The Vegetation and Flora of Bou Guemmez, Grand Atlas, Morocco

BY

D. H. N. SPENCE

Department of Botany, University of Glasgow *

CONTENTS

	PAGE
Introduction	243
Itinerary	245
Notes on the Vegetation	246
Summary of Vegetation-Zones	252
Plant List	235
References	269

INTRODUCTION

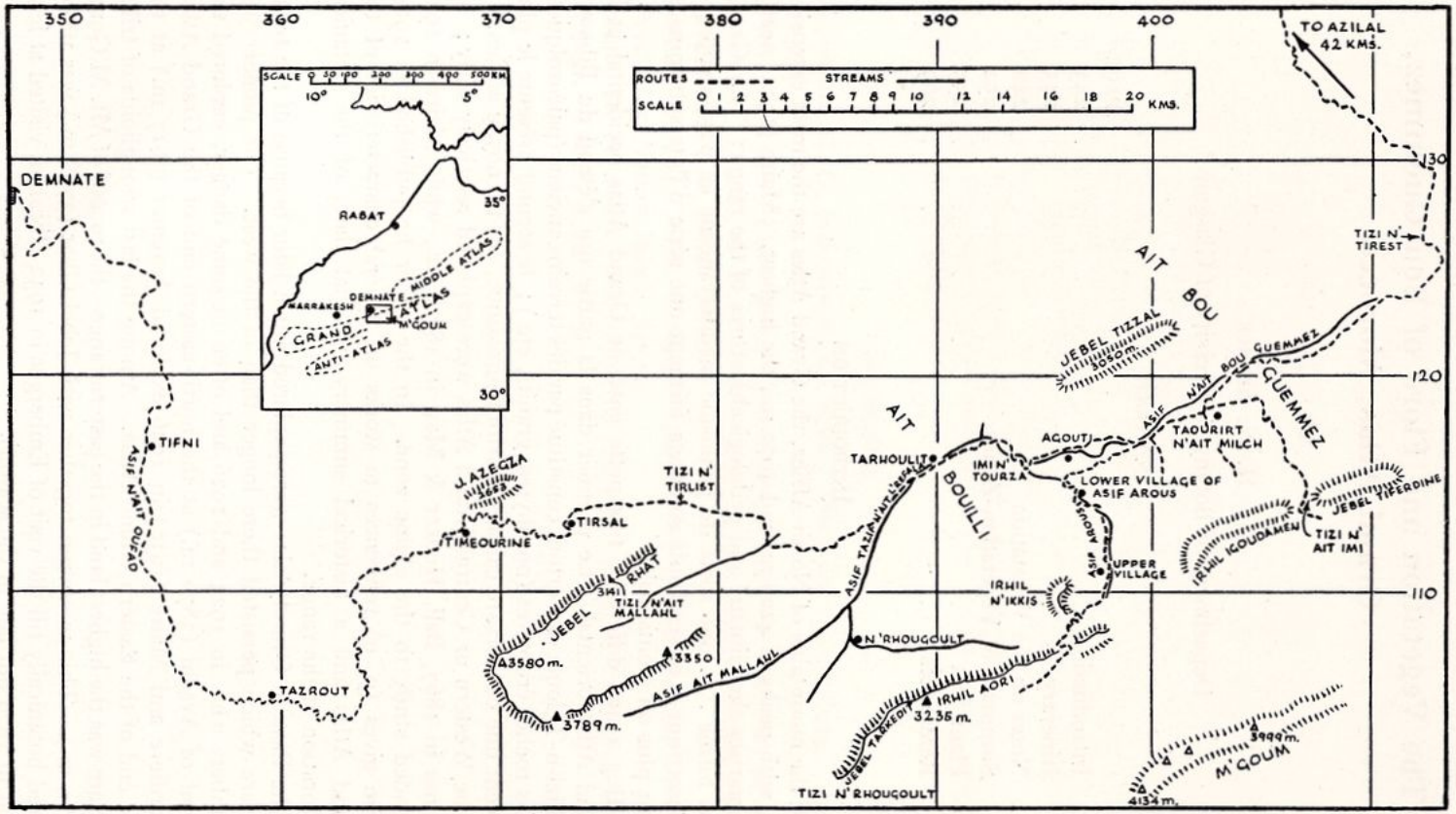
Of the mountains of North Africa, the Grand Atlas are the most extensive and, with peaks of 4220 m. and 4070 m., the highest. Maire (1924) neatly summarises the climatic and pedological features of the range: " Le Grand Atlas forme . . . une sorte de péninsule méditerranéene en pays steppique et désertique; et ses hauts sommets forment une série d'îlots subalpins et alpins plus ou moins isolés.

" Il y a une différence très nette entre le Grand Atlas occidental et le Grand Atlas oriental. Le premier dans la partie qui s'étend du Bibaoun au Tizi-n-Telouet est surtout constitué par des terrains anciens (paléozoiques) et des roches éruptives (porphyres, granits, etc.); le second présente le plus souvent une couverture calcaire, surtout jurassique, sur un noyau ancien."

The Western or Central Grand Atlas were explored relatively early; by Balansa in 1867, Ball, Hooker & Maw in 1871, etc., while Maire in 1921 extended study to the alpine zone. In the paper he published in 1924, Maire gives (p. 9) references to works on general characteristics of the Grand Atlas and a historical summary, to that date, of the botanical exploration of the range.

The Eastern Grand Atlas were explored much later because of the tribal warfare which persisted there longer than in the west. The pioneer was Humbert who, in 1923 and 1926 and often in some danger, explored the massif of Ayachi (3876 m.) at the north-eastern end of the Grand Atlas. Litardière and Maire (1930) in 1926 explored Anremer (3617 m.) at the west end of the Eastern Grand Atlas. Among the last strongholds of tribal warfare was the highest land in the eastern range—the massif of Mt. M'Goum (4070 m.). This mountain together with Jebel Ghat (3788 m.) was unexplored botanically till the visit of Emberger in 1932 (Ibrahim visited at least Ghat in 1879 but late in the season).

* At the time of this expedition, Department of Botany, University of Edinburgh.



Sketch Map of Bou Guemmez and neighbouring areas of the Grand Atlas.

In July 1951 five members * of the University of Edinburgh set out to visit the Grand Atlas. A party of biologists, our intention was to collect in a region quite new to us and, if possible, new to science. For various reasons, we had planned to choose our exact area in the Grand Atlas once we had reached Rabat. Arrived in that city, we were able to discuss our intentions with M. Joly, Director of the Institut scientifique chérifien, and his staff.

With their helpful advice, the area finally selected was the land of Ait Bou Guemmez, which lies north of Mt. M'Goum in the limestone eastern Grand Atlas, and in that phytogeographical division of the range now known as Div. XV—M'Goum (see p. 253). All the collecting and notes on the vegetation were done in the relatively small area of Bou Guemmez, apart from some on the journey to and from the area. Emberger (1932, p. 12 *et seq.*) climbed and returned from M'Goum by a route at one point fairly near, but not (see p. 246) covering any of the ground in Bou Guemmez which I visited. Like him, several authors have traversed nearby regions (most recently M. Quezel) but none, so far as I know, has published any account of the flora and vegetation of Bou Guemmez itself.

It is with pleasure that I record on p. 253 my thanks and indebtedness to Monsieur J. Vindt of the Institut scientifique chérifien for his work in identifying my collection. Then I should like, on behalf of my colleagues and myself, to thank :—M. Joly, Director of the Institut scientifique chérifien and members of his staff : M. Joly both before and after our arrival in Rabat gave us his willing help in our dealings with the military authorities, in getting permits, choosing an area and by assisting us in so many of the small details that make one's stay in a foreign country more pleasant ; the French military authorities who, in Rabat, Marrakech, Azilal and Ait Mohammed, all assisted us quickly and courteously ; the hospitable Berbers of Ait Bou Guemmez (should they read this) and, not least, the staff of the British Consulate in Rabat for their helpfulness, Mr. Brown in particular.

Mr. B. L. Burtt, of the Royal Botanic Garden, Edinburgh, has made many useful suggestions and kindly read my manuscript.

I must finally record my colleagues' and my own indebtedness to the Trustees of the Cross Trust for their award of a grant towards the expenses of the expedition ; and my thanks to the Senatus Academicus of the University of Edinburgh for their award to me of a post-graduate research grant. Without the generous financial assistance from these two sources we could not have undertaken the expedition, for his encouragement of which our thanks are due to Professor Sir William Wright Smith.

Itinerary

The part of the expedition during which I collected is covered by the Demnate, Ouaouizarhte (sheet No. XLVI), Telouet and Dades sheets of the map " Maroc au 200000e," published in Rabat, 1950. Figure 1 is based on this map.

24 July : Azilal—Ait Mohammed—Taourirt n'Ait Milch (Ait Bou Guemmez), which became our base (Map Reference 404118). 25 July : lower slopes of Irhil Igoudamen (M.R. 404116). 27 July : Taourirt n'Ait

* K. W. Miller, A. B. & Lynda Roy, D. G. M. Wood-Gush and the author.

Milch—Tizi n'Ait Imi (M.R. 407114)—Taourirt. 29 July: Valley of Ait Bou Guemmez in region of Taourirt. 31 July: Taourirt—Agouti—valley of Asif Arous, past village (at 397112)—westward to point c. 3200 m. on Irhil Aori (M.R. 396107). 1 August: eastern cliffs of Irhil Aori. 2 August: Irhil Aori—village of Asif Arous—Asif Arous—Agouti—Taourirt n'Ait Milch. 4 August: valley and hillsides near Taourirt. 6 August: limestone cliffs (M.R. 401115) at north of Irhil Igoudamen. 8 August: Taourirt. 10 August: Taourirt—Agouti—down Imi n'Tourza toward Tarhoulit, and back. 11 August: lower slopes of Jebel Tizzal and valley of Bou Guemmez. 12 August: lower slopes of Jebel Tiferdine. 13 August: Taourirt—Agouti—Asif Arous, and back. 14 August: Taourirt —Tarhoulet—Tizi n'Tirlist—Tirsal—Tazrout. 15 August: Tazrout—Demnate.

Note on Irhil Aori. In recounting his expedition to M'Goum, Emberger (Emberger 1932, p. 12 *et seq.*) says that, from Tirsal, " nous avons projeté cette fois-ci de parcourir la partie Sud du massif du Ghat et d'atteindre, par le Ghat-centre et la vallée de l'Asif Ait Mallahl, le Mont Maaghal et le M'Goum. . . ." His route can be followed (on the 1950, 200000^{e} map) as far as the valley of l'Asif Rougoul, which he climbed (l.c., p. 13), " jusqu'a un confluent puis on s'engage dans la vallée de gauche (i.e., going eastward) longeant la magnifique muraille du Mont Maaghal . . . la Maaghal lui-même est calcaire."

I cannot find the name " Maaghal " on this map, but from his description both of the journey to and from M'Goum, it seems that Emberger's Maaghal is now called Irhil Aori. Irhil Aori (or Maaghal) Emberger approached eastward via Asif Rougoul and returned down the same valley, while I climbed it from the south-west and returned north-east via the valley of Asif Arous. The col of Irhil Aori is the only point where our routes may have overlapped.

Note on Jebel Ghat. Spelt " Rhat " on the map, and " Ghat " or " Rhat " in the literature. I use " Ghat."

Notes on the Vegetation

This is a brief description of the vegetation of Bou Guemmez. I have relied for comparison upon the account of the vegetation of the neighbouring Jebel Ghat and Mt. M'Goum by Emberger (1932), whose zonation I adopt, and of the more distant western Grand Atlas by Maire (1924); to both of these papers reference should be made for more detailed accounts. Though my notes add little that is new to Emberger's findings, I make no excuse for presenting them, as I think this method (even if superficial) does give a more complete picture of the vegetation than habitat-notes attached to a plant-list, and they incidentally confirm Emberger's observations in a neighbouring, new, district.

A. Irrigated and Flushed Communities (Associations ripilsives).

1. *Plantations.*—The valley-floor of Ait Bou Guemmez is relatively flat and broad, and the irrigated Berber fields are not terraced up the hillsides as, say, at Tirsal. Where near the scattered villages they cross the fields, the streams and irrigation-canals are often bordered by aged Walnut trees and by small woods of *Populus nigra*, *P. alba* and *Salix purpurea*.

A shrub-layer is generally absent since the woods are grazed, and the field-layer of a semi-open Poplar-wood at Taouriet (2000 m.) comprises: *Holcus lanatus*, *Agrimonia Eupatoria*, *Lotus corniculatus*, *Arctium minus*, *Cerinthe major*, *Rubia laevis*, *Potentilla reptans*, *Knautia arvensis*, *Euphorbia pubescens*, *Mantisalca salmantica*, *Daucus carota*, *Plantago major*, *Campanula Mairei*, etc. With the possible exceptions of *Arctium* and *Cerinthe*, which I only saw once, none of these species is confined to woodland. All occur in thickets of *Rosa*, *Rubus* etc., and many absent elsewhere are found too in the surrounding Berber pastures and hay-fields. This is to be expected if the restriction of these mesophytes is due to water-shortage; all these habitats are at least periodically irrigated by the Berbers.

2. Such a *periodically-irrigated pasture* at the upper village of Asif Arous, 2350 m., still unmown at that date (2 August 1951) contained: *Linum catharticum*, *L. angustifolium*, *Sonchus maritimus*, *Centaurea pullata*, *C. incana*, *Echium flavum*, *Plantago coronopus*, *Mantisalca salmantica*, *Festuca* sp. and *Aegilops* sp.; in addition there were *Catananche caerulea*, *Anthyllis Vulneraria*, *Galium Mollugo*, *Potentilla maura*, *Dianthus caryophyllus*, *Thymelaea virgata*, *Ononis antiquorum*, *Potentilla reptans*, *Setaria viridis* and *Dactylis glomerata*; these latter species are commonly found in dry semi-open, and even (*Galium Mollugo*) high-montane pastures.

3. *Edges of streams, of irrigation-canals*; *and flushed pastures* (pozzines).—These form the more or less natural habitats of which the artificially irrigated pastures are an extension. The edges of streams and irrigation-canals have an association of *Cirsium flavispinum*, with, at about 2000 m., *Senecio Doria*, *Orchis latifolia*, *Mentha longifolia*, *Leontodon hispanicus*, *Centaurium pulchellum*, *Prunella vulgaris*, *Chlora* (*Blackstonia*) *perfoliata*, *Orobanche* spp., *Eryngium tricuspidatum* and, rarely, *Aquilegia vulgaris*.

This Cirsietum flavispini (or C. chrysacanthi or both) seems very typical of such habitats in the Grand Atlas and, bordering the irrigation-canals, lies as a conspicuous green band across the bare hillsides. Subordinate species varying with altitude, this association is reported by Maire (1924, p. 63) at over 3100 m. near Tizi-n-Tachdirt; he considers it most typical of the "subalpine" and "alpine" zones, from 1800–2300 m. upwards.

A damp lime-flushed pasture, which Maire (1924, p. 58) might call a pozzine, at 2300 m. in the valley of Asif Arous is dominated by *Brachypodium phoenicoides* and *Agrostis Reuteri*, with *Sanguisorba minor*, *Trifolium fragiferum* and almost pure stands of *Cirsium flavispinum* and *Eryngium tricuspidatum*. Lower down Asif Arous at 1950 m. *Gentiana ciliata* (see p. 264) was found in a similar lime-flushed pasture.

4. Limestone wet-flush near the same locality had *Carex flacca*, *C. panicea*, *Scirpus pauciflorus* and *Juncus articulatus*, with *Chara* spp. In the canals at 2000 m. were *Carex divisa*, *C. flava*, *Scirpus palustris*, *Juncus inflexus*, *Equisetum ramosissimum*, *Veronica Anagallis-aquatica*, *Rorippa Nasturtium-aquaticum*, *Helosciadium repens* and *Potamogeton densus* var. *lancifolius* in the slow reaches, var. *rigidus* in the swifter.

B. Semi-arid (cold) Zone of Mediterranean Vegetation—*Juniperus phoenicea* (l'étage de végétation méditerranéen semi-aride); 2000–2100 m.

1. At 2000 m. the valley is sparsely covered by a very degraded forest of *Juniperus phoenciea*. The trees rarely form a continuous cover (by the

villages, never), and such as survive show every sign of mutilation and grazing (this is not an original observation; it is reported from every part of the Grand Atlas). Other trees in the open associations are *Juniperus oxycedrus*, *Fraxinus xanthoxyloides*, *Quercus Ilex* and *Juniperus thurifera*. *Pinus halepensis* is absent in Bou Guemmez but fine stands occur (up to c. 2300 m. on the north slopes) in the neighbouring, westward, valley of Ait Bouilli; the other trees are only present as a more or less mutilated undergrowth (possibly the Pine is conserved by the people of Ait Bouilli). Absent too from Bou Guemmez, *Chamaerops humilis* grows to about 2000 m. on the south-facing slopes of Ait Bouilli.

2. There are occasional thickets of *Rubus ulmifolius*, *Clematis flammula*, *Cotoneaster nummularia* and *Rhamnus lycioides*, while limestone outcrops often support, in addition to these species, *Prunus prostrata* and *Ephedra major* ssp. *nebrodensis* (similarly described by Maire, 1924, p. 39, for Toubkhal). In the north-facing gorge of Irhil Igoudamen, to about 2300 m., grow *Cotoneaster nummularia*, *Rosa canina* and *R. micrantha*, *Jasminum fruticans* and *Crataegus oxyacantha*; *Hedera Helix* trails over the shaded cliffs. There are also in this gorge many pure societies of *Buxus sempervirens*, with *Geranium Robertianum* and *G. pyrenaicum* growing beneath them or in the shade of boulders. Excepting *Buxus*, these shrubs seem almost restricted to thickets near cultivated fields or crags, both of which situations offer some protection from grazing.

3. Associated at the same altitudes with these shrubs on outcrops and cliffs are *Putoria brevifolia* (to 3100 m.) and *Asperula hirsuta* (strict chasmophytes), *Sedum album*, *Globularia Nainii*, *Antirrhinum majus* ssp. *hispanicum* and *Arenaria serpyllifolia*.

4. Rocky open pasture. Rock-strewn open ground occupies the vast remainder of the valley-floor at 2000 m. Dominated by *Ormenis scariosa*, *Bupleurum atlanticum*, *Pituranthos scoparius* and *Artemisia atlantica* or xerophytes-*Genista Scorpius*, *Erinacea Anthyllis* and *Astragalus Ibrahimianus*; associates: *Scolymus hispanicus*, *Eryngium triquetrum*, *Carlina involucrata*, *Euphorbia megalatlantica* and *E. nicaeensis*, *Lactuca viminea* and *Isatis tinctoria*, *Cicerbita tenerrima*, *Hirschfeldia incana*, *Teucrium Polium* and *T. chamaedrys*, *Delphinium pubescens* and *D. peregrinum* ssp. *halteratum*, *Anarrhinum fruticosum*; less frequently *Urginea maura*, *Convolvulus sabatius*, *Anagallis Monelli* (often in xerophytes), *Solanum nigrum*, *Malva silvestris*, *Pimpinella tragium*, etc.; *Artemisia atlantica* in a more closed facies with *Dianthus serrulatus*, *D. caryophyllus*, *Catananche caerulea*, *Scabiosa Parielli*, *Leontodon hispanicus*. These last five species are also found in irrigated pasture.

Juniperus phoenicea dominates in the degraded forest at 2000–2100 m., though rocky open pasture far exceeds that community in area. This forest is characteristic of the semi-arid zone of Mediterranean vegetation. *Chamaerops humilis*, *Jasminum fruticans*, *Clematis flammula*, *Globularia Nainii* and *Pituranthos scoparius* indicate the cold substage or zone (Emberger, 1932, p. 5). Replacement of Olive by Walnut, of *Nerium* by *Salix purpurea* and presence of Ash and Poplar probably signify that the valley floor is at the upper limit of this zone.

C. Temferate Zone of Mediterranean Vegetation—*Quercus Ilex*; 2100–2500 m. (l'étage de végétation méditerranéen tempéré).

1. *Quercus Ilex* grows to about 2500 m. on the north and south sides of the valley, in patchy open woods with *Juniperus thurifera* and, in the lower reaches, with *J. phoenicea*, *Fraxinus xanthoxyloides* and *Buxus sempervirens*. *Buxus* forms extensive scrub, with *Rosa canina* in its denser parts, on the limestone of the valley of Asif Arous and seems more or less indifferent to aspect of slope. It merges at about 2400 m. into degraded *Quercus Ilex*—*Juniperus thurifera* scrub. *Arbutus Unedo* and *Cistus laurifolius* are absent.

2. In a limestone gorge, at about 2300 m.—2400 m., grow chasmophytes like *Anthyllis Warnieri*, *Potentilla alchemilloides*, *Viola saxifraga* (all alpines), *Asplenium trichomanes*, *Polygala rupestris*, *Sedum sediforme*, *Seseli nanum*, and, further eastwards, *Paronychia capitata* and *Kentranthus angustifolius* ssp. *Battandieri*.

3. As on the valley-floor, the greater part of the hillsides between the thin scattered woods is occupied by rocky open pasture. The alpine xerophytes *Erinacea Anthyllis*, *Astragalus Ibrahimianus* and *Genista Scorpius*, already fairly conspicuous at 2000 m., are reinforced by others—*Arenaria pungens* and *Alyssum spinosum* (appearing at 2200 m.)—and approach dominance at c. 2500 m. on north-facing slopes. Below this altitude, *Pituranthos*, *Ormenis*, *Cicerbita*, *Isatis*, *Dianthus serrulatus*, *Catananche*, *Lactuca*, *Solanum*, *Urginea* gradually disappear. We see now *Digitalis lutea*, *Anthemis pedunculata*, *Jasione humilis*, *Trisetum flavescens*, *Papaver rupifragum*, *Hedysarum humile* which, with *Bupleurum atlanticum*, *Scutellaria orientalis*, *Pterocephalus* and *Euphorbia nicaeensis*, persist to at least 3100 m.

In the Grand Atlas maximum rainfall is apparently between 2000–2500 m., decreasing steadily above and below these altitudes. Emberger (1932, p. 20) considers this to be the zone of *Quercus Ilex*, its width in any area depending on humidity. Oaks in Bou Guemmez lie more or less between these maximum altitudinal limits.

Among the characteristic species of the oak zone *Ormenis scariosa*, *Rubia laevis* and *Anarrhinum fruticosum* are found at 2000 m. with *Juniperus phoenicea*, but *Pterocephalus depressus*, *Scutellaria orientalis* (both preferring shale to limestone) and *Kentranthus angustifolius* ssp. *Battandieri* occur most widely within this zone.

D. Lower Zone of High-montane Vegetation—*Juniperus thurifera*; 2500 m.–3100 m. (l'étage de végétation de haute montagne : sous-étage inférieur).

Juniperus thurifera is the only tree above about 2500 m. Isolated clumps of *Prunus prostrata* are normally the only indications of an accompanying low-shrub layer. On shale, however, at about 2700 m. on the north-east facing shoulder of Irhil Aori, there is a small community of *Buxus sempervirens*, *Ribes uva-crispa* and *Prunus prostrata*. Maire (1924, p. 47) mentions the last two species as characteristic of Juniperetum thuriferae and states that *Ribes uva-crispa* ascends to 3200 m. Scattered trees of *J. thurifera* are seen on crags north of Irhil Aori at about 3000 m. That figure is the upper tree-limit as given by Emberger (1932, p. 23).

Rocky open pasture is considered with the next section.

E. Upper Zone of High-montane Vegetation; 3100 m. upwards (sous-étage supérieur).

1. Above 3000 m., rocky limestone open pasture still occupies the largest area. That near Tizi n'Ait Imi comprises, at its steepest parts, few species other than *Astragalus Ibrahimianus*, *Arenaria pungens* and *Alyssum spinosum*. But where the slope is gentler, an open community, still dominated by these xerophytes and *Erinacea* and *Genista*, has *Pimpinella tragium*, *Digitalis lutea*, *Bupleurum atlanticum*, *Euphorbia nicaeensis*, *Jasione humilis* (in xerophytes), *Papaver rupifragum*, *Trisetum flavescens* (all seen below this altitude); *Dactylis glomerata* var. *hispanica*, *Festuca Hystrix*, *Poa alpina*, *Erysimum Bocconei*, *Arenaria armerina*, *Minuartia verna* and *Cerastium arvense*, with *Anagallis Monelli* (seen at 2000 m.) and *Odontites Rameauana* growing in xerophytes.

2. At 3100 m. the north-facing, broken, limestone cliffs of Tizi n'Ait Imi hold such chasmophytes as *Bellis caerulescens*, *Erigeron Mairei*, *Hypochaeris leontodontoides*, *Polycarpon polycarpoides*, *Sarcocapnos baetica*, *Anthyllis Warnieri*, *Asplenium viride*, *A. Ruta-muraria*, *Campanula filicaulis* var. *pseudo-radicosa*, *Aethionema saxatile*, *Echium pycnanthum* and *Thymus serpyllum*. *Asperula cynanchica* and *Galium Mollugo* (and at 2000 m.) appear frequently in the open pasture.

Lonicera pyrenaica trails down the north-facing limestone cliffs of Irhil Aori at 3000 m.–3100 m., and there are rosettes of *Saxifraga longifolia* with inflorescences up to 18″ high; in clefts grow *Draba hederifolia* ssp. *Cossoniana*, *Myosotis alpestris* and *Hieracium amplexicaule*. *Silene Boryi*, *Melica ciliata*, *Festuca elatior* ssp. *arundinacea* and *Dactylis glomerata* var. *hispanica* grow on ledges or the open hillside.

3. Sweeping down from the cliffs are long talus-slopes, having in their looser parts only *Vicia glauca*, *Linaria tristis* and *Dracocephalum Renati*.

As in the lower zones, rocky open pasture in which chamaephytes and hemicryptophytes predominate is the areal dominant but, unlike these zones, it is here primarily a climatically-determined community.

Discussion.

Climate, Cedar and the Aleppo Pine.—The aridity of this climate is emphasised by the majority of mesophytes being confined to irrigated or flushed communities or, as chasmophytes, to shaded cliffs. The Cedar (*Cedrus atlantica*) is absent from the Grand Atlas. Though it is reported from Ayachi (Maire, 1924, p. 142), that region is now considered, perhaps in this connection significantly, to have more affinity with the Middle Atlas and has been placed in "Moyen-Atlas-Ayachi" (Sauvage & Vindt, 1952, p. xi). I say "significantly" because Cedar is typical of the semi-arid (Maire's subalpine) stage of Mediterranean vegetation of other North-African mountains (1700–2100 m. in the Middle Atlas), when it is associated with *Quercus Ilex*. Progression through the Middle Atlas to the drier west of the range sees replacement of Cedar by *Juniperus thurifera* which, with further increase in aridity, next replaces the Oak, as in the still drier Grand Atlas. Absence of Cedar from these mountains must be due to this climatic, rather than a historical biotic, factor for, as Maire points out, some specimens would surely have survived on inaccessible crags, etc. (Maire, 1924, pp. 69 and 98).

Extensive forest of *Pinus halepensis* grows near Bou Guemmez (and in other parts of Div. XV—Abachkou, etc.: see Emberger, 1932, p. 29) but

the species is very rare in the West Grand Atlas. How far this is due to biotic factors is not known : it is odd that the species should be so abundant in, for example, Ait Bouilli and quite absent in neighbouring Ait Bou Guemmez ; Emberger can only conclude that *Pinus halepensis* grows in those areas of the Grand Atlas where the climate is " aussi peu atlantique que possible " (Emberger, 1932, p. 19). But, though the Pine may prefer a dry climate, it nevertheless does flourish near Bou Guemmez in an area where the belt of maximum rainfall, as indicated by the *Quercus Ilex* zone, is at its widest (see p. 249).

These forests of pine occur between the same broad altitudinal limits as Cedar in the Middle Atlas, and with the same principal associate, *Quercus Ilex* (but with *Juniperus phoenicea* at the lower levels). As aridity increases with altitude *Pinus*, like Cedar in the Middle Atlas and *Quercus Ilex* in both ranges, gives way to *Juniperus thurifera*. Field observations thus suggest that *Pinus halepensis* occupies a position climatically between *Cedrus atlantica* and *Juniperus thurifera* and overlapping, like *Cedrus*, with *Quercus Ilex* ; perhaps *Pinus halepensis* replaces *Cedrus* in the Grand Atlas.

Validity of zonation of vegetation, and the biotic factor.

I have said that rocky open pasture occupies the largest area in every zone. So scarce, indeed, are the name-species of, and so considerable is the mingling of, plants from Emberger's different zones that one should question their validity in this region.

Of course the zones are subjective and observations on, say, *Buxus sempervirens* show how they may be modified. This species forms patches of vegetation from 2000 m. on the lower north-facing slopes of Irhil Igoudamen and more extensively up the valley of Asif Arous, to 2700·m. (with *Ribes uva-crispa*) on Irhil Aori ; that is, in the zones of *Juniperus phoenicea* (B), *Quercus Ilex* (C) and *J. thurifera* (D). *Buxus* grows in three zones between wide altitudinal limits, not simply in that of *J. thurifera* as stated by Emberger (1922, p. 21).

Allowing for such natural incompleteness of facts and subjective error in interpreting and applying Emberger's zonation, can we account for the overlapping in general ? In the shelter of north-facing gorges one may expect upward penetration of such species as *Jasminum* and *Crataegus* (characteristic of a lower zone) and the presence of a perpetual stream could account for the downward extension of alpine chasmophytes like *Anthyllis Warnieri* and *Potentilla alchemilloides*. But these small areas provide exceptional habitats compared with the great expanses of open mountain-side.

A certain amount of overlap is quite natural in the ecotone between two altitudinal zones. The valley-floor—degraded *Juniperetum phoeniceae* at its upper limit—has many species typical of the higher, temperate, zone : *Quercus Ilex*, *Ormenis scariosa*, *Rubia laevis* and subalpine *Juniperus thurifera*, *Bupleurum atlanticum*, etc. Presence of most of these species could be due to natural overlap, but that cannot explain the dominance of (for example) *Ormenis*, and even less of the alpines like *Astragalus Ibrahimianus*, *Genista Scorpius* and *Erinacea Anthyllis*. Even at 2300 m. on north-facing slopes, we encounter more alpines—*Arenaria pungens* and *Alyssum spinosum*.

Maire (1934, p. 49) dubbed as " pseudo-alpine " the rocky pasture dominated at these altitudes (in his case 2500 m.) by alpine xerophytes, and

indicates that this type is the result of anthropogenic deforestation. The important point about deforestation is this : through subsequent drying-out and erosion, it could be expected *a priori* to cause the downward extension of the pioneer stage of vegetation, here high-montane and once limited (more or less) by the tree-line at about 3100 m. ; as a result, much climatic zonation would be obliterated. Such indeed seems to be the case in Bou Guemmez.

I think, however, one is justified on several counts in zoning the vegetation and in naming the zones after plants which are not dominant. Uniformity of treatment is desirable and, scattered though these trees are here, they follow Emberger's altitudinal zones, zones based primarily on forested areas of equivalent altitudes in neighbouring regions. Most significantly, the present status of the larger life-forms, to about 3000 m., seems almost certainly due to anthropogenic rather than climatic factors, deforestation causing both lack of trees and mingling of plants from different climatic zones. Only above about 3100 m. can the areal predominance of chamaephyte and hemicryptophyte communities be regarded as climatic.

Summary of Vegetation Zones

A. Irrigated and flushed communities, 2000–3100 m.

1. Plantations of Poplar, Willow, Walnut at 2000 m. with associated herbs ; many of these also in

2. Periodically-irrigated pasture.

3. Edges of streams, etc. : Cirsietum flavispini (to 3100 m.) and lime-flushed pasture.

4. Wet-flush and aquatic plants.

B. Semi-arid (cold) zone of Mediterranean vegetation—*Juniperus phoenicea* ; 2000–2100 m.

1. Degraded *J. phoenicea* forest at its upper limit : *Pinus halepensis*.

2. Thickets of *Rubus ulmifolius*, *Buxus sempervirens*, etc.

3. Chasmophyte communities.

4. Rocky open pasture (areal dominant—biotic climax) ; *Ormenis*, *Bupleurum* and alpines like *Astragalus Ibrahimianus*, etc.

C. Temperate zone of Mediterranean vegetation—*Quercus Ilex* ; 2100–2500 m.

1. Degraded *Quercus Ilex* scrub with trees of both lower and upper zones. Thickets of *Buxus sempervirens*, etc. Oak in zone of presumably highest rainfall ; *Pinus halepensis* to 2300 m.

2. Chasmophyte communities.

3. Rocky open pasture (areal dominant—biotic climax) ; mainly alpines.

D. Lower zone of high-montane vegetation—*Juniperus thurifera* ; 2500–3100 m.

1. *Juniperus thurifera* the only tree ; some *Prunus prostrata* and *Buxus sempervirens*.

2. Rocky open pasture (areal dominant—biotic climax) ; alpines.

E. Upper zone of high-montane vegetation—chamaephytes and hemicryptophytes ; 3100 m. upwards.

1. Rocky open pasture (areal dominant—climatic climax).
2. Chasmophyte communities } edaphic climax.
3. Scree communities }

Plant List

The list of plants collected is given below. The collection is to be lodged in the Herbarium of the Royal Botanic Garden, Edinburgh, a small set of duplicates being in the Herbarium of the Institut scientifique chérifien in Rabat.

The bulk of the work of identification was courteously undertaken by Monsieur J. Vindt, of the Institut scientifique chérifien, who saw practically all my collection and corrected or confirmed the small part I had myself named. It is a great pleasure to thank him for the time and trouble he must have spent on this task, and on the lengthy correspondence it has involved.

New Records.

New records for Morocco ; *Gentiana ciliata* L. and *Linum catharticum* L.
New records for the Grand Atlas ; Species : *Knautia arvensis* L. ssp. *Paui* Maire, *Hibiscus trionum* L. (alien) and *Arctium minus* (Hill) Bernh. ssp. *atlanticum* (Pomel) Maire—this last species is recorded for " GA—N.E. de l'Ayachi," in Catalogue des Plantes du Maroc, Vol. IV, but see below.

Till 1952, the recorded distribution of plants in Morocco has followed the geographical divisions used in the Catalogue des plantes du Maroc by Jahandiez and Maire. The Grand Atlas (including Ayachi) they denoted as one huge region, " GA." Sauvage and Vindt, in the first volume (1952) of their Flore du Maroc, have among other changes divided Jahandiez' and Maire's " GA " into four regions, based on pedological differences, and as we saw earlier abstracted Ayachi to " Moyen-Atlas-Ayachi " (for reasons, see Sauvage and Vindt, 1952, Intro. p. xi, and for divisions, p. xxviii). Our region is part of the new Division XV, M'Goum, and the following are, so far as I am aware,
New records for Div. XV ; Species : *Carex flava* L. ssp. *eu-flava* Asch. et Gr. ; sub-species : *Blackstonia perfoliata* (L.) Huds. ssp. *grandiflora* (Viv.) Maire and *Centaurium pulchellum* (Swartz) Hayek ssp. *laxiflorum* (Lindb.) Jah. et Maire.
New stations in Div. XV for the following rare species and subspecies ; *Anthyllis Warnieri* Emberger (endemic) : *Odontites Rameauana* Emberger (endemic) : *Potentilla alchemilloides* Lap. : *Buxus sempervirens* L. : *Draba hederifolia* Cosson ssp. *Cossoniana* (O. E. Schulz) Maire (endemic) : *Saxifraga longifolia* Lap. ssp. *Gaussenii* Emb. (ssp. endemic) : *Echium pycnanthum* Pomel ssp. *nanum* (Coss.) Jah. et Maire (ssp. endemic) : *Antirrhinum majus* L. ssp. *hispanicum* (Chav.) Maire.

Method of presenting information in the Plant List.

1. Nomenclature is that used in the Catalogue des Plantes du Maroc. As a result some names are carried to a lower subspecific level than the writer himself would be inclined to use. Furthermore the Stockholm ruling

on the naming of the typical subspecies, varieties, etc., is not followed. For ease of cross-reference, it seems desirable to maintain Maire's nomenclature without trying to bring it up to date in this respect.

2. Plant List; Angiosperms are arranged both by families and genera according to the Genera Plantarum of Bentham and Hooker, Pteridophyta and Gymnosperms preceding them.

3. Habitat and distribution notes are given here only for those species or subspecies constituting new records, or of especial rarity.

4. For all other species, locality and altitude of collection are given, together with a letter which refers to the vegetation zone and broad community in which the plant seemed generally to occur. These letters correspond to the divisions adopted in Notes on the Vegetation, of which a summary is given on p. 252.

EQUISETACEAE

EQUISETUM RAMOSISSIMUM L. Nos. 211, 219. Taourirt, 2000 m., A4.

POLYPODIACEAE

ASPLENIUM VIRIDE Huds. No. 50. Tizi n'Ait Imi, 3100 m., E2.

ASPLENIUM RUTA-MURARIA L. No. 51. Tizi n'Ait Imi, 3100 m., E2.

ASPLENIUM TRICHOMANES (L.) Huds. No. 176. Irhil Igoudamen, 2200 m., C2.

GNETACEAE

EPHEDRA MAJOR Host ssp. NEBRODENSIS (Tineo) St. Lager No. 225. Ait Bouilli, 1900 m., B2.

CONIFERAE

JUNIPERUS OXYCEDRUS L. No. 224. Bou Guemmez, 2000 m., B—C, by far the rarest of the Junipers.

JUNIPERUS PHOENICEA L. var. EU-PHOENICEA Maire et Weiller No. 223. Taourirt, 2000 m., B—C.

JUNIPERUS THURIFERA L. No. 230. Bou Guemmez, 2000 m., B–C–D.

PINUS HALEPENSIS Mill. No. 226. Ait Boulli (westward of Agouti), 1900 m., B–C.

RANUNCULACEAE

CLEMATIS FLAMMULA L. var. GENUINA Batt. No. 248. Asif Arous, 2000 m., B2.

AQUILEGIA VULGARIS L. var. BALLII Lit. et Maire No. 173. Bou Guemmez & Irhil Igoudamen, 2300 m., A3.

DELPHINIUM PUBESCENS DC. No. 150. Taourirt, 2000 m., B4.

DELPHINIUM PEREGRINUM L. ssp. HALTERATUM (Sibth. et Sm.) Batt. No. 280. (Azilal and) Bou Guemmez, 2000 m., B4.

PAPAVERACEAE

PAPAVER RHOEAS L. No. 67. Taourirt, 2000 m., A2/B4.

PAPAVER RUPIFRAGUM Boiss. et Reut. ssp. ATLANTICUM Maire No. 92. Irhil Aori, 2500 & 3200 m., C3—E1.

FUMARIACEAE

SARCOCAPNOS BAETICA (Boiss. et Reut.) Nym. var. ATLANTIS Emb. et Maire No. 43. Tizi n'Ait Imi, 3100 m., E2; three previous varietal stations all in Div. XV.

CRUCIFERAE

RORIPPA NASTURTIUM-AQUATICUM (L.) Hay. No. 241. Bou Guemmez 2000 m., A4.

ALYSSUM SPINOSUM L. No. 99. Irhil Aori, 3100 m., C3—E1.

DRABA HEDERIFOLIA Cosson ssp. COSSONIANA (O. E. Schulz) Maire No. 102. Irhil Aori, 3000 m., E2.

Strict chasmophyte on north-facing limestone cliffs, in fruit 1/8/51; with *Myosotis alpestris*, *Saxifraga longifolia*, *Silene Boryi*, *Hieracium amplexicaule* etc.

Distribution. Species endemic to Morocco. Ssp. COSSONIANA known from Ayachi (Div. XIII–4) and three other stations in Div. XV (Mont Ghat, Zaouia Ahansal et Plateau des lacs).

ERYSIMUM BOCCONEI (All.) Pers. No. 64. Tizi n'Ait Imi, 3000 m., D2—E1.

HIRSCHFELDIA INCANA (L.) Lagrèze-Fossat ssp. ADPRESSA (Moench) Maire
var. TYPICA Fiori No. 148. Taourirt, 2000 m., B4.
var. HIRTA (Babington) O. E. Schulz No. 157. Taourirt, 2000 m., B4.

AETHIONEMA SAXATILE (L.) R. Br. ssp. OVALIFOLIUM (DC.) Rouy et Fouc. var. LATIFOLIUM (Lindb.) Maire No. 284. Tizi n'Ait Imi, 3100 m., E2.

ISATIS TINCTORIA L. No. 156. Taourirt, 2000 m., B4.

RESEDACEAE

RESEDA LUTEA L. ssp. NEGLECTA (Müll.-Arg.) Ball No. 151. Taourirt, 2000 m., B4.

CISTACEAE

CISTUS SALVIIFOLIUS L. No. 38. Tirsal, 2000 m., B1.

HELIANTHEMUM CROCEUM (Desf.) Pers. (s.l.). No. 65. Tizi n'Ait Imi, 3050 m. and upper Asif Arous, 2400 m., C3–D2.

FUMANA ERICOIDES (Spach) Gaud. No. 13. Irhil Igoudamen, 2200 m., C3.

VIOLACEAE

VIOLA SAXIFRAGA Maire No. 181. Irhil Igoudamen, 2200 m., and Tizi n'Ait Imi, 3000 m., C2–E2.

POLYGALACEAE

POLYGALA RUPESTRIS Pourr. No. 182. Irhil Igoudamen, 2400 m., C2–E2.

CARYOPHYLLACEAE

DIANTHUS CARYOPHYLLUS L. (s.l.). Nos. 23, 139. Asif Arous, 2350 m., and Bou Guemmez, 2000 m., A2/C3.

DIANTHUS SERRULATUS Desf. var. MACRANTHUS Maire No. 87. Asif Arous, 2100 m., B4.

DIANTHUS GADITANUS Brot. (s.l.). No. 234. Bou Guemmez, 1950 m., B4.

SILENE BORYI Boiss. var. EU-BORYI Maire No. 100. Irhil Aori, 3100 m., E2.

SILENE CUČUBALUS Wibel var. VULGARIS Briq. No. 171. Irhil Igoudamen, 2100 m., B4.

CERASTIUM ARVENSE L. No. 44. Tizi n'Ait Imi, 3100 m., E1.

ARENARIA PUNGENS Clem. ssp. BOISSIERI Emb. var. ERIOSEPALA Emb. No. 24. Irhil Igoudamen, 2300 m., C2–E1.

ARENARIA ARMERINA Bory var. ELONGATA (Boiss.) Pau No. 94. Tizi n'Ait Imi, 31000 m., E1. Variety new to Grand Atlas.

ARENARIA SERPYLLIFOLIA L. ssp. EU-SERPYLLIFOLIA Briq. No. 239. East Valley of Bou Guemmez, 2200 m., B4.

MINUARTIA VERNA L. No. 46. Tizi n'Ait Imi, 3000 m., E1.

TELEPHIUM IMPERATI L. No. 10. Irhil Igoudamen, 2200 m., C2.

POLYCARPON POLYCARPOIDES (Biv.) Zodda var. PEPLOIDES (DC.) J. Vindt in Bull. Soc. Sc. Nat. Maroc, 1949, xxix, 142 (1951). No. 36. Tizi n'Ait Imi, 3000 m., E2.

HYPERICACEAE

HYPERICUM TOMENTOSUM L. No. 14. Tirsal, 2000 m., B1.

MALVACEAE

MALOPE MALACOIDES L. ssp. STIPULACEA (Cav.) Maire var. POMARIENSIS Fauré et Maire No. 185. Near Agouti, 1950 m., A2/B4.

MALVA SILVESTRIS L. ssp. SUBACAULIS (Cosson) Maire No. 201. Taourirt, 2000 m., A2/B4.

HIBISCUS TRIONUM L. Nos. 149, 199. Taourirt n'Ait Milch, Bou Guemmez, 2000 m., 8/8/51, A2. In cultivated fields—alien. Species new to Div. XV (M'Goum).

LINACEAE

LINUM CATHARTICUM L. ssp. CATHARTICUM Hayek No. 115. Upper village of Asif Arous, south of Bou Guemmez, Grand Atlas (Div. XV), 2350 m., 4/8/51, A2.

Habitat and Community. Periodically irrigated meadow of tall grasses and herbs, at that date (4th August 1951) unmown, with *Linum angustifolium*, *Sonchus maritimus*, *Plantago Coronopus*, *Knautia arvensis*, *Erigeron Naudinii*, *Centaurea incana*, *Dactylis glomerata* var. *typica*, *Lolium rigidum* etc. *Linum catharticum* is found here on basic soil but is, over its whole area, common on a wide variety of habitats, such tolerance being reflected presumably in its wide distribution-range.

Distribution. *Linum catharticum* L. is a new species for Morocco, its nearest previously-recorded stations being in Central Spain and the Canary Islands. It is unrecorded for Morocco and Cyrenaica. I cannot find the basis for the record of the species for North Africa given by Reiche (in Engl. & Prantl, Nat. Pflanzenfam, iii, Abt. 4, 31 : 1896) and by Hegi (Ill. Fl. Mitt.-Eur. v, Abt. 1, 6 : 1924).

Recorded distribution ; Europe, from Iceland and Finland (68° 50′ N. at Sandso) to North Portugal, Central and East Spain, Corsica, to Central Italy (not Sicily or Sardinia), to Macedonia ; Asia Minor, Caucasus and North Persia ; Canary Islands ; North Africa (see above).

LINUM ANGUSTIFOLIUM Huds. No. 116. Asif Arous, 2350 m., and Taourirt, 2000 m., A2.

GERANIACEAE

GERANIUM ROBERTIANUM L. ssp. PURPUREUM (Vill.) Murb. No. 175. Irhil Igoudamen, 2200 m., B2.

GERANIUM PYRENAICUM L. f. TYPICUM Woronov No. 177. Irhil Igoudamen, 2200 m., B2.

ERODIUM CICUTARIUM (L.) L'Hérit. No. 209. Taourirt, 2000 m., B4.

PAPILIONACEAE

GENISTA SCORPIUS DC. No. 254. Taourirt, 2000 m., B4—E1.

ERINACEA ANTHYLLIS Link No. 282. Taourirt, 2000 m., B4—E1.

ONONIS CENISIA L. No. 89. Asif Arous, 2200 m., C3.

ONONIS PUSILLA L. (*O. Columnae* All.). No. 184. Irhil Igoudamen, 2200 m., C3.

ONONIS ANTIQUORUM L. No. 198. Taourirt, 2000 m., A2/C3.

MEDICAGO LUPULINA L. ssp. CUPANIANA (Guss.) Batt. var. GLANDULOSA Rouy (R. Nègre det.). No. 81. Taourirt, 2000 m., A1/A2.

MEDICAGO SATIVA L. (R. Nègre det.). No. 249. Taourirt, 2000 m., A2.

TRIFOLIUM FRAGIFERUM L. No. 257. Taourirt, 2000 m., A3.

ANTHYLLIS WARNIERI Emb. Nos. 26, 35. Irhil Igoudamen, 2400 m., 26/7/51, and Tizi n'Ait Imi, 3100 m., 27/7/51, C2—E2.

Chasmophyte on limestone cliffs with, in the north-facing gorge at 2400 m., *Potentilla alchemilloides*, *Viola saxifraga*, *Asplenium trichomanes*, *Polygala rupestris*, *Seseli nanum* etc., and, at 3100 m., *Bellis caerulescens*, *Erigeron Mairei*, *Sarcocapnos baetica*, *Echium pycnanthum*, *Aethionema saxatile*, *Asplenium viride*, etc. In full flower; prostrate grazed, erect ungrazed, specimens.

Distribution. Species, endemic to the Grand Atlas, recorded from " les falaises verticales des gorges calcaires d'Imi n'Ouaka (1800 m.) et Ghat S.E. (3000 m.) " (Emberger, 1932, p. 35), the type localities. Both previous, like the two new, stations are in Div. XV.

ANTHYLLIS VULNERARIA L. (s.l.). Nos. 49, 95. Asif Arous, 2350 m., and Tizi n'Ait Imi, 3100 m., A2/C3—E1.

LOTUS CORNICULATUS L. (s.l.). No. 162. Taourirt, 2000 m., A1—A2.

ASTRAGALUS IBRAHIMIANUS Maire var. COSSONIANUS Emb. et Maire No. 135. Asif Arous, 2100 m., B4—E1.

HEDYSARUM HUMILE L. (s.l.). No. 16. Irhil Igoudamen, 2200 m., C3—E1.

VICIA GLAUCA Presl No. 106. Irhil Aori, 3000 m., E3.

ROSACEAE

PRUNUS PROSTRATA Labill. No. 134. Irhil Aori, 2800 m., B2—D1.

RUBUS ULMIFOLIUS Schott. f. No. 247. Near Agouti, 1950 m., B2.

POTENTILLA MAURA Th. Wolf var. GLABRESCENS Emb. et Maire Nos. 40, 136. Asif Arous, 2350 m., A2—C3. Variety previously recorded from GA for Tassent.

POTENTILLA REPTANS L. No. 207. Taourirt, 2000 m., A1—A2.

POTENTILLA ALCHEMILLOIDES Lap. No. 170. Irhil Igoudamen, 2300 m., 6/8/51, C2—E2.

Trailing chasmophyte on north-facing limestone cliffs, with *Anthyllis Warnieri*, *Viola saxifraga*, *Polygala rupestris* etc. In flower.

Distribution. Species recorded in Morocco only from the Grand Atlas.

PLATE I

Saxifraga longifolia Lap. subsp. Gaussenii Emb. (No. 107)
Below is *Hieracium amplexicaule* L. (No. 104)

Like this, the three previous stations are all in Div. XV, the nearest being Maaghal (Irhil Aori).

AGRIMONIA EUPATORIA L. var. INTERMEDIA Batt. No. 72. Taourirt, 2000 m., A1—A2.

SANGUISORBA MINOR Scop. Nos. 142, 172. Irhil Igoudamen and Asif Arous, 2200 m., A3.

ROSA CANINA L. ssp. DUMETORUM (Thuill.) Parmentier var. DESEGLESEI Christ No. 166. Irhil Igoudamen, 2200 m., B2—C1. Variety previously recorded for GA., Vallée du Todra.

ROSA MICRANTHA Sm. et Sow. No. 246. Asif Arous, 1950 m., B2.

CRATAEGUS OXYACANTHA L. (s.l.). No. 169. Irhil Igoudamen, 2200 m., B2—C1.

COTONEASTER NUMMULARIA Fisch. et Meyer (s.l.) Nos. 20, 245. Irhil Igoudamen, 2200 m., and Agouti, 1950 m., B2—C1.

var. TYPICA Asch. et Gr. No. 167. Irhil Igoudamen, 2200 m., C1. Variety previously recorded for Ghat and M'Goum.

CRASSULACEAE

SEDUM ALBUM L. ssp. GYPSICOLUM (Boiss. et Reut.) Maire No. 28. Irhil Igoudamen, 2400 m., C2.

var. GLANDULIFERUM Ball No. 88. Bou Guemmez, 2100 m., B3—B4.

SEDUM ACRE L. ssp. NEGLECTUM (Ten.) Murb. No. 66. Irhil Igoudamen, 2400 m., C2.

SEDUM SEDIFORME (Jacq.) Pau No. 179. Irhil Igoudamen, 2200 m., C2.

SAXIFRAGACEAE

SAXIFRAGA GLOBULIFERA Desf. (s.l.). No. 123. Taourirt, 2200 m., C2.

SAXIFRAGA LONGIFOLIA Lap. ssp. GAUSSENII Emb. No. 107. Irhil Aori, 3100 m., E2.

Strict chasmophyte on north-facing limestone cliffs. In full flower on 1/8/51; specimens with inflorescences up to 18″ high. With *Lonicera pyrenaica*, *Draba hederifolia*, *Hieracium amplexicaule*, *Silene Boryi*, etc.

Distribution. *Saxifraga longifolia* Lap. is represented in Morocco by the two subspecies (Jahandiez and Maire, iv, p. 1020): ssp. *pyrenaica* Emb. (Mat. 552: Saxifraga longifolia Lap. s.s.), found in the Middle Atlas and the endemic ssp. *Gaussenii* Emb. (Mat. 552) recorded from two stations in Ayachi (Div. XIII–4) and two in the Grand Atlas, both (Zaouia Ahansal and Ghat), like the new station, in Div. XV.

GROSSULARIACEAE

RIBES UVA-CRISPA L. var. ATLANTICUM Ball. f. GLANDULIFERUM Lindb. No. 133. Irhil Aori, 2800 m., D1.

ONAGRACEAE

EPILOBIUM HIRSUTUM L. No. 189. Taourirt, 2000 m., A1.

ARALIACEAE

HEDERA HELIX L. ssp. CANARIENSIS (Willd.) Maire No. 168. Irhil Igoudamen, 2300 m., B2—C2.

UMBELLIFERAE

ERYNGIUM TRICUSPIDATUM L. ssp. EU-TRICUSPIDATUM Maire var. SUBINTEGRUM Maire No. 129. Asif Arous, 2150 m., A3.

ERYNGIUM TRIQUETRUM Vahl No. 264. Near Agouti, 1950 m., B4.

BUPLEURUM ATLANTICUM Murb. No. 260. Taourirt, 2000 m., B4—E1.

HELOSCIADIUM REPENS (Jacq.) Koch No. 204. Taourirt, 2000 m., A4.

PITURANTHOS SCOPARIUS (Coss. et Dur.) Benth. et Hook. var. JUNCEUS (Ball) Maire No. 261. Taourirt, 2000 m., B4.

PIMPINELLA TRAGIUM Vill. Nos. 18, 62. Tizi n'Ait Imi, 3100 m., D2—E1.

SESELI NANUM (L.) Duf. No. 174. Irhil Igoudamen, 2300 m., C3—E1.

DAUCUS CAROTA L. (s.l.). No. 188. Taourirt, 2000 m., A2.

CAPRIFOLIACEAE

LONICERA PYRENAICA L. No. 98. Irhil Aori, 3100 m., E2.

RUBIACEAE

PUTORIA BREVIFOLIA Coss. et Dur. var. DYRIS Jah. et Maire Nos. 53, 85. On route to Tizi n'Ait Imi, 2500 m., and Asif Arous, B3—C2.

RUBIA LAEVIS Poiret No. 208. Taourirt, 2000 m., A1/C1.

RUBIA PEREGRINA L. var. INTERMEDIA Grenier No. 269. Tirsal, 2000 m., B1.

GALIUM MOLLUGO ssp. GERARDI (Vill.) Briq. Nos. 74, 114. Tizi n'Ait Imi, 3100 m., and Asif Arous, 2350 m., A2/E1–E2.

ASPERULA CYNANCHICA L. (s.l.). No. 45. Tizi n'Ait Imi, 3100 m., E1–E2.

ASPERULA HIRSUTA Desf. var. LONGIFOLIA Maire f. PERSQUARROSA Maire No. 86. Asif Arous, 2200 m., B3—C2,

VALERIANACEAE

KENTRANTHUS ANGUSTIFOLIUS DC. ssp. BATTANDIERI Maire No. 27. Irhil Igoudamen, 2400 m., C2.

DIPSACACEAE

SCABIOSA PARIELLI Maire var. TYPICA Maire No. 32. Irhil Igoudamen, 2200 m., A2/B4—C3.

KNAUTIA ARVENSIS L. ssp. PAUI Maire var. MAURITANICA (Pom.) Batt. Nos. 77, 161. Taourirt n'Ait Milch, 2000 m., 29/7/51 : and valley of Asif Arous, 2350 m., 4/8/51 ; A1/A2.

In thin-shaded poplar wood at Taourirt, with *Agrimonia Eupatoria*, *Rubia laevis*, *Euphorbia pubescens*, *Cerinthe major*, *Arctium minus* etc. and in tall-grass meadow (not then mown) at Asif Arous with *Linum catharticum*, *L. angustifolium*, *Sonchus maritimus*, *Plantago coronopus* etc.

Distribution. Species recorded in Morocco from " R., MA., Z., Siroua " (Divisions of Jahandiez and Maire) ; new to the Grand Atlas.

PTEROCEPHALUS DEPRESSUS Coss. var. EU-DEPRESSUS Emb. et Maire f. OCHROLEUCUS Lit. et Maire No. 9. Irhil Igoudamen, 2100 m., C2—E1.

COMPOSITAE

BELLIS CAERULESCENS Cosson ap. Ball No. 57. Tizi n'Ait Imi, 3100 m., E2.

ERIGERON NAUDINII (Bonnet) G. Nonnier. No. 101. Asif Arous, 2350 m., A2

ERIGERON MAIREI Braun-Blanquet No. 39. Tizi n'Ait Imi, 3100 m., E2.

GNAPHALIUM LUTEO-ALBUM L. No. 238. Bou Guemmez, 2100 m., B4.

INULA MONTANA L. var. CALYCINA (Presl) Batt. No. 128. Asif Arous, 2350 m., A2.

ANTHEMIS PEDUNCULATA Desf. ssp. GRANULATA (Pomel) Maire No. 29. Irhil Igoudamen, 2200 m., C3—E1.

ORMENIS SCARIOSA (Ball) Lit. et Maire No. 155. Taourirt, 2000 m., B4–C.

LEUCANTHEMUM ARUNDANUM (Boiss.) Cuatr. var. MAIREI (Humbert) Maire No. 138. Valley of Asif Arous, 2300 m., and Tizi n'Ait Imi, 2900 m., C3–D2.

ARTEMISIA ATLANTICA Coss. et Dur. var. MAROCCANA (Cosson) Maire No. 15. Irhil Igoudamen, 2100 m., B4–D2 ; parasitised by *Cuscuta triumvirati* Lange.

SENECIO DORIA L. var. CANESCENS Porta No. 120. Asif Arous, 2350 m., and Bou Guemmez, 2000 m., A3.

ECHINOPS STRIGOSUS L. No. 283. Taourirt, 2000 m., B4.

CARLINA INVOLUCRATA Poir. Nos. 54, 259. Azilal, 1400 m., and Taourirt, 2000 m., B4.

CARLINA LANATA L. No. 59. Taourirt, 2000 m., B4.

ARCTIUM MINUS (Hill) Bernh. ssp. ATLANTICUM (Pomel) Maire No. 192. Taourirt n'Ait Milch, 2000 m., 8/8/51, A1.

In *Populus nigra* wood, with *Euphorbia pubescens*, *Cerinthe major*, *Lotus corniculatus*, etc.

Distribution. Species recorded in Morocco from "R.; MA.; GA: Ayachi" (Emberger & Maire, 1941, p. 1153). Ayachi is now abstracted from the Grand Atlas (Sauvage & Vindt, 1952, Intro., p. XI *et seq.*). Species new to Grand Atlas.

CARDUUS MACROCEPHALUS Desf. No. 82. Taourirt, 2000 m., B4.

CIRSIUM FLAVISPINUM Boiss. (s.s.). No. 190. Near Agouti, 1950 m., A3.

CIRSIUM ACARNA (L.) Moench No. 262. Taourirt, 2000 m., A2.

CYNARA HYSTRIX Ball No. 37. Azilal, 1400 m., B1.

CENTAUREA PULLATA L. var. TYPICA Maire No. 125. Near Agouti, 1950 m., A2–B1.

CENTAUREA INCANA Desf. (s.l.). No. 132. Asif Arous, 2350 m., A2.

CENTAUREA CALCITRAPA L. No. 196. Taourirt, 2000 m., B4.

MANTISALCA SALMANTICA (L.) Briq. et Cavill. var. TYPICA Maire No. 141. Valley of Asif Arous, 2350 m., A1—A2.

CARDUNCELLUS POMELIANUS Batt. No. 251. Near Agouti, 1950 m., B4.

SCOLYMUS HISPANICUS L. var. TYPICUS Maire No. 263. Taourirt, 2000 m., B4.

CATANANCHE CAERULEA L. Nos. 33, 60. Irhil Igoudamen, 2200 m., and Asif Arous, 2350 m., A2/B4–C3.

HIERACIUM AMPLEXICAULE L. (s.l.). No. 104. Irhil Aori, 3000 m., E2.

HYPOCHAERIS LEONTODONTOIDES Ball var. EU-LEONTODONTOIDES Maire No. 41. Tizi n'Ait Imi, 3100 m., E2; on calcareous rock.

LEONTODON HISPANICUS Poir. ssp. HELMINTHOIDES (Coss. et Dur.) Maire var. MAROCCANUS Batt. No. 121. Asif Arous, 2350 m., A3.

LACTUCA VIMINEA (L.) Presl var. CHONDRILLIFOLIA (Bor.) Car. et St. Lager No. 1. Taourirt, 2100 m., B4—C3.

LACTUCA VIROSA L. ssp. EU-VIROSA Maire No. 152. Taourirt, 2000 m., B4—C3.

CICERBITA TENERRIMA (Pourr.) Beauverd No. 3. Taourirt, 2000 m., B4–C3.

SONCHUS MARITIMUS L. var. AQUATICUS (Pourr.) Boiss. No. 117. Asif Arous, 2350 m., A2.

CAMPANULACEAE

JASIONE HUMILIS Lois. var. LANUGINELLA (Lit. et Maire) Maire No. 90. Irhil Aori, 3000 m., C3–E1. Variety previously only known from Anremer.

CAMPANULA MAIREI Pau No. 22. Irhil Igoudamen, 2300 m., A1/B4—C3.
var. ANREMERICA Lit. et Maire No. 109. Taourirt, 2000 m., A1.

CAMPANULA FILICAULIS DC. No. 160. Taourirt, 2000 m., A2/B4.
var. PSEUDO-RADICOSA Lit. et Maire No. 52. Tizi n'Ait Imi, 3100 m., E2.

PRIMULACEAE

ANAGALLIS MONELLI L. ssp. COLLINA (Schousb.) Maire var. HISPANICA (Willk.) Jah. et Maire No. 63. Tizi n'Ait Imi, 3100 m., B4—E1.

OLEACEAE

JASMINUM FRUTICANS L. No. 165. Irhil Igoudamen, 2200 m., B2.

FRAXINUS XANTHOXYLOIDES Wall. No. 229. Bou Guemmez, 2000 m., B, C.

GENTIANACEAE

BLACKSTONIA PERFOLIATA (L.) Huds. ssp. GRANDIFLORA (Viv.) Maire Nos. 143, 212. Valley of Asif Arous, 2150 m., 2/8/51 and Taourirt, 2000 m., 8/8/51; A3.

One specimen by damp stream-bank, the other in damp-flush limestone pasture dominated by *Brachypodium phoenicoides* and *Agrostis Reuteri*, with *Sanguisorba minor*, *Eryngium tricuspidatum* etc.

Distribution in Morocco (see Sauvage & Vindt, 1952, p. 113); subspecies new to Div. XV.

CENTAURIUM PULCHELLUM (Swartz) Hayek ssp. LAXIFLORUM (Lindb.) Jah. et Maire No. 235. Taourirt n'Ait Milch, 2000 m., 10/8/51, A3.

Distribution in Morocco (see Sauvage & Vindt, 1952, p. 106); subspecies new to Div. XV.

GENTIANA CILIATA Linn. No. 268. Confluence of Asif Arous with Asif Bou Guemmez, Grand Atlas (Div. XV), 1950 m., 13/8/51, A3.

Habitat and Community. Damp lime-flushed meadow or pozzine (see below); damp in mid-August, the habitat may be presumed to be so permanently, not seasonally. A tall grass and herb community, the dominant grasses were *Brachypodium phoenicoides* and *Agrostis Reuteri*, the principal herb being *Cirsium flavispinum* with *Orchis latifolia*, *Leontodon hispanicum*, *Eryngium tricuspidatum*, *Lotus corniculatus*, etc.

This lime-flushed habitat accords with the calcicole nature of the species as reported by De Candolle (1845, p. 101), Wilkomm and Lange (1870, p. 654) and Hegi (1927, p. 2028) who, however, regard dry limestone pasture as its most typical habitat, Hegi adding that the species is rarely found on organic or peaty soil (Moorboden). Perhaps *G. ciliata* occurs in damp pasture in its Moroccan station because limestone's natural aridity is here augmented by climate. In growing in a damp closed community, this species agrees with the four other Gentians found in Morocco, all of which are confined (Sauvage & Vindt, 1952, p. 116) to what must be the same habitat, " pozzines "; that is to say, alpine meadows or greensward kept damp by a perennial spring or stream; the term was originally applied by Briquet to analogous Corsican communities (Maire, 1924, p. 58).

Recorded hitherto from Central and Southern Europe and the Caucasus, *Gentiana ciliata* L. is a new species for North Africa (Morocco). It brings to five the total number of *Gentiana* species (including two endemics) found in Morocco and, there, only in the Grand Atlas.

This Grand Atlas station is over 800 miles from the nearest previously-known localities, in the Spanish Pyrenees, and is isolated in the south rather like the Caucasus station(s) in the east.

Recorded distribution; the Alps of Germany, Austria, Switzerland, France and Italy may be regarded as the centre of distribution of *G. ciliata*, the species extending northwards to Belgium, Central Germany and South Poland; southwest across France to the Spanish Pyrenees of Catalonia and Aragon (absent from Portugal); southwards through Italy to Naples; southeast to Dalmatia and east, via (pre-1914) Hungary, to the east Caucasus.

G. ciliata belongs to section XIX, *Crossopetalum* Fröl. (see Engl. & Prantl, Natürl. Pflanzenfam., iv, 86 : 1891).

BORAGINACEAE

ANCHUSA AZUREA Mill. No. 250. Near Agouti, 1950 m., B4.

HELIOTROPIUM EUROPAEUM L. var. HEBECARPUM Lindb. No. 11. Taourirt, 2000 m., A2/B4.

MYOSOTIS ALPESTRIS Schm. emend. Fiori ssp. ALBOMARGINATA (Lindb.) Maire No. 103. Irhil Aori, 3100 m., E2.

ECHIUM PYCNANTHUM Pomel ssp. NANUM (Coss.) Jah. et Maire No. 34. Tizi n'Ait Imi (Irhil Igoudamen), 3100 m., 27/7/51, E2.

Limestone chasmophyte with *Bellis caerulescens*, *Erigeron Mairei*, *Anthyllis Warnieri*, *Sarcocapnos baetica*, etc.

Distribution. This endemic subspecies is recorded from three other Grand Atlas stations (Entifa, Dj. Takreda, Imi-n-Onaka).

ECHIUM FLAVUM Desf. No. 126. Taourirt, 2000 m., A2—B4.

CERINTHE MAJOR L. ssp. GYMNANDRA (Gasparr.) Rouy var. MACROSIPHONIA Murb. No. 71. Taourirt, 2000 m., A1.

CONVOLVULACEAE

CONVOLVULUS SABATIUS Viv. ssp. MAURITANICUS (Boiss.) Murb. f. ATLANTICUS (Ball) Pau et Font-Quer No. 84. Asif Arous, 1950 m., B4.

CONVOLVULUS ARVENSIS L. var. TYPICUS Fiori (s.l.). No. 74. Taourirt, 2000 m., A1.

CUSCUTA MONOGYNA Vahl Nos. 266, 17. Tirsal, 2000 m., on *Satureja Calamintha* and *Cistus salviifolius*.

CUSCUTA TRIUMVIRATI Lange var. JAHANDIEZII (Trabut) Maire No. 267. Irhil Aori, 3000 m., on *Dracocephalum Renati* and *Artemisia atlantica*.

SOLANACEAE

SOLANUM NIGRUM L. (s.l.). No. 233. Bou Guemmez, 1950 m., B4.

SCROPHULARIACEAE

LINARIA TRISTIS (L.) Mill. (s.l.). Nos. 56, 108. Tizi n'Ait Imi, 3100 m., and Irhil Aori, 3100 m., E3.

LINARIA ORIGANIFOLIA (L.) DC. ssp. FLEXUOSA Desf. No. 61. Tizi n'Ait Imi, 3000 m., E2.

ANARRHINUM FRUTICOSUM Desf. ssp. EU-FRUTICOSUM Maire var. TYPICUM Maire No. 19. Irhil Igoudamen, 2300 m., B4—C1.

ANTIRRHINUM MAJUS L. ssp. HISPANICUM (Chav.) Maire var. OCHROLEUCUM Coss. subvar. GLABRESCENS Maire No. 237. Bou Guemmez, near Taourirt, 2100 m., 12/8/51, B3.

Limestone chasmophyte, in full flower.

Distribution. Subspecies recorded in GA for Ouzoud and Plateau des lacs (Emberger & Maire, 1941).

DIGITALIS LUTEA L. ssp. TRANSIENS (Maire) Emb. et Maire var. MESATLANTICA Emb. No. 12. Irhil Igoudamen, 2400 m., to 3100 m., C3—E1.

VERONICA ANAGALLIS-AQUATICA L. ssp. AQUATICA (Bernh.) Maire var. ELATA Hoffmansegg et Link No. 195. Taourirt, 2000 m. (to 2350 m.), A4.

ODONTITES RAMEAUANA Emberger No. 58. Tizi n'Ait Imi (Irhil Igoudamen), 3000 m., E1.

Rocky limestone open pasture dominated by *Astragalus Ibrahimianus*, *Arenaria pungens*, *Alyssum spinosum* with *Arenaria armerina*, *Anagallis Monelli*, etc., growing, like the last species, in xerophytes.

Distribution. Species, endemic to the Grand Atlas, recorded from Ghat and Mont Maaghal (Irhil Aori: see my Notes p. 246), the type locality, which lies 16 kms. west of the new station. All three stations are in Div. XV.

GLOBULARIACEAE

GLOBULARIA NAINII Batt. No. 146. Valley of Asif Arous, south of Bou Guemmez, 2150 m., B3.

VERBENACEAE

VERBENA OFFICINALIS L. No. 76. Bou Guemmez, 2000 m., B4.

LABIATAE

MENTHA LONGIFOLIA (L.) Huds. No. 197. Taourirt, 2000 m., A3.

MENTHA LONGIFOLIA (L.) Huds. × ROTUNDIFOLIA L. No. 265. Taourirt, 2000 m., A3.

THYMUS SERPYLLUM L. (s.l.). No. 55. Tizi n'Ait Imi, 3100 m., E2.

SATUREJA ALPINA (L.) Scheele ssp. GRANATENSIS (Boiss. et Reut.) Maire
var. MACRANTHA Lindb. Nos. 25, 178. Irhil Igoudamen, 2200 m., C3.
var. PARVIFLORA (Ball) Maire No. 30. Irhil Igoudamen, 2200 m., C3.

SATUREJA CALAMINTHA (L.) Scheele No. 159. Tirsal, 2000 m., B1, parasitised by *Cuscuta monogyna* Vahl.

DRACOCEPHALUM RENATI Emberger No. 119. Irhil Aori, 3000 m., E3, parasitised by *Cuscuta triumvirati* Lange.

SCUTELLARIA ORIENTALIS L.
var. PORPHYRANTHA Lit. et Maire No. 91. Irhil Aori, 3000 m., D2.
var. DEMNATENSIS Lit. et Maire No. 8. Irhil Igoudamen, 2100 m., C3.

PRUNELLA VULGARIS L. var VULGARIS Benth. No. 220. Taourirt, 2000 m., A3.

STACHYS ARVENSIS L. No. 40. Tizi n'Ait Imi, 3100 m., E1.

MARRUBIUM MULTIBRACTEUM Humb. et Maire var. TYPICUM Humb. et Maire No. 4. Taourirt, 2000 m., B4.

MARRUBIUM VULGARE L. No. 154. Taourirt, 2000 m., B4.
var. LANATUM Benth. No. 6. Irhil Igoudamen, 2200 m., C3.

TEUCRIUM POLIUM L. (s.l.). No. 2. Taourirt, 2100 m., B4.

TEUCRIUM CHAMAEDRYS L. var. GRACILE Batt. No. 7. Irhil Igoudamen, 2100 m., B4.

TEUCRIUM MUSIMONUM Humbert No. 42. Tizi n'Ait Imi, 3100 m., E1.
var. VIRESCENS Maire No. 253. Taourirt, 2000 m., B4.

PLANTAGINACEAE

PLANTAGO MAJOR L. No. 83. Taourirt, 2000 m., A1—A2.

PLANTAGO CORONOPUS L. (s.l.). No. 137. Asif Arous, 2350 m., A2.

PLANTAGO MAURITANICA Boiss. et Reut. No. 256. Bou Guemmez, 2100 m., B4.

ILLECEBRACEAE

PARONYCHIA CAPITATA (L.) Lamk. non DC. No. 21. Irhil Igoudamen, 2400 m., C2.

CHENOPODIACEAE

CHENOPODIUM MURALE L. No. 200. Taourirt, 2000 m., A1.

CHENOPODIUM OPULIFOLIUM Schrader No. 191. Taourirt, 2000 m., A1.

POLYGONACEAE

RUMEX CRISPUS L. No. 194. Taourirt, 2000 m., A3.

THYMELAEACEAE

THYMELAEA VIRGATA (Desf.) Endl. var. BROUSSONETII (Ball) Maire No. 210. Taourirt, 2000 m., A2.

EUPHORBIACEAE

EUPHORBIA MEGALATLANTICA Ball No. 5. Taourirt, 2050 m., B4.

EUPHORBIA PUBESCENS Vahl
f. GENUINA Godron (pro var.) No. 69. Taourirt, 2000 m., B4.
f. INTERMEDIA J. Vindt No. 70. Taourirt, 2000 m., A1.

EUPHORBIA NICAEENSIS All. No. 153. Taourirt, 2000 m., B4—E1.

EUPHORBIA CHAMAESYCE L. var. EU-CHAMAESYCE Thell. f. PILOSA (Guss.) Thell. No. 240. East valley of Bou Guemmez, 2100 m., B4.

BUXUS SEMPERVIRENS L. var. ANGUSTIFOLIA Loud. No. 164. Valley of Asif Arous south of Bou Guemmez, 2100 m., B2, C1, D1.

This species forms patches of scrub from 2000 m. on the lower north-facing slopes of Irhil Igoudamen (Juniperetum phoeniceae), more extensively

up the valley of Asif Arous (Quercetum Ilicis), to 2700 m., on Irhil Aori. Mainly on limestone in the first two areas, on shale only at 2700 m., *Buxus* is indifferent to aspect, at its middle altitudes at least, occurring on all slopes of the N–S valley of Asif Arous.

These observations seem to alter the conclusions of Emberger (1932, pp. 21 and 36) who found *Buxus* characteristic of the zone of *Juniperus thurifera*, localised on north-facing non-calcareous slopes (see my notes p. 251).

Distribution. Recorded in Morocco from the Grand Atlas (Zaouia Ahansal and S.E. of Demnate), its maximum altitude is given as 2400 m. (Emberger, 1932, p. 36). These new localities extend its range altitudinally and eastward and, like the previous stations, are in Div. XV.

CUPULIFERAE

QUERCUS ILEX L. No. 163. Irhil Igoudamen, 2200 m., B–C.

SALICACEAE

SALIX PURPUREA L. No. 244. Near Agouti, 1950 m., A1.

SALIX PEDICELLATA Desf. No. 244. Near Agouti, 1950 m., A1.

POPULUS NIGRA L. No. 228. Bou Guemmez, 2000 m., A1.

POPULUS ALBA L. No. 255. Bou Guemmez, 2000 m., A1.

ORCHIDACEAE

ORCHIS LATIFOLIA L. (s.l.). No. 131. Valley of Asif Arous, 2350 m., A3.

LILIACEAE

URGINEA MARITIMA L. ssp. MAURA Maire No. 232. Ait Boulli, 2000 m., B4–C3.

JUNCACEAE

JUNCUS INFLEXUS L. Nos. 79, 80, 21. Taourirt, 2000 m., A4.

NAIADACEAE

POTAMOGETON DENSUS L.
var. LANCIFOLIUS Mert. et Koch No. 205. Taourirt, 2000 m., A4.
var. RIGIDUS Opiz No. 206. Taourirt, 2000 m., A4.

CYPERACEAE

SCIRPUS PALUSTRIS L. No. 213. Taourirt, 2000 m., A4.

SCIRPUS PAUCIFLORUS L. No. 144. Valley of Asif Arous, 2150 m., A4.

CAREX FLACCA Schreb. (s.l.). No. 130. Valley of Asif Arous, 2150 m., A4.

CAREX DIVISA Huds. No. 222. Taourirt, 2000 m., A4.

CAREX PANICEA L. No. 183. Valley of Asif Arous, 2150 m., A4.

CAREX FLAVA L. ssp. EU-FLAVA Asch. et Gr. No. 202. Taourirt n'Ait Milch, 2000 m., A4.

In damp ground bordering irrigation-canal, with *Carex divisa*, *Juncus inflexus*, *Scirpus palustris*, etc.

Distribution. Species recorded in Morocco from "R.; MA; GA: Toubkhal: Gourza" (Jahandiez & Maire). Subspecies new to the Grand Atlas, species to Div. XV.

GRAMINEAE

SETARIA VIRIDIS (L.) P. Beauv. No. 203. Taourirt, 2000 m., A2/B4.

AGROSTIS STOLONIFERA L. ssp. EU-ALBA (Lit.) Emb. et Maire Nos. 78, 147. Taourirt, 2000 m., A1–A2.

AGROSTIS REUTERI Boiss. No. 124. Valley of Asif Arous, 2150 m., A3.

HOLCUS LANATUS L. var. TYPICUS Fiori Nos. 73, 193. Taourirt, 2000 m., A1–A2.

TRISETUM FLAVESCENS (L.) P. Beauv. No. 97. Irhil Aori, 3150 m., C3–E1.

MELICA CILIATA L. ssp. LINNAEI Hack. No. 113. Irhil Aori, 3100 m., E2.

DACTYLIS GLOMERATA L.
var. TYPICA Posp. No. 217. Taourirt, 2000 m., A2/B4.
var. HISPANICA (Roth) Koch No. 111. Irhil Aori, 3100 m., C3–E1.

POA ALPINA L. (s.l.). No. 96. Irhil Aori, 3150 m., E1.

FESTUCA ELATIOR L. ssp. ARUNDINACEA (Schreb.) Hack. var. ATLANTIGENA St. Yves (R. de Litardière det.). No. 112. Irhil Aori, 3100 m., E2.

FESTUCA HYSTRIX Boiss. No. 48. Tizi n'Ait Imi, 3100 m., E1.

BRACHYPODIUM PHOENICOIDES (L.) Roem. et Schult. var. GENUINUM St. Yves
subvar. EU-PHOENICOIDES St. Yves No. 214. Taourirt, 2000 m., A2.
subvar. MUCRONATUM St. Yves No. 127. Asif Arous, 2150 m., A3.

LOLIUM RIGIDUM Gaud. No. 215. Taourirt, 2000 m., A2/B4.

REFERENCES

ARCANGELI, G., 1894. Flora Italiana, ed. 2, p. 368.

COUTINHO. A. X. P., 1939, Flora de Portugal, ed. 2, p. 448.

DE CANDOLLE, A. P., 1845. Prodromus Systematis Naturalis Regni Vegetabilis, ix.

EMBERGER, L., 1932. Recherches botaniques et phytogéographiques dans le Grand-Atlas oriental (Massifs du Ghat et du M'Goum). *Mem. Soc. Sc. Nat. Maroc*, xxxiii.

EMBERGER, L., & MAIRE, R., 1941. Catalogue des Plantes du Maroc (Spermatophytes et Ptéridophytes), iv.

HEGI, GUSTAV, (1908–)1927. Illustrierte Flora von Mittel-Europa, V, 1, p. 6, V, 3, p. 2028.

HUMBERT, H., 1928. Végétation de l'Atlas saharien occidental et addition à l'étude botanique de l'Ari Ayachi. *Bull. Soc. Hist. Nat. Afr. N.*, xix, p. 219.

JAHANDIEZ, E., & MAIRE, R., 1931–1934. Catalogue des Plantes du Maroc (Spermatophytes et Ptéridophytes), i-iii.

MAIRE, R., 1924. Etudes sur la végétation et la flore du Grand Atlas et du Moyen Atlas marocains. *Mem. Soc. Sc. Nat. Maroc*, vii.

SAUVAGE, CH., & VINDT, J., 1952. Flore du Maroc (Spermatophytes), i.

WILKOMM, M., & LANGE, J., 1870. Prodromus Florae Hispanicae, ii, p. 654 ; iii, p. 544.