata* (L.) Link *2n*=14

This is the second count for Moroccan plants, which agrees with that given by Galland (1988) in Moroccan plants from de Hight Atlas (Oukaimenden) at 2680 m altitude, and with previous reports for other Mediterranean plants (Table 2).

*Polygonaceae*

*Rumex papilio* Coss. & Balansa *2n*=18

This chromosome number is in accordance with previous reports in the species by Baltisberger & Charpin (1989) and Vogt & Oberprieler (2012 as var. *quadrivalvis* Maire) for Moroccan plants, respectively from High Atlas and Meknès region (*Iter Mediterranean V*, gathering nº 3.88).

*Portulacaeae*

*Montia fontana* L. subsp. *amporitana* Sennen *2n*=20

This is the first karyological study for this subspecies in Moroccan plants which agrees with

other counts given for the same subspecies in plants from Spain (Löve & Kjellqvist 1974a; Luque & Díaz Lifante 1991) and Greece (Runemark 1996).

*Primulaceae*

*Anagallis foemina* Mill. *2n*=20, 40

Two different chromosome numbers *2n*=20 and *2n*=40 have been counted in plants collected in three locations. However only *2n*=40 has been indicated for this species in the literature (Table 2). The diploid number *2n*=20 has not been found either in *A. arvensis*, species to which *A. foemina* has been sometimes subordinated as subspecies, although recent evidence molecular has pointed out as different species (Manns & Anderberg 2007).

*Ranunculaceae*

*Ranunculus macrophyllus Desf.* *2n*=16

This seems to be the first report for the chromosome number for Morocco. It agrees with the numerous previous counts for Western Mediterranean plants (Table 2).

*Ranunculus ophioglossifolius* Vill. *2n*=16

This count is in accordance to previous reports for plants from Portugal, Spain Italy and Bulgaria (Table 2). It seems to be the first account for Moroccan plants.

*Ranunculus parviflorus* L. *2n*=28

This count corresponds to the tetraploid level as stated by Diosdado & Pastor (1993). It is in accordance to previous reports (Table 2), and it seems to be the first time that it is counted for Moroccan plants.

*Ranunculus trilobus* Desf. *2n*=48

The chromosome number found corresponds to the hexaploid level and it is in accordance with that indicated by Valdés & Parra (1997) in Moroccan plants from Guercif (Taza region).

*Resedaceae*

*Reseda lanceolata* subsp. *constricta* (Lange) Valdés Berm. *2n*=24

The present count is the first for this subspecies. It agrees with several reports in the species for Spanish plants (Fernández Casas & Ruíz Rejón 1974; Valdés 1978; González Aguilera & Ruíz Rejón 1978; González Aguilera & al. 1980; González Aguilera & Peralta 1984).

*Rosaceae*

*Sanguisorba verrucosa* (G. Don) Ces. *2n*=28

This count was obtained in plants from two populations. It agrees with the first one reported by Valdés & Parra (1997) in plants from Chechaoune and with those indicated for Spanish plants from Balearic Islands (Dahlgren & al. 1971) and Granada (Luque & Díaz Lifante 1991) as *S. minor* subsp. *magnolii* (Spach) Briq.

*Rubiaceae*

*Galium murale* (L.) All. *2n*=44

The present count is the first for Moroccan plants. The same chromosome number has been reported by Dahlgren & al. (1971), Queirós (1986) and Díaz Lifante & al. (1992) for plants from Balearic Islands, Portugal and Israel, respectively.

*Galium setaceum* Lam. *2n*=44

Presumably this is the first count in Moroccan plants, which corresponds with the tetraploid level. Two somatic chromosome numbers have been reported in the literature. The diploid *2n*=22 was indicated by Dahlgren & al. (1971) for plants from the Balearic Islands. However in plants from Creta *2n*=22 and *2n*=44 were reported by Ehrendorfer (1982) and Montmollin (1986), respectively.

*Scrophulariaceae*

*Chaenorhinum villosum* Lange subsp. *granatense* (Willk.) Valdés *2n*=14

There are two previous counts for this species, *2n*=12 by Viano (1973) in Iberian plants, and 2*n*=14 by Vogt & Oberprieler (1994) in plants from Morocco. The only previous count for the subspecies found in literature is that of Löve & Kjellqvist (1974b), given for Spanish plants.

*Linaria tristis* (L.) Mill. subsp. *pectinata* (Pau & Font Quer) Maire *2n*=12

The same chromosome number was indicated in the species without subspecific indication by Valdés (1969) and Aparicio (1993) for Iberian plants and by Quézel (1957), Favarger & al. (1979), Galland (1988) and Vogt & Oberprieler (1994) for Moroccan plants. This is presumably the first account for this subspecies in Morocco.

*Misopates orontium* (L.) Raf. *2n*=16

This chromosome number is in agreement with numerous previous reports (Table 2). Vogt & Oberprieler (2012) have indicated the same number in plants collected during the *Iter V* in Taineste (Taza region, gathering 39.1329), also at high altitude.

*Scrophularia arguta* Aiton *2n*=36

This somatic chromosome number disagrees with the only counts found in the literature, *n*=20+B and *2n*=40+B, for Macaronesian plants (Dalgaard 1979).

*Scrophularia lyrata* Willd. *2n*=58

This count constitutes the first record for Moroccan plants. It agrees with previous counts by Grau (1976, 1979) in plants from Sardinia and by Fernandes & al. (1977) in plants from Portugal.

*Veronica verna* L. *2n*=18

This is the first time that the somatic number *2n*=18 has been found in this species, in which only *2n*=16 was reported by several authors in plants of the North and East of Europe (Table 2).

*Valerianaceae*

*Valerianella microcarpa* Loisel. *2n*=16

This somatic chromosome number here included agrees with those reported in plants from the South of France (Kliphuis & Wieffering 1972), Italy (Detlev 1972) and Balearic Islands (Dahlgren & al. 1971). It seems to be the first count for Moroccan plants.

Table 1. Origin of the plants studied. Geographic localities have been numbered consecutively. Collectors: A. Acchal, F. Conti, M. Fennane, S.L. Jury, M. Lisci, P. Mazzola, Ch. Oberprieler, S. Peccenini, F.M. Raimondo, M. Rejdali, E. Rico, G.J. Stark, H. t'Hart, B. Valdés, R. Vogt, R.G. Wilson.

1 Khémisset (Kénitra): c. 12 km from Rabat on road to Meknès, forêt de la Maâmora, 34º2'N 6º42'W, *Quercus suber* forest, 80 m, 09.06.1992.

2 Khémisset (Meknès): c. 45 km E of Meknès, 2 km W of Oued Beht on Rabat to Meknès road, 33º52´N 5º57´W, open rocky area with *Pinus halepensis*, 150 m, 09.06.1992.

3 Khémisset (Meknès): c. 42 km E of Meknès, 1 km E of Oued Beht on Rabat to Meknès road, 33º53´N 5º55´W, degraded *Tetraclinis articulata* woodland with planted *Pinus halepensis*, 220 m, 09.06.1992.

4 Ifrane (Meknès): c. 15 km from El Hajeb or road to Ifrane, forêt de Jaaba, 33º36´N 5º17´W, *Quercus canariensis* wood, 1400 m, 09.06.1992.

5 Midelt (Ksar-Es-Souk = Errachidia): Outskirt of Midelt on track to Cirque du Jaffar, Jbel Ayachi, 32º40´N 4º46´W, 1500 m, 10.06.1992.

6 Midelt (Ksar-Es-Souk = Errachidia): c. 15 km from Midelt, near village on road to Cirque du Jaffat, Jbbel Ayachii, 32º38´N 4º46´W, 1700 m, 10.06.1992.

7 Midelt (Ksar-Es-Souk = Errachidia): By forest house above Midelt on road to Cirque du Jaffar, 32º35´N 4º51´W, W & S facing slopes above road and below house, 1850 m, 10.06.1992.

8 Ifrane (Meknès): c. 22 km to Ain-Leuh from Azrou-Midelt road, 33º25´N 5º12´W, *Quercus ilex* subsp. *ballota*, *Viburnum tinus* woodland, 1450 m, 11.06.1992.

9 Ifrane (Meknès): c. 17 km from Ain-Leuh from Azrou-Midelt road, 33º23´N 5º14´W, shrub in *Quercus ilex* subsp. *ballota* wood and with some *Viburnum tinus*, *Cedrus libani* subsp. *atlantica* and *Ilex aquifolium*, 1585 m, 11.06.1992.

10 Ifrane (Meknès): c. 11 km from Azrou on road to Ain-Leuh, 33º22´N 5º15´W, *Quercus ilex* subsp. *ballota* woodland with open grassy clearing, 1550 m, 11.06.1992.

11 Ifrane (Meknès): c. 4 km from Ain-Leuh on road to Tiouririne and Azrou, 33º20´N 5º21´W, among rocky outcrops in cultivated area, 1150 m, 04.06.1992.

12 Ifrane (Meknès): c. 7 km from Azrou by road to Midelt, 33º16´N 5º12´W, FLNM559315, *Cedrus libani* subsp. *atlantica* forest sourrounded by *Quercus ilex* subsp. *ballota* scrubland, 1650 m, 12.06.1992.

13 Ifrane (Meknès): c. 19 km from Azrou by road to Midelt, 33º19´N 5º7´W, on *Cedrus libani* subsp. *atlantica* forest, 1900-2000 m, 12.06.1992.

14 Taza: c. 19 km from Taza, 46 km W from Guercif, 34º5´N 3º50´W, basic marls with wheat, 520 m, 14.06.1992.

15 Taza: c. 52 km from Taza, 13 km W from Guercif, 34º2´N 3º27´W, semi-arid, stony area, planted area with *Schinus molle* and *Eucaliptus*, 520 m, 14.06.1992.

16 Nador: c. 55 km from Nador on road to Guercif, 34º48´N 3º11´W, limestone slopes heavily grazed, 500 m, 14.06.1992.

17 Taza: c. 4 km from village of Ain Zorah on road from Saka, 34º38´N 3º31´W, limestone gorge, 890 m, 14.06.1992.

18 Taza: c. 11 km from Taza on minor road S to Jbel Tazekka, 34º9´N 4º1´W, FLNM628395, hillsides and bank of river, 745 m, 15.06.1992.

19 Taza: c. 18 km from Taza along minor road to Gouffe de Friouato and Djbel Tazekka, 34º8´N 4º2´W, limestone rocks under *Quercus ilex* subsp. *ballota*, 1200 m, 15.06.1992.

20 Taza: c. 42 km from Taza on minor road, 34º3´N 4º12´W, 1200 m, 15.06.1992.

21 Taza: c. 6 km SE of Sidi Abdallah (town from Fes-Taza road) along minor road to Bab Boudir, 34º9´N 4º19´W, limestone gorge, W facing slopes and cliffs, with *Olea europaea* and *Ceratonia siliqua*, 340 m, 15.06.1992.

22 Taza: Arround Summit of Jbel Tazekka, 34º5´N 4º11´W, schistose, 1900 m, 16.06.1992.

23 Taza: c. 6 km up track on Jbel Tazekka, 3 km from summit, 34º5´N 4º11´W, schistose, 1780 m, 16.06.1992.

24 Taza: c. 27 km from Taza, along minor road to Bab Boudir, 34º6´N 4º5´W, 1400 m, 16.06.1992.

25 Taza: c. 13 km SSW of Taza, 23 km from Taza, on minor road to Bab Boudir, 34º7´N 4º3´W, 1420 m, 16.06.1992.

26 Taza: c. 37 km from Taza on road to Nador, S of Dar-Caïd-Medboh, 34º26´N 3º54´W, steep open mudstone and marls hills, 900 m, 17.06.1992.

27 Taza: c. 14 km E from Boured, on road to Taza, 34º44´N 4º1´W, FLNM626460, slatey mudstones, 1350 m, 17.06.1992.

28 Taza: c. 2 km E of Ajdir, 16 km E of Boured, on road to Taza, 34º45´N 3º59´W, 860 m, 17.06.1992.

29 Taza: Col du Nador, about 10 km from Aknoul on road to Boured, 34º43´N 3º56´W, 1340 m, 17.06.1992.

30 Taza: Western outskirts of Taineste, c. 40 km due NNW of Taza, 4º34´N 4º8´W, 1100 m, 18.06.1992.

31 Taza: Junction of road from Tahar Souk, Boured and Taineste, c. 50 km NNW of Taza, 34º39´N 4º13´W, dry roadside banks and fields margins, 855 m, 18.06.1992.

32 Taounate (Fes): Ikaouen, c. 40 km N from Taounate on road to Targuist, 34º48´N 4º38´W, 1000 m, 19.06.1992.

33 Al Hoceima (Fes): c. 15 km SW of Issaguen (= Ketama) along road to Taounate and Fes, 34º53´N 4º38´W, 1000 m, 19.06.1992.

34 Al Hoceima: c. 4 km along track to Jbel Tidirhine, 1 km SW of Tleta Ketama and 9 km from Issaguen (= Ketama), 34º43´N 4º36´W, *Quercus ilex* subsp. *ballota* woodland with stream above village, 1500 m, 20.06.1992.

35 Al Hoceima: c. 15 km along track below summit of Jbel Tidirhine, 34º52´N 4º31´W, 2000 m, 20.06.1992.

36 Al Hoceima: c. 5 km from Tleta Ketama along track to Jbel Tidirhine, aux Eaux et Forêst house, 34º53´N 4º35´W, fields of *Cannabis sativa*, 1550 m, 20.06.1992.

37 Chefchaouen (Kénitra): c. 21 km from Ouazzane on road to Souk El Arba du Gharb, 34º47´N 5º45´W, 140 m, 23.06.1992.

38 Chefchaouen (Tétouan): c. 5 km up track to Jbel Tizirane, start of track 72 km from Chefchaouen on road to Issaguen (= Ketama), 14 km from Bab Berred, 35º2´N 4º56´W, 1700 m, 24.06.1992.

39 Chefchaouen (Tétouan): c. 71 km from Chefchaouen on road to Issaguen (= Ketama), 13 km from Bab Berred, 35º1´N 4º59´W, ponds and sourrounding fields, 1450 m, 25.06.1992.

40 Chefchaouen (Tétouan): c. 20 km from Chefchaouen on route to Jbel Tassaout, 35º17´N 5º14´W, N-facing limestone cliffs, 350 m, 25.06.1992.

41 Chefchaouen (Tétouan): Jbel Tassaout, c. 44 km from Chefchaouen on route to Jbel Tassaout, 14 km above Talambote, 35º15´N 5º5´W, limestones, forests of *Abies marocana*, 1600 m, 25.06.1992.

42 Chefchaouen (Tétouan): Jbel Tassaout, c. 40 km from Chefchaouen on route to Jbel Tassaout. 10 km above Talambote, 35º16´N 5º8´W, mixed forest of *Quercus ilex* subsp. *ballota* and *Q. alpestris*, 1565 m, 25.06.1992.

43 Chefchaouen (Tétouan): Jbel Talassemtane, c. 38 km from Chefchaouen, 14 km above Bab Taza on track to Jbel Talamssemtane, 35º9´N 5º12´W, mixed forest of *Abies maroccana* and *Cedrus libani* subsp. *atlantica*, on limestones, 1765-1900 m, 26.06.1992.

Table 2. Somatic chromosome numbers found in the taxa studied. The localities have been numbered as in Table 1. The number of the gathering in the *Iter Mediterraneum* V is given for each count. The haploid or diploid chromosome number of previous counts recorded in cytogenetic databases are included. A, ANTHOS (2013); B, Bolkovskih & al. (1969); BI: BSBI (2013); Ch, CHROBASE (2013); Cr, CROMOCAT (2013); I, IPCN (2013). *: First count for the species or subspecies.

| | | | | Previous counts | | |
|---|---|---|---|---|---|---|
| Taxon | Nº locality | Nº gathering | *2n* | *n* | *2n* | Databases |
| **Alliaceae** | | | | | | |
| *Allium ampeloprasum* L. | 3 | 3.103 | 32 | 16, 24 | 16, 24, 32, 40, 48, 56, 80 | A B Ch Cr I |
| *Allium pallens* Lam. subsp. *pallens* | 3 | 3.83 | 16 (fig. 1) | - | 16, 24, 32, 40 | B Ch Cr I |
| | 37 | 54.1789 | 16 | | | |
| **Apiaceae** | | | | | | |
| *Ammoides pusilla* (Brot.) Breistr. | 14 | 19.760 | 12 | 6 | 12 | A Cr |
| *Ridolfia segetum* Moris | 15 | 20.809 | 22 | 11 | 22, 22+2B | A B Cr I |
| **Brassicaceae** | | | | | | |
| *Alyssum simplex* Rudolphi | 7 | 9.409 | 32 | 8, 24 | 16, 32 | A Cr I |
| *Arabidopsis thaliana* (L.) Heynh. | 22 | 29.1310 | 10 | 5 | 10 | A B Cr I |
| | 38 | 57.1865 | 10 | | | |
| *Biscutella didyma* L. | 4 | 4.209 | 16 | 8 | 16 | B I |
| | 11 | 13.560 | 16 | | | I |
| | 30 | 39.1314 | 16 | 8 | | |
| *Biscutella frutescens* Coss. | 10 | 12.513 | 18 | 9 | 18 | B I |
| *Cardamine hirsuta* L. | 10 | 12.519 | 16 | 8, 16 | 16, 32, 64 | A Cr I |
| | 22 | 29.1307 | 16 | | | |
| *Crambe filiformis* Jacq. | 28 | 36.1223 | 30 | 15 | 30 | B I |
| *Diplotaxis tenuisiliqua* Delile | 2 | 2.63 | 18 | - | - | * |
| *Eruca vesicaria* subsp. *sativa* (Mill.) Thell. | 6 | 7.335 | 22 | 11 | 22 | I |
| *Jonopsidium prolongoi* (Boiss.) Batt. | 41 | 60.1992 | 36 | 11 | 22, 36 | A I |
| | 43 | 64.2202 | 36 | | | |
| *Lepidium heterophyllum* Benth. subsp. *riphanum* (Emb. & Maire) J.M. Monts. Martí | 38 | 57.1827 | 16 | - | - | * |
| *Lepidium hirtum* subsp. *dhayense* (Munby) Thell. | 4 | 4.204 | 32 | - | 16 | I |
| *Malcolmia triloba* (L.) Sprengel subsp. *broussonetii* (DC.) Asensi & Díaz Garretas | 1 | 1.34 | 20 | - | - | * |
| *Notoceras bicorne* (Aiton) Amo | 15 | 20.814 | 22 | 11 | 22 | A B I |
| *Psychine stylosa* Desf. | 14 | 19.771 | 30 | 15 | 16, 30 | A Ch Cr I |
| | 26 | 34.1166 | 30 | | | |
| *Sisymbrium erysimoides* Desf. | 21 | 28.1006 | 14 | - | 14 | Cr I |
| *Sisymbrium irio* L. | 6 | 7.316 | 14 | 7 | 14 | A B Cr I |
| *Teesdalia nudicaulis* (L.) R. Br. | 38 | 57.1863 | 36 | 18 | 36 | A B Cr I |
| **Cariophyllaceae** | | | | | | |
| *Arenaria pomelii* Munby | 22 | 29.1281 | 20 | 10 | - | A I |
| *Arenaria serpyllifolia* L. | 22 | 29.1279 | 40 | 10, 20 | 20, 22, 30, 40, 44 | A B Cr I |
| | 41 | 60.2016 | 40 | | | |

Table 2. Continued

| Taxon | Nº locality | Nº gathering | 2n | Previous counts n | Previous counts 2n | Databases |
|---|---|---|---|---|---|---|
| *Cerastium brachypetalum* Pers. subsp. *brachypetalum* | 4 | 4.228 | 72 | 36, 38, 39, 44-45, 46 | 52, 72, c78, 90 | B Cr I |
| *subsp. roeseri* (Boiss. & Heldr.) Nyman | 8 | 10.488 | 72 | | | |
| *Cerastium pumilum* Curtis | 22 | 29.1046 | 54 | 36 | 72, 90, 95 | A B Cr I |
| | 22 | 29.1309 | 54 | | | |
| *Cerastium ramosissimum* Boiss. | 12 | 14.599 | 54 | 27 | 44-46, 54 | A I |
| *Cerastium semidecandrum* L. (= *C. pentandrum* L.) | 12 | 14.588 | 36 | - | 18, 36, 37 | A B Cr I |
| *Minuartia hybrida* (Vill.) Schischkin | 19 | 26.932 | 42 | 11, 12, 21, 22, 23, 24, 25, 35, 46 | 20, 22, 24, 45, 46, 48, 70 | A Cr I |
| *Moehringia pentandra* Gay | 4 | 4.237 | 48 | - | 48 | A B Cr I |
| | 41 | 60.1998 | 48 | | | |
| *Petrorhagia dubia* (Raf.) G. López & Romo | 20 | 27.990 | 30 | - | 30 | A B I |
| *Polycarpon tetraphyllum* subsp. *tetraphyllum* (L.) L. | 17 | 23.860 | 16 | 16, 24, 32 | 16, 32, 48, 54, c.64 | A B Cr I |
| | 33 | 43.1500 | 48 | | | |
| *Scleranthus polycarpos* L. | 34 | 44.1529 | 44 | 22 | 44 | Cr I |
| | 38 | 57.1846 | 44 | | | |
| *Silene gallica* L. | 20 | 27.987 | 24 | 12 | 24 | A B Ch Cr I |
| | 32 | 42.1415 | 24 | | | |
| | 33 | 43.1463 | 24 | | | |
| *Silene inaperta* L. subsp. *inaperta* | 3 | 3.132 | 24 | 12 | 24 | A B Cr I |
| *Silene martyi* Emb. & Maire | 31 | 41.1398 | 24 | - | - | * |
| *Silene mekinensis* Coss. | 10 | 12.523 | 24 | - | 24 | B |
| *Silene patula* Desf. subsp. *patula* | 23 | 30.1077bis | 24 | 12 | 24 | I |
| *Silene vulgaris* (Moench) Garke subsp. *vulgaris* | 27 | 35.1214 | 48 | 24 | 24, 48 | A B BI Cr I |
| *Spergula pentandra* L. | 35 | 45.1556 | 18 | - | 18 | A Cr I |
| **Chenopodiaceae** | | | | | | |
| *Chenopodium murale* L. | 21 | 28.1025 | 18 | 9 | 18 | A B Cr I |
| *Chenopodium opulifolium* W.D.J. Koch & Ziz | 3 | 3.130 | 18 | 9, 27 | 18, 36, 54 | A B Cr I |
| **Cistaceae** | | | | | | |
| *Cistus ladanifer* subsp. *mauritianus* Pau & Sennen | 32 | 42.1409 | 18 | - | - | * |
| *Cistus salviifolius* L. | 18 | 25.894 | 18 | 9 | 18 | A Cr I |
| *Helianthemum anthemoides* (Desf.) Grosser | 24 | 32.1098 | 20 | 10 | 20 | B Ch I |
| *Tuberaria macrosepala* (Boiss.) Willk. | 20 | 27.984 | 36 | 18 | - | A I |
| **Cyperaceae** | | | | | | |
| *Carex pendula* Huds. | 32 | 42.1434 | 40 | - | 58**,** 60, 62 | A B BI Ch Cr I |
| **Dipsacaceae** | | | | | | |
| *Lomeliosa stellata* (L.) Raf. | 30 | 39.1348 | 18 | 9 | 16, 18, 26, 27, 28 | A Cr I |
| **Euphorbiaceae** | | | | | | |
| *Euphorbia characias* L. | 41 | 60.2002 | 20 | 10 | 20 | A B Cr I |

Table 2. Continued

| Taxon | Nº locality | Nº gathering | *2n* | *n* | *2n* | Databases |
|---|---|---|---|---|---|---|
| *Euphorbia dracunculoides* Lam. subsp. *inconspicua* (Ball) Maire | 17 | 23.871 | 40 | - | - | * |
| *Euphorbia medicaginea* Boiss. | 3 | 3.134 | 16 | 8 | 16 | A I |
| *Mercurialis annua* L. | 16 | 22.825 | 48 | - | 16, 32, 48, 64 | A B Ch Cr I |
| **Fabaceae** | | | | | | |
| *Lathyrus nissolia* L. | 42 | 61.2072 | 14 | - | 14 | A B Cr I |
| *Lotus longisiliquosus* R. de Roemer | 26 | 34.1155 | 28 | - | - | * |
| *Medicago lupulina* L. | 4 | 4.193 | 16 | 8 | 16, 32 | A B Cr I |
| *Onobrychis humilis* (Loefl.) G. López subsp. *jahandiezii* (Sirj.) Greuter & Burdet | 24 | 32.1104 | 14 | - | - | * |
| | 25 | 33.1115 | 14 | | | |
| *Ononis mitissima* L. | 36 | 51.1674 | 30-32 | 15 | 30 | Ch Cr I |
| | 37 | 54.1808 | 30-32 (fig. 2) | | | |
| *Ononis sicula* Guss. | 3 | 3.126 | 32 | - | 32 | A Cr I |
| *Scorpiurus sulcatus* L. | 25 | 33.1112 | 28 | - | 28 | A B I |
| *Tetragonolobus conjugatus* subsp. *requienii* (Sanguinetti) E. Domínguez & E.F. Galiano | 37 | 54.1804 | 14 | 7 | 14 | A I |
| *Vicia lecomtei* Humb. & Maire subsp. *lecomtei* | 22 | 29.1285 | 14 (fig. 3) | - | - | * |
| *Vicia pubescens* (DC.) Link | 33 | 43.1475 | 14 (fig. 4) | - | 14 | A Ch I |
| *Vicia vicioides* (Desf.) Cout. | 19 | 26.931 | 14 | - | 14 | A I |
| **Geraniaceae** | | | | | | |
| *Erodium guttatum* (Desf.) Willd. | 5 | 6.279 | 18 | - | 18, 20 | B, I |
| *Erodium malacoides* subsp. *brevirrostris* (Maire & Samuels.) Guittonneau | 14 | 19.752 | 36 | - | - | * |
| *Geranium purpureum* Vill. | 18 | 25.892bis | 26 (fig. 5) | - | 32, 64 | A B Ch I |
| **Juncaceae** | | | | | | |
| *Luzula forsteri* (Sm.) DC. | 41 | 60.2065 | 24 (fig. 6) | 12 | 24 | A B Cr I |
| **Lamiaceae** | | | | | | |
| *Salvia barrelieri* Etl. | 31 | 41.1397 | 32 | - | 38 | B |
| **Liliaceae** | | | | | | |
| *Muscari comosum* (L.) Mill. | 27 | 35.1217 | 18 | 9+1B, 27 | 18, 19, 36 | A B Ch Cr I |
| **Linaceae** | | | | | | |
| *Linum tenue* Desf. | 2 | 2.55 | 20 | 10 | 20 | A Mo |
| **Poaceae** | | | | | | |
| *Aegilops geniculata* Roth | 18 | 25.911 | 28 | 14 | 28 | A Cr I |
| | 26 | 34.1170 | 28 | | | |
| *Anisantha diandra* (Roth) Tutin | 34 | 44.1526 | 56 | 21, 28 | 28, 42, 56, 70, 112 | A Cr I |
| *Anisantha rubens* (L.) Nevski | 14 | 19.784 | 28 | 14 | 28 | A Cr I |
| *Anisantha sterilis* (L.) | 8 | 10.456 | 14 | 7 | 14, 28 | A B Cr I |
| *Anisantha tectorum* (L.) | 22 | 29.1278bis | 14 | 7, 14 | 14 | A B Cr I |
| *Aristida adscensionis* L. subsp. *coerulescens* (Desf.) Auquier & J. Dubign. | 3 | 3.102 | 22 | 11 | 22 | A Ch I |

Table 2. Continued

| Taxon | Nº locality | Nº gathering | Previous counts *2n* | *n* | *2n* | Databases |
|---|---|---|---|---|---|---|
| *Briza minor* L. | 32 | 42.1435 | 10 | 5 | 10 | A B Cr I |
| *Echinaria capitata* (L.) Desf. | 43 | 64.2274 | 18 | 9 | 18 | A Cr I |
| *Hordeum murinum* subsp. *glaucum* (Steud.) Tzvelev | 6 | 7.322 | 14 (fig. 7) | - | 14 | I |
| *Melica humilis* Boiss. | 2 | 2.58 | 18 | 9 | 18 | A I |
| | 29 | 37.1251 | 18 | | | |
| *Melica minuta* L. subsp. *minuta* | 28 | 36.1236 | 18 | 9, 18 | 18, 36 | A B Cr I |
| *Narduroides salzmanii* (Boiss.) Rouy | 34 | 44.1531 | 14 | - | 14 | A Cr I |
| *Patzkea patula* (Desf.) H. Scholz | 8 | 10.455 | 14 (fig. 8) | 7 | 14 | B I |
| *Piptatherum coerulescens* (Desf.) P. Beauv. | 33 | 43.1487 | 24 | - | 24 | Cr I |
| *Polypogon monspeliensis* (L.) Desf. | 26 | 34.1172 | 28 | 7, 14, 21 | 28, 35 | A B Cr I |
| *Stipa capensis* Thunb. | 2 | 2.56 | 36 | 18 | 18, 36 | A Ch I |
| | 14 | 19.770 | 36 | | | |
| *Vulpia bromoides* (L.) S. F. Gray | 22 | 29.1038 | 14 | 7 | 14 | A Ch |
| | 34 | 44.1535 | 14 | | | |
| *Vulpia geniculata* (L.) Link | 38 | 57.1882 | 14 | 7 | 14 | A B Cr I |
| **Polygonaceae** | | | | | | |
| *Rumex papilio* Coss. & Balansa | 3 | 28.1000 | 18 | - | 18 | B I |
| **Portulacaeae** | | | | | | |
| *Montia fontana* L. subsp. *amporitana* Sennen | 34 | 44.1525 | 20 | - | 20 | A Cr I |
| | 39 | 58.1942 | 20 | | | |
| **Primulaceae** | | | | | | |
| *Anagallis foemina* Mill. | 2 | 2.75 | 20 | 20 | 40 | B Cr I |
| | 17 | 23.850 | 20 | | | |
| | 26 | 34.1167 | 40 | | | B Cr I |
| *Asterolinon linum-stellatum* (L.) Duby | 20 | 27.989 | 20 | - | 20 | A Cr I |
| **Ranunculaceae** | | | | | | |
| *Ranunculus macrophyllus* Desf. | 32 | 42.1400 | 16 | 8 | 16 | A Cr I |
| | 36 | 48.1643 | 16 | | | |
| *Ranunculus ophioglossifolius* Vill. | 32 | 42.1448 | 16 | 8 | 16 | A B BI Ch Cr I |
| | 39 | 58.1936 | 16 | | | |
| *Ranunculus parviflorus* L. | 19 | 26.925 | 28 | 14 | 28 | A B BI Ch Cr I |
| *Ranunculus trilobus* Desf. | 32 | 42.1442 | 48 | 24 | 32, 48 | A B Ch I |
| **Resedaceae** | | | | | | |
| *Reseda lanceolata* subsp. *constricta* (Lange) Valdés Berm. | 27 | 35.1187 | 24 | - | - | * |
| **Rosaceae** | | | | | | |
| *Sanguisorba verrucosa* (G. Don) Ces. | 4 | 4.163 | 28 | - | 28 | A B I |
| | 13 | 16.637 | 28 | | | |
| **Rubiaceae** | | | | | | |
| *Cruciata pedemontana* (Bellardi) Ehrend. | 22 | 29.1311 | 22 | - | 22 | B |
| *Galium murale* (L.) All. | 18 | 25.909 | 44 | - | 44 | A B Cr I |

Table 2. Continued

| Taxon | Nº locality | Nº gathering | Previous counts | | | Databases |
|---|---|---|---|---|---|---|
| | | | *2n* | *n* | *2n* | |
| *Galium setaceum* Lam. | 2 | 2.77 | 44 | - | 22, 44 | A B I |
| *Valantia hispida* L. | 40 | 59.1986 | 18 | - | 18 | A B Cr I |
| **Scrophulariaceae** | | | | | | |
| *Chaenorhinum villosum* Lange subsp. *granatense* (Willk.) Valdés | 28 | 36.1230 | 14 | - | 14 | A I |
| *Linaria tristis* subsp. *pectinata* (Pau & Font Quer) Maire | 40 | 59.1984 | 12 | - | - | * |
| | 43 | 64.2259 | 12 | | | |
| *Misopates orontium* (L.) Raf. | 4 | 4.227 | 16 | 8 | 16 | A B Ch Cr I |
| *Scrophularia arguta* Aiton | 2 | 2.70 | 36 | 20+B | 40+B | I |
| *Scrophularia lyrata* Willd. | 10 | 12.526 | 58 | 29 | 58 | A Ch I |
| *Veronica verna* L. | 12 | 14.580 | 18 | 8 | 16, 16+1B | B BI Cr I |
| **Valerianaceae** | | | | | | |
| *Centranthus calcitrapa* (L.) Dufr. subsp. *calcitrapae* | 41 | 60.1994 | 32 | 16 | 32 | A B Cr I |
| | 43 | 64.2273 | 32 | | | |
| *Centranthus macrosiphon* Boiss. | 21 | 28.1013 | 32 | 16 | 32 | A B Ch I |
| | 32 | 42.1406 | 32 | | | |
| | 40 | 57.1900 | 32 | | | |
| *Fedia pallescens* (Maire) Mathez | 9 | 11.494 | 32 | - | 32 | I |
| *Valerianella microcarpa* Loisel. | 4 | 4.238 | 16 | 8 | 16 | A Ch Cr |
| | 22 | 29.1031 | 16 | | | |

**Acknowledgements**.

Authors are very grateful to Benito Valdés for his encouragement and advice during the development of this work. We also would like to thank the botanists who identified the plants here studied: B. Valdés, E. Rico, R.W. Rutherford, S.L. Jury, H. Scholz, M.A. Mateos, C. Romero, J. Pastor, J. Molero, S. Peccenini, I. Soriano, C. Gómez-Campo, P. Uotila, F. Pina, P. Jiménez Mejías.

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Bocconea 26: 173-179
doi: 10.7320/Bocc26.173
Version of Record published online on 7 September 2013

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# Bryophytes collected during the fifth "Iter Mediterraneum" in Morocco, 8-27 June, 1992

**Abstract**

Campisi P., Dia M. G., Jury S. L., Raimondo F. M.: Briophytes collected during the fifth "Iter Mediterraneum" in Morocco, 8-27 June, 1992. — Bocconea 26: 173-179. 2013. — ISSN 1120-4060 (print), 2280-3882 (online).

Part of the bryophytes collected during *Iter Mediterraneum V* are listed. *Politrichum piliferum*, new to Morocco and 6 others taxa no longer reported since 1962 for this country are recorded.

*Key words*: Flora of Morocco, Bryophytes, Itinera Mediterranea, OPTIMA.

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## Introduction

During the V OPTIMA Expedition, held in Morocco from June 8th to June 27th, 1992, 314 bryophyte specimens have been gathered by Stephen Jury and Rupert Wilson (Jury, 2013). A set of them (257) are kept in the *Herbarium Mediterraneum Panornitanum* (PAL).

In this contribution a list of the bryophytes until now identified is reported. It includes 55 taxa (5 liverworts and 50 mosses) belonging to 44 genera. Nomenclature and presence in Morocco was taken from Ros & al. (2013) for the mosses, and Ros & al. (2007) for the liverworts. Some interesting reports were found: *Politrichum piliferum*, new to Morocco and *Entosthodon duriaei, Hypnum cupressiforme* var. *cupressiforme, Hypnum cupressiforme* var. *lacunosum, Homalothecium lutescens, Plagiomnium undulatum* and *Tortula lindbergii* no longer reported since 1962 for this country. They are respectively indicated with two and one asterisk (*) in the following list.

**Bryophytes identified**

***Marchantiophyta***

***Frullania dilatata*** (L.) Dumort. – c. 23 km from Ouazzane, on road to Chefchaouen. Locality 52. 105m 34°57'N, 5°32'W. French lambert, North Morocco Grid 488484. On ground in shade. 23 june 1992, 10749.

– 3 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 56. 1480 m 35°2' N, 4°58' W. French lambert, North Morocco Grid 540492. 24 june 1992, 10798.

***Lunularia cruciata*** (L.) Lindb. – 34 km from Chefchaouen, 10 km above Bab Taza on track to Jbel Talassemtane. Locality 63. 1420m 35°6'N, 5°11'W. French lambert, North Morocco Grid 520499. 26 june 1992, 10947.

***Porella cordeana*** – c. 13 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 46. 1850 m 34°52'N, 4°31' W. French lambert, North Morocco Grid 580474. 20 june 1992, 10678.

***Reboulia hemisphaerica*** (L.) Raddi – 3 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 56. 1480 m 35°2' N, 4°58' W. French lambert, North Morocco Grid 540492. 24 june 1992, 10806.

***Targionia hypophylla*** L. – c. 23 km from Ouazzane, on road to Chefchaouen. Locality 52. 105m 34°57'N, 5°32'W. French lambert, North Morocco Grid 488484. On ground in shade. 23 june 1992, 10766.

***Bryophyta***

***Antitrichia californica*** Sull. – 44 km from Chefchaouen on route to Jbel Tassaout, 14 km above Talambote. Locality 60. 1600m 35°15'N, 5°5'W. French lambert, North Morocco Grid 528517. 25 june 1992, 10880.

***Antitrichia curtipendula*** (Hedw.) Brid. – c. 23 km from Ouazzane, on road to Chefchaouen. Locality 52. 105m 34°57'N, 5°32'W. French lambert, North Morocco Grid 488484. on *Quercus suber*. 23 june 1992, 10745a.

– 5 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 57. 1700 m 35°2' N, 4°56' W. French lambert, North Morocco Grid 543491. On N-facing soil bank. 24 june 1992, 10857.

***Aulacomnium palustre*** (Hedw.) Schwägr. – 71 km from Chefchaouen on road to Ketama, 13 km W from Bab Berred. Locality 58. 1450 m 35°1' N, 4°59'W. French lambert, North Morocco Grid 539490. 24 june 1992, 10864.

***Bartramia pomiformis*** Hedw. – 5 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 57. 1700 m 35°2' N, 4°56' W. French lambert, North Morocco Grid 543491. On N-facing soil bank. 24 june 1992, 10855.

– 5 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 57. 1700 m 35°2' N, 4°56' W. French lambert, North Morocco Grid 543491. On N-facing soil bank. 24 june 1992, 10856.

***Bartramia stricta*** Brid. – c. 15 km SW of Ketama along road to Taounate and Fès. Locality 43. 1000m 34°53'N, 4°38'W French lambert, North Morocco Grid 570476. 19 june 1992, 10632a.

***Cratoneuron filicinum*** (Hedw.) Spruce – c. 13 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 46. 1850 m 34°52'N, 4°31' W. French lambert, North Morocco Grid 580474. 20 june 1992, 10689.

***Crossidium squamiferum*** (Viv.) Jur. var. ***pottioideum*** (De Not.) Mönk. – 9 km from Taineste, c. 42 km due NNW from Taza. Locality 40. 1000m 34°36'N, 4°5'W. French lambert, North Morocco Grid 621445. Under limestone overhang. 18 june 1992, 10621.

***Cryphaea heteromalla*** (Hedw.) D. Mohr – c. 23 km from Ouazzane, on road to Chefchaouen. Locality 52. 105m 34°57'N, 5°32'W. French lambert, North Morocco Grid 488484. on *Salix*. 23 june 1992, 10747.

– c. 16 km from Ouazzane, on road to Chefchaouen. Locality 53. 110m 34°55'N, 5°32'W. French lambert, North Morocco Grid 488479. on Salix. 23 june 1992, 10773.

***Dicranella howei*** Renauld & Cardot – c. 29 km from Chefchaouen, on road to Guazzane, Douar El Kob. Locality 51. 115 m 35°2' N, 5°26' W. French lambert, North Morocco Grid 498492. On ground. 23 june 1992, 10732.

***Dicranoweisia cirrata*** (Hedw.) Lindb. – 3 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 56. 1480 m 35°2' N, 4°58' W. French lambert, North Morocco Grid 540492. 24 june 1992, 10803.

***Didymodon rigidulus*** Hedw. – 18 km from Taza along minor road to Gouffe de Friouato and Jbel Tazzeka. Locality 26. 1200 m 34°8' N, 4°2' W. French lambert, North Morocco Grid 612383. On soil in Quercus suber and Q. canariensis mixed woodland on acid slatey schist. 15 june 1992, 10584.

***Didymodon vinealis*** (Brid.) R.H.Zander – 34 km from Azrou along road to Midelt. Locality 17. 1880 m 33°12'N, 5°4'W. French lambert, North Morocco Grid 531290. On Limestone rock by river in small gorge below road. 12 june 1992, 10517.

***Encalypta vulgaris*** Hedw. – 18 km from Taza along minor road to Gouffe de Friouato and Jbel Tazzeka. Locality 26. 1200 m 34°8' N, 4°2' W. French lambert, North Morocco Grid 626394. Limestone rocks and soil under Quercus ilex. 15 june 1992, 10567.

****Entosthodon duriaei*** Mont. – 4 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 44. 1500 m 34°43'N, 4°36' W. French lambert, North Morocco Grid 574477. On rocks in stream. 20 june 1992, 10657.

***Eucladium verticillatum*** (With.) Bruch & Schimp. – 9 km from Taineste, c. 42 km due NNW from Taza. Locality 40. 1000m 34°36'N, 4°5'W. French lambert, North Morocco Grid 621445. Under limestone overhang. 18 june 1992, 10619.

***Fissidens crispus*** Mont. – c. 21 km from Guazzane on road to Souk el Arba du Gharb. Locality 54. 140 m 34°47'N, 5°45'W. French lambert, North Morocco Grid 468465. On ground under olives. 23 june 1992, 10785.

***Fontinalis antipyretica*** Hedw. – 4 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 44. 1500 m 34°43'N, 4°36' W. French lambert, North Morocco Grid 574477. On rocks in stream. 20 june 1992, 10670.

***Funaria hygrometrica*** Hedw. – Eaux et Foret, Ikaouen, c. 40 km N from Taounate on road to Ketama. Locality 42. 1000 m 34°48'N, 4°38' W. French lambert, North Morocco Grid 571466. On burnt area in wood. 19 june 1992, 10630.

***Grimmia laevigata*** (Brid.) Brid. –c. 15 km from El Hajeb on road to Ifrane, Forest de Jaaba. Locality 4. 1400m 34°36'N, 5°17'W. French lambert, North Morocco Grid 511333. On rock in *Quercus canariensis* woodland. 09 june 1992, 10458.

– 22 km towards Ain Leuh from Azrou to Midelt main road. Locality 10. 1450m, 33°25'N, 5°12'W. French lambert, North Morocco Grid 518312. On rock in Quercus rotundifolia forest. 11 june 1992, 10484.

– c. 15 km SW of Ketama along road to Taounate and Fès. Locality 43. 1000m 34°53'N, 4°38'W. French lambert, North Morocco Grid 570476. 19 june 1992, 10632b.

***Hedwigia stellata*** Hedenäs – 3 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 56. 1480 m 35°2' N, 4°58' W. French lambert, North Morocco Grid 540492. 24 june 1992, 10795.

****Hypnum cupressiforme*** var. ***cupressiforme*** Hedw. – c. 23 km from Ouazzane, on road to Chefchaouen. Locality 52. 105m 34°57'N, 5°32'W. French lambert, North Morocco Grid 488484. 23 june 1992, 10759.

****Hypnum cupressiforme*** Hedw. var. ***lacunosum*** Brid. – 22 km towards Ain Leuh from Azrou to Midelt main road. Locality 10. 1450m, 33°25'N, 5°12'W. French lambert, North Morocco Grid 518312. On rock in Quercus rotundifolia forest. 11 june 1992, 10492.

****Homalothecium lutescens*** (Hedw.) H.Rob. – c. 9 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 47. 1750 m 34°53'N, 4°34' W. French lambert, North Morocco Grid 576475. 20 june 1992, 10705.

***Imbribryum alpinum*** (Huds. ex With.) N. Pedersen – 71 km from Chefchaouen on road to Ketama, 13 km W from Bab Berred. Locality 58. 1450 m 35°1' N, 4°59'W. French lambert, North Morocco Grid 539490. 24 june 1992, 10869.

***Kindbergia praelonga*** (Hedw.) Ochyra – c. 9 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 47. 1750 m 34°53'N, 4°34' W. French lambert, North Morocco Grid 576475. 20 june 1992, 10710.

– 3 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 56. 1480 m 35°2' N, 4°58' W. French lambert, North Morocco Grid 540492. *S.L. Jury & F.M. Raimondo*, 24 june 1992, 10804.

***Leptodon smithii*** (Hedw.) F. Weber & D. Mohr – 22 km towards Ain Leuh from Azrou to Midelt main road. Locality 10. 1450m, 33°25'N, 5°12'W. French lambert, North Morocco Grid 518312. On rock in *Quercus rotundifolia* forest. 11 june 1992, 10488.

– c. 16 km from Ouazzane, on road to Chefchaouen. Locality 53. 110m 34°55'N, 5°32'W. French lambert, North Morocco Grid 488479. On *Quercus suber*. 23 june 1992, 10778.

– 34 km from Chefchaouen, 10 km above Bab Taza on track to Jbel Talassemtane. Locality 63. 1420m 35°6'N, 5°11'W. French lambert, North Morocco Grid 520499. on rock. 26 june 1992, 10936.

***Leucodon sciuroides*** (Hedw.) Schwägr. – c. 23 km from Ouazzane, on road to Chefchaouen. Locality 52. 105m 34°57'N, 5°32'W. French lambert, North Morocco Grid 488484. on Quercus suber. 23 june 1992, 10748.

– 40 km from Chefchaouen on route to Jbel Tassaout, 10 km above Talambote. Locality 61. 1565m 35°16'N, 5°8'W. French lambert, North Morocco Grid 524518. 25 june 1992, 10923.

***Neckera menziesii*** Drumm. – 34 km from Chefchaouen, 10 km above Bab Taza on track to Jbel Talassemtane. Locality 63. 1420m 35°6'N, 5°11'W. French lambert, North Morocco Grid 520499. 26 june 1992, 10942.

***Neckera pumila*** Hedw. – 84 km from Chefchaouen on road to Ketama, Bab Berred. Locality 54A. 1130m 35°0'N, 4°53'W. French lambert, North Morocco Grid 547488. 24 june 1992, 10790d.

***Nogopterium gracile*** (Hedw.) Crosby & W.R. Buck – c. 9 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 47. 1750 m 34°53'N, 4°34' W. French lambert, North Morocco Grid 576475. 20 june 1992, 10708.

***Orthotrichum lyellii*** Hook. & Taylor – 18 km from Taza along minor road to Gouffe de Friouato and Jbel Tazzeka. Locality 26. 1200 m 34°8' N, 4°2' W. French lambert, North Morocco Grid 626394. Limestone rocks and soil under Quercus ilex. 15 june 1992, 10561a.

– 40 km from Chefchaouen on route to Jbel Tassaout, 10 km above Talambote. Locality 61. 1565m 35°16'N, 5°8'W. French lambert, North Morocco Grid 524518. 25 june 1992, 10928.

***Palustriella commutata*** (Hedw.) Ochyra – c. 15 km SW of Ketama along road to Taounate and Fès. Locality 43. 1000m 34°53'N, 4°38'W French lambert, North Morocco Grid 570476. On rock in stream. 19 june 1992, 10636.

***Philonotis fontana*** (Hedw.) Brid. – c. 13 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 46. 1850 m 34°52'N, 4°31' W. French lambert, North Morocco Grid 580474. Wet flush in Cedrus atlantica forest. 20 june 1992, 10696.

***Philonotis tomentella*** Molendo – 71 km from Chefchaouen on road to Ketama, 13 km W from Bab Berred. Locality 58. 1450 m 35°1' N, 4°59'W. French lambert, North Morocco Grid 539490. *S.L. Jury & F.M. Raimondo* 24 june 1992, 10874.

***Polytrichum juniperinum*** Hedw. – 5 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 57. 1700 m 35°2' N, 4°56' W. French lambert, North Morocco Grid 543491. 24 june 1992, 10840.

*****Polytrichum piliferum*** Hedw. – 5 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 57. 1700 m 35°2' N, 4°56' W. French lambert, North Morocco Grid 543491. 24 june 1992, 10846.

****Plagiomnium undulatum*** (Hedw.) T.J.Kop. – c. 13 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 46. 1850 m 34°52'N, 4°31' W. French lambert, North Morocco Grid 580474. Wet flush in Cedrus atlantica forest. 20 june 1992, 10686.

***Pogonatum aloides*** (Hedw.) P. Beauv. – 71 km from Chefchaouen on road to Ketama, 13 km W from Bab Berred. Locality 58. 1450 m 35°1' N, 4°59'W. French lambert, North Morocco Grid 539490. 24 june 1992, 10867.

***Pterigynandrum filiforme*** Hedw. var. ***majus*** (De Not.) De Not. – 5 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 57. 1700 m 35°2' N, 4°56' W. French lambert, North Morocco Grid 543491. 24 june 1992, 10854.

***Rhizomnium punctatum*** (Hedw.) T.J.Kop. – c. 13 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 46. 1850 m 34°52'N,

4°31’ W. French lambert, North Morocco Grid 580474. Wet flush in *Cedrus atlantica* forest. 20 june 1992, 10676.

***Rhynchostegium megapolitanum*** (Blandow *ex* F. Weber & D. Mohr) Schimp. – c. 12 km from Rabat on road to Meknès, Forêt de la Maârmora. Locality 1. 80m 34°2’N, 6°42’W. French lambert, North Morocco Grid 379382. on base of *Chamaerops* in *Quercus suber* wood. 09 june 1992, 10452a.

***Rhynchostegium riparioides*** (Hedw.) Cardot – 4 km along track to Jbel Tidirhine, the track starting 1 km SW of Tleta-Ketama and 9 from Ketama. Locality 44. 1500 m 34°43’N, 4°36’ W. French lambert, North Morocco Grid 574477. On rocks in stream. 20 june 1992, 10669.

***Scleropodium touretii*** (Brid.) L.F. Koch – c. 16 km from Ouazzane, on road to Chefchaouen. Locality 53. 110m 34°55’N, 5°32’W. French lambert, North Morocco Grid 488479. on Salix. 23 june 1992, 10770.

***Syntrichia laevipila*** Brid. – c. 23 km from Ouazzane, on road to Chefchaouen. Locality 52. 105m 34°57’N, 5°32’W. French lambert, North Morocco Grid 488484. 23 june 1992, 10757.

***Syntrichia papillosissima*** (Copp.) Loeske – 34 km from Azrou along road to Midelt. Locality 17. 1880m 33°12’N, 5°4’W. French lambert, North Morocco Grid 531290. On NE-facing limestone rock by river in small gorge below road. 12 june 1992, 10525.

***Syntrichia ruralis*** (Hedw.) F. Weber & D. Mohr var. ***ruralis*** – 5 km up track to Jbel Tizinare; start of track 72 km from Chefchaouen on road to Ketama, 12 km W from Bab Berred. Locality 57. 1700 m 35°2’ N, 4°56’ W. French lambert, North Morocco Grid 543491. 24 june 1992, 10849.

– 44 km from Chefchaouen on route to Jbel Tassaout, 14 km above Talambote. Locality 60. 1600m 35°15’N, 5°5’W. French lambert, North Morocco Grid 528517. 25 june 1992, 10896.

***Timmiella barbuloides*** (Brid.) Mönk. – c. 16 km from Ouazzane, on road to Chefchaouen. Locality 53. 110m 34°55’N, 5°32’W. French lambert, North Morocco Grid 488479. on *Salix*. 23 june 1992, 10777.

***Tortella nitida*** (Lindb.) Broth. – 36 km from Taquist, 1 km above Torres de Alcalá. Locality 49. 125m, 35°10’N, 4°19’W. French lambert, North Morocco Grid 599506. On soil. 21 june 1992, 10715.

***Tortella squarrosa*** (Brid.) Limpr. – c. 6 km SE of Sidi Abdallah (town on Fès-Taza road), along minor road to Bab-Boudir. Locality 28. 340m 34°9’N, 4°19’W. French lambert, North Morocco Grid 601395. Limestone gorge, W-facing slope in *Olea ceratonion*. 15 june 1992, 10587.

– Western outskirts of Taineste, c. 40 km due NNW of Taza. Locality 39. 1100m 34°34’N, 4°8’W. French lambert, North Morocco Grid 616441. 18 june 1992, 10617c.

****Tortula lindbergii*** Broth. – 44 km from Chefchaouen on route to Jbel Tassaout, 14 km above Talambote. Locality 60. 1600m 35°15’N, 5°5’W. French lambert, North Morocco Grid 528517. 25 june 1992, 10888.

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Stampato nel mese di settembre 2013
presso la Tipolitografia Luxograph s.r.l.
Piazza Bartolomeo da Messina 2/e
Palermo