The Southern Element in the British Flora.

By

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At the meeting of the British Association for the Advancement of Science at Portsmouth in 1911 a discussion took place on the relation of the present plant population of the British Isles to the Glacial period. It was opened by Mr. Clement Reid in an address in which he advocated the theory that no temperate flora could have survived the conditions prevailing in the islands during the Glacial period, that the existing flora apart from a few arctic and alpine species, came in towards the end of, and after, that period, and that especially the »Atlantic or Lusitanian« plants (also referred to as »Pyrenean«) and the »American« and »limestone« elements arrived and, may be, still arrive by chance introductions of seeds, now mainly due to birds driven by exceptional gales. I then expressed my agreement with the speaker's view as to the effect of the glaciation of the British Isles on the flora, and the reimmigration of the bulk of the latter in post-glacial times, but combated the supposition of the presence of the peculiar American, Atlantic and limestone elements being due to chance introduction over great distances. Since then Dr. Scharff (3) has thrown doubt on the theory of a wholesale destruction of the preglacial flora of Great Britain and Ireland and refuted the idea of the introduction of the »Pyrenean« element by migrating or gale-driven birds. In my opinion the question of the presence of those peculiar elements and especially of the so called »Atlantic«, »Pyrenean« or »Lusitanian« plants has in a general way already been solved by Engler (4) in his »Versuch einer Entwicklungsgeschichte der Pflanzenwelt« more than thirty years ago. To him their immigration or rather reimmigration took place in post glacial times — for he too assumes the wiping out of the greater part of the preglacial flora during the Glacial period — and it happened along with the repopulation of the eglaciated land by a flora advancing mainly from south-western Europe through western France where the improvement of the climatic conditions following on the retreat of the ice in the north set in first. It might be sufficient to refer to the pages quoted from his book, if it were not for the brevity with which he was obliged to deal with the matter and for the fact that great confusion exists as regards the

meaning of the terms »Atlantic«, »Pyrenean«, or »Lusitanian« plants and the place which these elements hold in the British flora and its history. I have therefore thought it useful to sort out from the British flora that constituent portion which from its distribution in Europe might justly be called »Atlantic« and to analyse it with regard to the relative continuity or discontinuity of the British and Continental areas of its members. In doing so it became evident, as was to be expected, that the »Atlantic« fraction of the flora could not be separated from another portion which whilst covering the Atlantic region extended beyond it into the Mediterranean region of which it is a characteristic part. In fact they belong to the same Southern stock, but with this difference that one is more specialised with respect to the conditions which determine the distribution of its members than the other. The scope of my analysis had therefore to be extended, so as to include both. The former are the »Atlantic« and the latter the »Mediterranean« types as understood in this essay.

I have not considered it necessary to enter into the question whether these Atlantic and Mediterranean types have survived the Glacial period in Great Britain and Ireland or whether their present habitats in those islands are postglacial. Whether one accepts the »land-ice« or the »submergence« theory both of which have been dealt with so admirably by Professor Bonney (5) the botanist cannot but assume that survival under the rigorous conditions postulated by both theories was impossible for most or probably all the plants under consideration. If in the future new facts should come to light which make the climatic conditions during the Glacial period appear more favourable for plant life, the question of survival will have to be reconsidered; but at present I see no way out of the conclusions at which Mr. Reid, and many years before him, Professor Engler have arrived.

The term »Atlantic type« was formulated by H. C. Watson in his »Remarks on the Geographical Distribution of British Plants« in 1835. There on p. 86 he says: »The Atlantic type embraces species found in the southwest of England or Wales, sometimes very locally, sometimes extending far along the southern or western counties, but rare or wanting on the east coast. Some plants of very limited geographical extension are common to this part of Britain, the west of France and Portugal. *Erica ciliaris*, *Sibthorpia europaea*, *Euphorbia Peplis*, *Bartsia viscosa* and *Pinguicula lusitanica* may be given as examples of the type.» From the reference to France and Portugal it might be inferred that he had in view the general extension of the areas of his Atlantic types over western Europe when introducing the term. But if he had it in view originally, he made it abundantly clear in »Cybele Britannica« in 1847, that this did not hold good any longer. For he remarks here on p. 51 of the first volume: »These species (i. e. of the Atlantic type) correspond in the one circumstance of having some decided tendency to the western or Atlantic side

of the island, in contradistinction to the eastern or Germanic side. Although there may exist other reasons for especially denominating some of these the »Atlantic species«, the name of the type will be here understood as having reference only to their distribution within Britain itself, and by itself«. (The spacing is mine). This limitation of the term »Atlantic« to the circumstance of a western distribution within Britain — and the same applies more or less to the definitions of Watson's other types of distribution — was unfortunate in so far as it tended towards a onesided conception of the British flora as a detached unit. His »types of distribution« may be in order in his scheme of topographical statistics; to some extent they are also expressive of certain ecological conditions that determine their limits. But if we try to make them the basis for working out the relation of the British flora to the floras of the European Continent, or for tracing its history they break down. It is evident that for that purpose we have to treat it as a section of the flora of Western Europe whose history it has shared and out of which it has recruited itself. This was the standpoint of Edward Forbes (6) in his brilliant memoir »On the Connexion between the Distribution of the existing Fauna and Flora of the British Isles, and the Geological changes which have affected their area, especially during the epoch of the Northern Drift«, published as long ago as 1846. To him the British flora was made up of 5 subfloras, all derived from different quarters of the European mainland. Two of them, the Asturian and the Gallican or Norman floras correspond to Watson's »Atlantic type«. Forbes enumerates the species which in his opinion belong to the Asturian flora. Reduced to the modern conception of those species they are nine in number. Of the »Norman« type he quotes merely examples, and so he also does for the »Kentish« or »North French« flora which forms part of Watson's Germanic and English types, but is treated as a Southern type. These lists were drawn up rather loosely and being moreover incomplete they found practically no consideration in the numerous British local floras. They rather based their classifications into types of distribution on Watson's work which had at least the advantage of definiteness and completeness.

More recently, in 1899, Mr. Cl. Reid, in his »Origin of the British Flora« spoke of certain British plants as Iberian, Lusitanian and Pyrenean, whilst in his Portsmouth address he uses such terms as »Atlantic or Lusitanian plants«, »Atlantic element«, »Pyrenean element« and »Lusitanian flora« as if they were synonymous. No definition of the terms is given, but from the half dozen names he quotes it appears that he meant species which outside the British Isles were, as he thought, confined to the Pyrenees or the North of Spain or the Iberian or Pyrenean peninsula generally.

So much as to Watson's term »Atlantic type« and the more loosely used descriptions Norman, Asturian, Iberian, Lusitanian and Pyrenean. But

what then is that southern element which undoubtly is present in the British flora and has so early attracted the attention of British botanists by its peculiar distribution, mostly westward, frequently much interrupted and in many cases extremely limited? If we take a British flora, for instance, the last edition (1904) of Babington's »Manual« and a flora of Germany, like Koch's »Flora Germanica«, ed. III, whose area after the deduction of the Mediterranean districts in Switzerland and Austria and the extreme West is practically that of Central Europe, and if we mark off in the British flora those species which are not recorded from Central Europe as defined, we obtain a rough list of the plants which do not partake in the composition of the flora of Central Europe. Of these a small number is peculiar to Northern Europe, or, outside Great Britain and Ireland, only known from North America; these may be struck off. If we further revise with the help of the latest floras the distribution of the species remaining on the list partly to exclude errors, and partly to add such British species as in isolated cases enter the Central European region either from their headquarters in the west or south, we shall have left an assemblage of about 150—160 species, (9 % of the British flora) the European continental areas of which lie mainly along the west coast of Europe from Holland and Belgium or from Normandy to Spain and Portugal, or beyond those countries to Italy and even the Orient. They fall into two fairly distinct classes. That set which does not extend into the eastern Mediterranean region may be called for the purposes of the paper the Atlantic element, the other the Mediterranean. The Atlantic element extends in Belgium and France more or less eastward, but crosses the Rhine or the Rhone only in exceptional cases. A few species referred to it reach North Italy, but outside the typically Mediterranean region. A few also extend along the west coast to Denmark or Norway, but they have in each case their main area farther south. I have grouped those species in 3 classes:

1. Species generally found in and near cultivated land.
2. Species confined to the coasts (littoral species).
3. Species other than those referred to classes 1 and 2.

All the species[1]) enumerated are considered as native in Great Britain and Ireland with the exception of some of class 1 and one or two of classes 2 and 3 which may be denizens rather than natives. Exception may be taken to the inclusion or exclusion of certain species; but I think their number is so small that the broad conclusions for which the lists may serve as a basis, will not be affected thereby. Moreover, no classification of this kind can be absolute, unless it is made artificial or arbitrary.

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1) The species of *Rosa*, *Rubus* and *Hieracium* have not been taken into consideration owing to the difficulty of a satisfactory collation of the species recognised by British and continental authors.

The species of class 1 are so few and for my purpose relatively so unimportant, that I have not set them out in tabular form as I have done with the rest. The tables for the species composing the classes 2 and 3 require some explanation. They consist of 10 columns apart from the lists of names. Column 1 gives the northern limit which the species reach in continental Western Europe. As far as France is concerned, I have generally quoted departments. Where Calvados is mentioned it may as a rule be assumed that the plant also occurs in the Département Manche which extends a little farther north than Calvados. Columns 2—4 indicate the distribution in Great Britain. The names are usually the names of the counties. They had to be abbreviated in some cases, but these abbreviations will easily be understood.

In column 2 the distribution is from Cornwall north through western England and Scotland, in column 3 from Cornwall east to Kent, in column 4 from Kent north through eastern England and Scotland. Where the species is only known from one county, the name of the county is given between inverted comas. In some cases a species is known from only two or three counties coming under one of the three columns, in which case the counties are indicated.

Columns 5 and 6 refer to the distribution in western and eastern Ireland, the mode of marking the extension being the same as in columns 2—4.

Column 7 is an attempt to characterise very approximately the ecological character of the conditions under which the plants are found, not so much within the British Isles, as in the more southern portions of their areas.

Column 8 contains the number of »vice-counties« given in the last edition (1908) of the London Catalogue of British Plants; Column 9 those of the divisions of Praeger's »Irish Topographical Botany« (1901). In Column 10 I have added the type of »distribution« as stated in Watson's Compendium of the Cybele Britannica« (1870). Throughout the lists and in the following text the names of the species referred by me to the Atlantic element are printed in »spaced out« type.

1. Species generally found on and near cultivated land.

Fumaria capreolata, *F. purpurea*, *F. occidentalis*, *F. muralis*, *F. paradoxa*, *F. Bastardii*, *F. micrantha*, *F. parviflora*, *Coronopus didymus*, *Silene gallica*, *Oxalis corniculata*, *Linaria supina*, *Antirrhinum majus*.

Some of the Fumarias and probably *Linaria supina* are possibly true natives in at least a part of the British Isles and might, with equal right, be transferred to class 3, where they would add to the Atlantic element. Apart from them the whole of the species of this class extends far into the Mediterranean region.

	Northern limit on the Continent	Great Britain		
		West	South	East
Mathiola sinuata	Manche	Anglesey	—	—
M. incana	Charente inférieure	—	Wight and Sussex	—
Brassica oleracea . .	Denmark	Carnarvon	Kent	—
B. monensis	Belgium	Glamorgan to Cantire	—	—
Raphanus maritimus	Holland	Hebrides	throughout	S. E. York
Viola Curtisii	Holland	throughout	Devon	Northumb. t
Frankenia laevis	Eure	—	Wight to Kent	Norfolk
Spergularia rupestris	Calvados	throughout	throughout	—
Polycarpum tetraphyllum.	Seine inférieure	—	Dorset	—
Tamarix anglica . .	Manche	—	Cornw.(to Hants?)	—
Lavatera arborea	Calvados?	Ayr	Dorset	—
Erodium maritimum.	Somme	Wigtown	throughout	Norfolk
Trifolium maritimum . .	Holland	Glamorgan	throughout	Lincoln
T. Bocconii	Manche	Cornwall	—	—
Lotus angustissimus . . .	Manche	—	Kent	—
Eryngium maritimum . .	Norway	throughout	throughout	Aberdeen
Crithmum maritimum . .	Calais	Ayr	throughout	Suffolk
Daucus gummifer	Manche	Wigtown	Kent	S. E. York
Inula crithmoides	Calvados	Wigtown	Kent	Essex
Diotis maritima.	Manche	Anglesey	Kent	Suffolk
Limonium vulgare. . . .	Norway	Wigtown	Kent	Fife
L. humile	Norway	Pembroke to Wigtown	Hants to Kent	Northumb.
L. binervosum	Pas de Calais	Wigtown	throughout	Norfolk
L. recurvum.	—	»Anglesey«	Dorset	—
L. bellidifolium . . .	Medit. France	—	—	Lincoln
Corrigiola littoralis . . .	Holland; Denmark	—	Devon	—
Salicornia radicans .	Pas de Calais	—	Kent	N. E. York
Suaeda fruticosa	Holland	—	Hants	Norfolk
Euphorbia Peplis	Manche	Cardigan	Wight	—
E. Paralias	Holland	Wigtown	Kent	Suffolk
E. portlandica	Manche	Wigtown	Wight	—
Juncus maritimus	Denmark	W. Inverness	throughout	E. Inverne
J. acutus	Manche	Carnarvon	throughout	Norfolk
J. pygmaeus.	Denmark	Cornwall	—	—
J. capitatus	S. Sweden	Cornwall	—	—
Carex punctata	Manche	Wigtown	Hants	Suffolk
Scirpus filiformis	Calvados	Hebrides	Hants	Norfolk
Spartina stricta . . .	Holland	—	Dorset to Kent	Lincoln
S. Townsendii	Manche (introduced)	—	Dorset to Sussex	—
Phleum arenarium . . .	Norway	Kirkcudbr.	throughout	Aberdeen
Polypogon monspeliensis .	Seine inférieure	»Gloucester«	Dorset to Kent	Norfolk
Gastridium lendigerum .	Seine inférieure	Glamorgan	throughout	Norfolk
Atropis festuciformis. . .	Cantabria	—	—	—
A. Borreri.	Holland	—	Kent	York
A. rupestris.	Norway	Lancashire	throughout	Kincardin
Vulpia membranacea . .	Belgium	Lancashire	throughout	Norfolk
Lepturus filiformis . . .	Holland; Denmark	Mull	throughout	Fife
Asplenium marinum.	Seine inférieure	throughout	Sussex	York to C

1) A few of the species enumerated here extend inland on the continent, inhabiting waste
southern Europe.

Ireland West	Ireland East	Character of habitat	Vice-Counties in Great Britain	Divisions in Ireland	Type according to Watson
are	»Wexford«	Cliffs	7	2	Atl.
—	—	Cliffs	4	—	Engl. loc.
—	—	Cliffs	11	—	Atl.
—	—	Sandy shores	19	—	Atl.
roughout	throughout	Sandy shores	26	14	Atl.
roughout	throughout	Sanddunes	27	20	Atl.
—	—	Salt marshes	12	—	Atl. Germ.
roughout	throughout	Cliffs	21	19	Brit.
—	—	Waste places	4	—	Atl. loc.
—	—	Banks	?	—	—
are	throughout	Cliffs	16	12	Atl.
are	throughout	Sandy shores	33	11	Atl. Engl.
—	—	Maritime pastures	24	—	Engl.
—	—	Pastures	1	—	Atl. loc.
—	—	Pastures	6	—	Atl. engl.
oughout	throughout	Sandy shores	54	18	Engl. brit.
oughout	throughout	Cliffs	27	18	Atl.
—	—	Sandy shores	17	—	—
rry	Dublin	Salt Marshes	19	5	Atl. engl.
—	Wexford	Sandy shores	(9)	2	Engl.?
—	—	Salt Marshes	36	—	Engl.
oughout	throughout	Salt Marshes	22	21	Engl.
negal	Louth	Salt Marshes	23	11	Atl. engl.
—	—	Salt Marshes	1	—	Germ.
—	—	Salt Marshes	6	—	Germ.
—	—	Sandy shores	2	—	Atl. loc.
—	—	Salt Marshes	12	—	Germ.
—	—	Salt Marshes	7	—	Germ. engl.
—	—	Sandy shores	9	—	Atl.
oughout	throughout	Sandy shores	30	15	Atl. engl.
negal	Antrim	Sandy shores	21	17	Atl.
oughout	throughout	Salt Marshes	54	26	Brit. engl.
ry	Wicklow	Salt Marshes	16	4	Engl. atl.
—	—	Salt Marshes	1	—	—
—	—	Salt Marshes	1	—	—
ry & Cork	—	Salt Marshes	10	5	—
oughout	throughout	Salt Marshes	28	26	Atl.
—	—	Salt Marshes	11	—	Germ.
—	—	Mud flats	4	—	—
oughout	throughout	Sandy shores	47	17	Engl. Brit.
—	—	Sandy shores	7	—	Germ. Engl.
—	—	Sandy shores	24	—	Engl.
—	»Down«	Salt Marshes	—	1	—
—	Dublin	Salt Marshes	14	2	Germ.
—	—	Salt Marshes	25	—	Engl. Germ.
—	Louth	Sandy shores	20	5	Engl. atl.
oughout	throughout	Salt Marshes	50	19	Engl.
oughout	throughout	Cliffs	53	20	Brit. atl.

ets favourable to halophytes, but even these affect with preference the littoral region of western and

3. Species neither littoral nor confin

	Northern limit on the Continent	Great Britain		
		West	South	East
Ranunculus tripartitus	Manche	»Pembroke«	Cornwall	—
R. Lenormandii	Manche	S. Hebrides	Co. to Kent	Northum
R. ophioglossifolius	Manche	»Gloucester«	»Hants«	—
Helleborus foetidus	Holland	Hereford	Hants to Kent	Essex
Meconopsis cambrica	Calvados	Carn. and W.York	—	—
Corydalis claviculata	Calvados	throughout	throughout	througho
Arabis stricta	Pyrenees	Som. to Radn.	—	—
Lepidium heterophyllum	Seine inférieure	Mull	throughout	E. Ross
Helianthemum guttatum	Holland	»Anglesey«	—	—
H. polifolium	Belgium	»Somerset«	»Devon«	—
Hypericum Androsaemum	Belgium	throughout	throughout	Durham
H. undulatum	Tarn?	Pembroke	Devon	—
H. linariifolium	Calvados	Cornw. Carnar.	Devon	—
H. elodes	Holland	Mull	throughout	York
Linum angustifolium	Seine inférieure	Man	throughout	Norfolk
Erodium moschatum	Holland	Man	Kent?	S. E. Yo
Ilex Aquifolium	Norway	throughout	throughout	through
Genista anglica	Holland; Denmark	throughout	throughout	through
Ulex europaeus	Holland	throughout	throughout	through
U. Gallii	Manche	Ayr	most parts	Northum
U. nanus	Seine inférieure	Dumfries	most parts	Norfolk
Ononis reclinata	Côtes du Nord	»Wigtown«	Devon	—
Trigonella ornithopodioides	Holland; Denmark	Ayr	throughout	Norf., Ecb Fife
Ornithopus pinnatus	Côtes du Nord	—	»Scilly«	—
Medicago denticulata	Holland	Derby	throughout	York
Trifolium subterraneum	Holland	Chester	throughout	Lincoln
T. Molineri	Côtes du Nord	—	Dorset	—
T. glomeratum	Holland	—	throughout	Norfolk
T. suffocatum	Manche	»Anglesey«	throughout	Norfolk
Lotus hispidus	Manche	—	Hants	—
Vicia Orobus	Norway	throughout	Devon to Hants	Northun. Forfa
V. bithynica	Morbihan	Flint	throughout	York
Saxifraga Geum	Pyrenees	—	—	—
S. umbrosa	Pyrenees	—	—	—
S. hypnoides	Norway	Severn to Orkneys	—	Northun. Caithn
Tillaea muscosa	Holland	—	Devon to Hants	Norfolk
Cotyledon Umbilicus	Seine inférieure	Mull	throughout	—
Sedum anglicum	Norway	Shetland	throughout	Sutherl
Callitriche truncata	Manche	—	Sussex to Kent	—

e neighbourhood of cultivated land.

Ireland West	Ireland East	Character of habitat	Vice-Counties in Great Britain	Divisions in Ireland	Type according to Watson
ork«	—	Aquatic	2	1	Engl. loc.
ry	Dublin	Aquatic	57	12	Engl.
—	—	Marshes	2	—	Germ.
—	—	Woods and Bush	16	—	Engl. Germ.
managh	N. Ulster	Open Woods	16	—	Atl. interm.
negal«	Dublin	Woods	89	5	Brit. Atl.
—	—	Rocks	2	—	Loc. Atl.
ry; Donegal	throughout	Heaths	89	26	Brit. Engl.
k; Mayo	—	Rocks	1	2	Loc. Atl.
—	—	Pastures	2	—	Loc. Atl.
ughout	throughout	Woods	80	40	Atl. Brit.
—	—	Bogs	4	—	Atl.
—	—	Pastures	4	—	Atl.
ughout	throughout	Bogs	62	23	Atl. Engl.
er Shannon	Dublin	Pastures	37	14	Atl. Engl.
egal	Ulster	Pastures	12	20	Atl.
ughout	throughout	Woods	105	40	Brit.
—	—	Heaths	86	—	Brit. Engl.
ughout	throughout	Heaths	112	40	Brit.
ughout	throughout	Heaths	59	29	—
—	—	Heaths	27	—	Engl.
—	—	Pastures	2	—	—
—	Louth	Pastures	29	5	Engl.
—	—	Pastures	1	—	Atl. loc.
—	—	Pastures	22	—	Engl.
—	Wicklow	Pastures	40	1	Engl.
—	—	Pastures	1	—	Atl. loc.
—	Wicklow	Pastures	19	2	Engl.
—	—	Pastures	16	—	Engl.
—	—	Pastures	6	—	Atl. Engl.
Shannon«	»Ulster«	Woods	34	4	Scott. interm.
—	—	Cult. ground	19	—	Engl. Atl.
ey and Cork	—	Damp places	—	3	—
ughout	—	Damp places	—	11	—
ughout	»Ulster«	Damp places	37	8	Scott. highl.
—	—	Pastures	8	—	Engl. Germ.
ughout	throughout	Rocks	54	39	Atl. Engl.
ughout	throughout	Rocks	60	30	Atl. Brit.
—	»Wexford«	Aquatic	4	1	—

	Northern limit on the Continent	Great Britain		
		West	South	East
Physospermum cornubiense	Cantabria	—	Cornw. to Devon	—
Bupleurum opacum . . .	Calvados	—	Devon to Sussex	—
Apium nodiflorum	Belgium	throughout	throughout	throughout
Carum verticillatum .	Holland	W. Inverness	Devon	Stirling to F
Conopodium majus .	Norway	throughout	throughout	throughout
Oenanthe crocata . .	Eure	throughout	throughout	Aberdeen
Rubia peregrina	Seine inférieure	Anglesey	throughout	—
Carduus pycnocephalus . .	Norway	Ayr	throughout	throughout
Cnicus tuberosus . . .	Calvados	»Wilts«	—	—
Lobelia urens	Eure	—	Cornw. to Devon	—
Wahlenbergia hederacea	Belgium	Argyll	throughout	Essex
Arbutus Unedo	Côtes du Nord	—	—	—
Erica ciliaris	Calvados	—	»Dorset«	—
E. Tetralix	Norway	throughout	throughout	throughout
E. Mackaii	Asturias	—	—	—
E. cinerea	Norway	throughout	throughout	throughout
E. vagans	Manche	—	Cornwall	—
E. mediterranea . . .	Gironde	—	—	—
Daboecia polifolia . .	Maine et Loire	—	—	—
Microcala filiformis . . .	Holland	»Pembroke«	Sussex	—
Echium plantagineum . .	Vendée	—	Cornwall	—
Scrophularia Scorodonia	Manche	—	Dorset	—
Sibthorpia europaea . . .	Seine inférieure	Carmarthen	Sussex	—
Eufragia viscosa	Calvados	Cantire	Sussex	—
Pinguicula grandiflora	Pyrenees	—	—	—
P. lusitanica	Eure	Orkneys	Hants	—
Salvia Verbenaca	Normandy	Ayr	throughout	Ross
Scutellaria minor . .	Holland	throughout	throughout	Durham
Orobanche Hederae .	Belgium	Anglesey	throughout	—
Euphorbia hiberna .	Sarthe	Devon to Somerset	—	—
Buxus sempervirens . . .	Belgium	»Gloucester«	Surrey, Kent, Bucks.	—
Neotinea intacta	Pyrenees	—	—	—
Spiranthes aestivalis . . .	Belgium	»Worcester«	»Hants«	—
Aceras anthropophora . .	Belgium	—	Sussex to Kent	York
Iris foetidissima . . .	Holland?	Anglesey	throughout	Durham
Romulea Columnae . . .	Manche	—	»Devon«	—
Gladiolus illyricus	Morbihan	—	»Hants«	—
Tamus communis	Belgium	Cumberland	throughout	Durham
Ruscus aculeatus	Belgium?	Glamorgan	throughout	Norfolk
Simethis planifolia .	Eure	—	»Dorset«	—

Ireland West	Ireland East	Character of habitat	Vice-Counties in Great Britain	Divisions in Ireland	Type according to Watson
—	—	Pastures	4	—	Atl. loc.
—	—	Pastures	2	—	Atl. Engl.
oughout	throughout	Marshes	82	40	Engl.
ɛ, Kerry; Don.	»Antrim«	Heaths	20	6	Atl.
oughout	throughout	Pastures, Woods	109	40	Brit.
oughout	throughout	Marshes	92	33	Brit. Engl.
yo	Dublin	Woods and Bush	23	16	Atl.
ɔughout	throughout	Waste places	70	31	Engl. Brit.
—	—	Meadows	2	—	—
—	—	Heaths	2	—	Loc. Atl.
k and Kerry	Dublin	Bogs	46	7	Atl.
ry	—	Woods and Bush	—	3	—
—	—	Heaths	3	—	Atl.
ɔughout	throughout	Heaths	110	40	Brit.
way	—	Heaths	—	1	—
ɔughout	throughout	Heaths	108	38	Brit.
—	—	Heaths	1	—	Loc. Atl.
yo and Galway	—	Heaths	—	2	—
yo and Galway	—	Heaths	—	2	—
ry	—	Pastures	9	3	Engl. Atl.
—	—	Pastures	1	—	—
—	—	Heaths	4	—	Atl.
ry	—	Rocks	8	2	Atl.
ry; Donegal	—	Pastures	19	7	Atl.
ɛ, Kerry, Clare	—	Bogs	—	5	—
ɔughout	throughout	Bogs	29	31	Atl. Scott.
re	Dublin	Waste places	64	10	Engl.
yo	Dublin	Heaths	72	16	Engl. Atl.
ɔughout	throughout	Woods	20	22	Engl. Atl.
ıegal	—	Woods	2	11	Loc. Atl.
—	—	Woods	3	—	—
re to Mayo	—	Pastures	—	5	—
—	—	Bogs	2	—	Loc. Engl.
—	—	Pastures	20	—	Germ.
ɔughout	throughout	Woods and Bogs	49	22	Engl.
—	—	Pastures	2	—	Loc. Atl.
—	—	Meadows	3	—	Loc. Engl.
—	—	Bush	69	—	Engl.
—	—	Woods	29	—	Germ. Engl.
ry	—	Heaths	1	1	Loc. Atl.

	Northern limit on the Continent	Great Britain		
		West	South	East
? *Allium triquetrum* . . .	Pyrenees; Guernsey?	—	Cornwall	—
Scilla autumnalis	Seine inférieure	Gloucester	W. Kent	—
S. verna	Norway	Shetland	Devon	Northumb. Caithn
S. non-scripta	Holland	throughout	throughout	throughou
Arum italicum	Normandy	—	Kent	—
Damasonium Alisma . .	Belgium	Salop	Hants to Kent	Essex
Luzula Forsteri	Belgium	Cardigan	throughout	W. Suffolk
Cyperus longus	Seine inférieure	»Pembroke«	most parts	—
Briza minor	Belgium	—	Hants	—
Bromus madritensis . . .	Belgium	Pembroke	most parts	—
Hymenophyllum tunbridgense	Belgium	W. Inverness	throughout	Northumb Stirlin
H. peltatum	Norway	Shetlands	Devon	York to Su land
Trichomanes radicans	Pyrenees	Merioneth to Arran	—	—
Adiantum Capillus Veneris	Morbihan	Man	Dorset	—
Asplenium lanceolatum . .	Calvados	Cumberland	throughout	—
Lastraea aemula . . .	Manche	Orkneys	throughout	York and N umb.

Summary.

Want of space forbids me to enter into a detailed consideration of the facts compressed into the columns of the tables; but I may be allowed to summarise them under certain points of view and point to a few of the most general conclusions that suggest themselves to me. As already pointed out (see p. 512) the Atlantic and Mediterranean elements in the British flora amount to about 9 % of the phanerogams and vascular cryptogams. Of these little more than two fifths are referable to the Atlantic, and almost three fifths to the Mediterranean element.

Neglecting class 1, we find among the Littoral species:

	18 Atlantic	30 Mediterranean
(or per hundred	37.5 »	62.5 »)
and among those of class 3 . . .	47 »	48 »
(or per hundred	50 »	50 »)

Littoral species. Of these 48 occur on the coasts of Great Britain and 24 on those of Ireland; but in either case the relative share in Atlantic and Mediterranean elements is the same as in the total, that is 3 Atlantic to 5 Mediterranean species. The only Irish coast plant which (as a

Ireland West	Ireland East	Character of habitat	Vice-Counties in Great Britain	Divisions in Ireland	Type according to Watson
—	—	Woods	1	—	—
—	—	Pastures	9	—	Engl.
—	Wicklow to Antrim	Pastures and Woods	27	6	Atl. Scott.?
hroughout	throughout	Woods	112	40	Brit.
—	—	Woods	6	—	Loc. Engl.
—	—	Aquatic	13	—	Germ.
—	—	Woods	29	—	Engl.
—	—	Aquatic	7	—	Atl. Engl.
—	—	Pastures	7	—	Atl. Engl.
Vaterf. and Tipper.	—	Pastures	11	3	Atl. Engl.
hroughout	throughout	Damp Moss	31	23	Atl.
hroughout	throughout	Damp Moss	47	26	Atl. Highl.
)onegal	Wicklow	Very damp rocks	4	12	Brit.
:lare to Donegal	—	Damp Rocks	8	6	Atl.
:ork and Kerry	—	Rocks	13	3	Atl.
hroughout	throughout	Shady rocks	37	37	Atl. Brit.

native) is absent in Great Britain is the Mediterranean *Atropis festuciformis*, to which *A. Foucaudii* might be added, if it can really be accepted as a distinct species. Generally diffused along the coasts of Great Britain and Ireland are 7 species, of which 3 are Atlantic and 4 Mediterranean, whilst one of each class is absent in Ireland, although widely distributed in Great Britain. They are *Limonium vulgare* and *Atropis rupestris*.

Taking the whole of the Western, Southern and Eastern British coasts we have

West 35 (12 Atl., 23 Med.).
East 30 (11 Atl., 19 Med.).
South 41 (16 Atl., 25 Med.).

Thus the proportion of 3 : 5 of the Atlantic and Mediterranean shares is still maintained in the south and the east, whilst in the west the Mediterranean element is slightly more prevalent. It has also to be added that excluding the widely diffused species most of the littoral plants of the southern type reach their northern limit on the east coast in Norfolk.

As to Ireland, there is practically no difference between the eastern and western sides of the island, whether we take into consideration the

total of the southern elements or the proportion of the Atlantic and Mediterranean shares.

The British areas of the littoral southern element generally join on to the continental areas so that there is no marked discontinuity, the only exceptions being *Mathiola incana* (Isle of Wight to Charente inférieure), *Limonium bellidifolium* (Norfolk to the eastern end of the French-Spanish frontier), *Atropis festuciformis* (Co. Down in Ireland to S. Sebastian in North Spain), and eventually *Atropis Foucaudii* (estuaries of the Shannon and the Thames to the mouth of the Charente). All these with the exception of the first are salt marsh plants which are particularly liable to casual introduction and may easily get a foothold on weakly tenanted ground.

Non-littoral species. The 95 species enumerated in the second table are distributed in the British Isles as follows:

Great Britain: 87 (Atl. 41 or 47 p. c., Med. 46 or 53 p. c.)
Ireland: 57 (Atl. 35 or 61 p. c., Med. 22 or 39 p. c.).

There is thus among the southern element a slight preponderance of Mediterranean plants in Great Britain and a decided predominance of Atlantic plants in Ireland.

Generally distributed through both islands, or the greater part of both, are *Hypericum Androsaemum*, *Ilex Aquifolium*, *Ulex europaeus*, *Apium nodiflorum*, *Conopodium majus*, *Oenanthe crocata*, *Carduus pycnocephalus*, *Erica Tetralix*, *E. cinerea*, *Scilla non-scripta* and general in Great Britain, but much restricted in Ireland, *Corydalis claviculata*. This means that the Atlantic element is very prominent among the most widely diffused of the southern species, and its predominance appears still more marked if we take into consideration that the general presence of the Mediterranean *Apium nodiflorum* and *Carduus pycnocephalus* is probably due to their great facilities for extending their area, the former as an aquatic, the latter as a waste land plant. The absence in Ireland of a plant very widely spread in Great Britain, *Genista anglica*, an Atlantic species, is very remarkable, and to it might be added *Tamus communis*, so common in England and yet doubtful as a native in Ireland. On the other hand widely distributed in England and Ireland are *Lepidium heterophyllum*, *Hypericum elodes*, *Ulex Gallii*, *Cotyledon Umbilicus* and *Sedum anglicum*, all but one Atlantic members of the southern element. Another group of species of fairly wide distribution is worth noting on account of the fact that they are absent from the greater part of the eastern counties of England, but extend through North England and Scotland to the north east coast. They are *Vicia Orobus*, *Saxifraga hypnoides*, *Scilla verna*, *Hymenophyllum tunbridgense*, *H. peltatum* and *Lastraea aemula*, all Atlantic species which are also found in Ireland. The Atlantic element is also prevalent among the

few southern species which are confined to the western part of Great Britain, *Meconopsis cambrica*, *Arabis stricta*, *Helianthemum guttatum* and *Trichomanes radicans*, of which the last but one is the only Mediterranean element. If we turn, however, to the remainder of the more limited [1]) species of the southern stock (excepting those which are confined to Ireland) we find the Mediterranean element dominant there being 33 of it against 18 of the Atlantic type. They range as follows:

Confined in Great Britain to		Extending to Ireland
West	3 (Atl. 2, Med. 1)	2 (Atl. 1, Med. 1)
West and south	13 (Atl. 5, Med. 8)	9 (Atl. 3, Med. 6)
South	25 (Atl. 9, Med. 16)	3 (Atl. 2, Med. 1)
South and east (mostly to Norfolk)	3 (all med.)	—
West, south and east (to Norfolk)	10 (Atl. 4, Med. 6)	2 (Atl. 1, Med. 1)

Pembroke in the west and Norfolk in the east mark off a zone which is particularly rich in Mediterranean forms, the maximum of them occuring in the Cornish peninsula. It is characteristic that of the 25 southern species confined to the south of England only 3 reach Ireland, and two of those are Atlantic, namely *Euphorbia hiberna* and *Simethis planifolia*.

The southern species which are generally diffused through Ireland and, at the same time, Great Britain have already been enumerated. To them have to be added *Cotyledon Umbilicus* and *Lastraea aemula* as general in Ireland, but more restricted in Great Britain. The majority of them (7) are Atlantic. So are also, with a single exception, the following ten species, each of which is recorded from 16 to 30 of Praeger's divisions: *Lepidium heterophyllum*, *Hypericum elodes*, *Erodium moschatum*, *Ulex Gallii*, *Sedum anglicum*, *Rubia peregrina*, *Scutellaria minor*, *Orobanche Hederae*, *Iris foetidissima*, *Hymenophyllum tunbridgense*.

Among the species with more restricted distribution in Ireland the Mediterranean element gains in number, but it nowhere outnumbers the Atlantic, as it does in the southern counties of England, the nearest approach to equalisation being in Cork West. The Atlantic share of the southern element predominates therefore over the Mediterranean throughout Ireland. The main area of the southern portion of the Irish flora with 18—29 species per division is in the south, then in the west as far as Galway, and in the east as far as Dublin. In the extreme southwest (Kerry and Cork West) the Atlantic forms number 18 to 21 species per

1) Recorded in the »London Catalogue« from 1—25 vice-counties. I count 51 species as belonging to this class.

division, whilst the remaining divisions in the South, the western to Mayo West, and the eastern to Dublin, count 12 to 17 of them. The bulk of the Mediterranean species shows a similar distribution, although their number is as we have seen much smaller.

Very striking is the result if we classify the Atlantic and Mediterranean elements from the ecological stand-point. Of the species which inhabit bogs or boggy places, wet meadows or wet rocks more than four fifths belong to the Atlantic group and the same holds good for the heath plants. On the other hand, of those found in woods or bush-formations about one half is Atlantic, the other Mediterranean, whilst those confined to pastures and light soil generally are, almost without exception, Mediterranean. The ecological contrast between the two classes which constitute the southern element could hardly find a more decided expression. Just as the areas of nearly all the littoral species among the southern element join on to the respective continental areas, in a way which is easy to understand, so also do the areas of most of the southern non-littoral plants of the British Isles. Out of the total of 95 of this class

10 (Atl. 8, Medit. 2) reach Southern Norway.
31 (Atl. 12, Medit. 19) » Belgium or Holland.
32 (Atl. 15, Medit. 17) » Normandy.
7 (all Mediterranean) » Brittany.

Thus of the insular areas 85 p. c. of the total are separated from the continental areas only by the width of the Channel plus their distances from the Channel, distances which lie over land, or in the case of the Irish plants also, over the Irish Sea. Of the remaining 15 p. c. the northern limits of *Euphorbia hiberna* in the department of the Sarthe (48°) and of *Daboecia polifolia* (47° 30′) in that of the Maine et Loire are in the latitude of Britany, but to the east and south east of that peninsula; that of *Echium plantagineum* is in the Vendée (46° 30′), and that of *Erica mediterranea* in the department of the Gironde (45°), whilst a further step of less than 2 degrees brings us to the latitude of the Pyrenees and the North Spanish mountains which harbour a number of plants whose British stations are the only ones north of that latitude. They are *Arabis stricta*, *Hypericum undulatum*, *Saxifraga Geum*, *S. umbrosa*, *Physospermum cornubiense*, *Pinguicula grandiflora*, *Erica Mackaii*, *Neotinea intacta*, *Allium triquetrum*, *Trichomanes radicans*.

It is this small group which, with some justification, might be designated as »Pyrenean« or »Cantabrian«. One of the plants, *Allium triquetrum*, a Mediterranean species, is a very doubtful native of England, whilst *Physospermum cornubiense* and *Neotinea intacta* have a wide range in the Mediterranean region. *Arabis stricta* inhabits a very much broken up area in Southern France (from the Pyrenees to Savoy) and in Spain. *Hypericum undulatum* is considered by some botanists as approaching so

closely to the widely distributed *H. quadrangulum* that it is treated by them as a western variety of it. *Trichomanes radicans* occurs in the warm regions of both hemispheres and is evidently a relict of very great age. Like the remaining species of the group it fits very naturally into the assemblage of Atlantic plants in the British Isles. Apart from the so called North American species these last four species (*Saxifraga Geum*, *S. umbrosa*, *Pinguicula grandiflora* and *Erica Mackaii* are usually quoted as the most puzzling instances of distribution among the British plants, and they have attracted the more attention as they are, within the British Isles, confined to the extreme southwest and west of Ireland. The day when *Simethis planifolia* disappears from its Dorset station will add another species to the peculiar Irish element of the British flora. Then we shall have the following progressive series of gaps between the Irish and the continental areas of that element.

Simethis planifolia,	S. W. Kerry	— Eure
Arbutus Unedo,	Kerry and Cork	— Côtes du Nord
Daboecia polifolia,	Galway and Mayo	— Maine et Loire
Erica mediterranea,	Galway and Mayo	— Gironde
Saxifraga Geum, *S. umbrosa*, *Pinguicula grandiflora*	West and Southwest of Ireland	— Eastern Pyrenees
Erica Mackaii	Galway	— Asturias.

If on the other hand *Simethis* should disappear first in Ireland its distribution in western Europe would become a parallel case to that of *Erica vagans* or *E. ciliaris*. Thus the apparent anomalies in the distribution of those often quoted plants resolve themselves into cases of far gone disintegration of area. How it has come about, or how the Atlantic and Mediterranean elements of the British flora have arrived in their island home, is a question which cannot be dealt with here. This southern element is like a weft in a woven fabric. It has not come alone. It is associated here in these islands with species which we call »Central-European« or »Germanic« although they are also found in the Pyrenees and the mountains of Northern Spain. At whatever period this element may have come into Great Britain and Ireland we must not think of its constituents as wandering singly and independently of each other.

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