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## THE MANX SAND-DUNE FLORA.

BY J. W. HARTLEY AND J. A. WHELDON, F.L.S.

EARLY in June of the present year we spent half a day on the sand-dunes of the north coast of the Isle of Man. Our chief object was the collection of lichens, but we were also desirous of comparing the vegetation of these dunes with the flora of the similar but more extensive eolian sands of the coasts of Lancashire and Cheshire. The season was too early for a thorough investigation of the higher plants, and we are sensible that the lists given are far from complete. Sufficient, however, was noted to show that these dunes are of a totally different type from those of Southport, Wallasey, or St. Anne's. The area of blown sand is not extensive, commencing near Jurby and extending in a narrow belt towards Point of Ayre. Inland the dunes overlie and merge into the boulder clay, which eventually rises into a range of low hills following the coast-line. At Point of Ayre there is a wide expanse of barren heath, where the blown sand only partially covers extensive beds of shingle, and does not form dunes properly so called.

In many places the sand has been blown away except where held by the roots of ling and heather, exposing the shingle or boulder clay beneath. The moorland then bears a not distant resemblance to the peat-hags of our moorland summits, only the peaty bases of the stools are composed of sand instead of peat. This ground looked interesting, and appeared to be especially rich in *Cladonia*, which were fine and well-developed. Unfortunately we arrived too late to give it an adequate examination, and darkness coming on we were reluctantly compelled to leave the exploration of this Point of Ayre heathland for a future excursion.

As compared with that of Southport, the flora of these dunes is poor and uninteresting. The species are fewer and of a less specialized dune-type. The differences which immediately strike the observer may be briefly summarised:—

(1) The dunes are comparatively flat, and provide less variety of aspect than those of the mainland. The absence of high dunes and intersecting deep hollows, besides affecting the flora, diminishes the picturesqueness of their appearance.

(2) The whole of the coast we examined, both dunes and heathland, was very dry. There are no wet "slacks." The flora is therefore more uniformly mesophytic and xerophytic than at Southport, the rich bryological and hydrophytic associations of the latter locality not being represented.

(3) The absence of *Salix repens*, a dominant species of the Lancashire dunes, enhances the general flatness; the secondary dunes built up by this species adding greatly to the diversity of the surface when it is present.

(4) The calciphilous species are less prominent, the restricted calciphile species being absent.

(5) The larger fungi are very scarce, much more so than on the damper dunes of the mainland, where, from May onwards,

they may always be seen in profusion. Not a single species was noticed on this occasion, and only one or two on a previous visit, some years ago, in September.

(6) The rapid transition from the sand-dune vegetation to that of heathland, with the presence of *Pteris*, *Calluna*, *Erica*, and *Ulex*, all of which are either excessively rare or absent from the Lancashire dunes, is especially noteworthy.

The causes which bring about these differences are apparently twofold. The dominant factor is probably the great depth of the subsoil water, due perhaps to the sand overlying pebble beds derived from the boulder clay. We were informed that at Point of Ayre it was possible to dig a depth of some seventeen feet without reaching water. At Southport, on the contrary, it lies only a few inches beneath the surface of the deeper hollows, and often stands in pools. Another factor, which probably strongly affects the vegetation, is the apparently smaller lime content of the soil. Shells are less plentiful in the sand, most of which is probably derived from the boulder clay of the north of the island. The bulk of sand is also smaller than that delivered to the estuarine dunes of the mainland. Owing to this deficiency of material, or to the steeper inclination of the land, the dunes are less extensive and of slower growth, and appear to go through a constant alternation of growth and demolition. The high boulder clay banks in the vicinity prevent the spread of blown sand to any considerable distance inland, and the material is not supplied in sufficient quantity to enable the dunes to make any marked advance on the seaward margin. Here in several places there is abundant evidence of recent erosion.

The poverty of species will be evident on perusal of the following list, which, whilst doubtless very incomplete, probably includes the majority of the plants found at the several points visited. The *List of Plants of the Isle of Man*, published by the Rev. S. A. Kermode, does not help much, as localities are rarely quoted, but some of those he enumerated may possibly have been from this area. If so, they are certainly not obtrusively evident. Amongst those he names which are likely to occur are *Glaucium luteum*, *Crambe maritima*, *Trifolium striatum*, *T. arvense*, *Anthyllis vulneraria*, *Carlina vulgaris*, *Leontodon hirtus*, *Erythraea Centaurium*, *Euphorbia Paralias*, *E. portlandica*, and *Sedum acre*. Most of these are abundant on the drier Lancashire dunes, and there seems to be no adequate reason for their absence here, if they really are absent.

About Jurby and Lhane several well-marked zones of vegetation could be discerned.

I. *The Strand Association*.—This in some places is developed on shingle, in others on sand. It forms an almost continuous band dominated by *Atriplex*, amongst which we were able to distinguish (although not yet flowering) *A. hastata* L., *A. Babingtonii* Woods, and *A. laciniata* L. Other plants observed were *Cakile maritima* Scop., *Glaux maritima* L., *Arenaria peploides* L., and *Salsola Kali* L. On pebbles where the ground was shingly

a few minute lichens develop. On a few pebbles brought home for examination we found *Acarospora pruinosa* Jatta f. *nuda* Nyl. ex Lamy., *A. smaragdula* Ach., and *Rhizocarpon confervoides* DC. f. *fuscescens* Leight and f. *dispersa* Leight. We did not observe at any of the points visited a fringing zone of *Agropyron junceum*, such as may be seen between Ainsdale and Birkdale, but the species occurs sparingly on the coast.

II. *The Marram Association*.—The dunes rise rather abruptly from the strand, in some parts in a continuous slope, in others with a low steep scarp. In the latter case the freely exposed roots of Marram grass show that erosion by tide or wind has taken place. This grass is the dominant plant, and the slightly undulating dunes it forms are neither as lofty nor as much cut into hills and valleys as those of the mainland. After reaching their maximum height, which is low as compared with the dunes between Formby and Southport, they fall in a gentle slope towards the land, forming a depression or shallow valley, which roughly and with some interruptions follows the contour of the coast-line. There are a few deeper hollows in which water probably stands for a short time in wet seasons, but there are no permanently wet "slacks." In these hollows a number of mosses and lichens carpet the ground, but none of them are of a distinctly hydrophilous type.

The following species of this association were recognizable at this early season of the year :—

*Ammophila arenaria* Link, dominant.

<i>Agropyron junceum</i> Beauv.	<i>Taraxacum officinale</i> Weber.
<i>Festuca rubra</i> (aggr.).	<i>T. obliquum</i> Dahlst.
<i>Senecio vulgaris</i> L.	<i>Carex arenaria</i> .

The above plants are the first to appear; further from the littoral zone they all still persist, with the addition of the following :—

<i>Arenaria serpyllifolia</i> L. var.	<i>Valerianella olitoria</i> Poll.
<i>macrocarpa</i> Lloyd.	<i>Galium verum</i> L. var. <i>maritimum</i> DC.
<i>Cerastium tetandrum</i> Curt.	<i>Polygonum Raii</i> Bab.
<i>C. semidecandrum</i> L.	<i>Phleum arenarium</i> L.
<i>Erodium maritimum</i> L'Hérit.	<i>Aira caryophyllea</i> L.
<i>E. cicutarium</i> var. <i>glutinatum</i>	<i>Bromus hordeaceus</i> var. <i>leptostachys</i> Beck.
Clav.	
<i>Eryngium maritimum</i> L.	

A single lichen was noted on dead stools of Marram grass, viz. *Cladonia fimbriata* Fr. f. *exilis* (Ach.).

III. *The Marram with Bracken Association*.—In the lower part of the main depression, *Pteris aquilina* begins to appear amongst the Marram grass, and soon forms a well-marked zone, sharing the ground with the grass, and in places becoming the dominant species. Here many of the plants mentioned in the preceding group continue to flourish. Lichens and mosses carpet the ground in profusion, thriving where the sand is enriched in humus by the decay of the more luxuriant vegetation. *Cladonia alcornis* forms light-coloured patches, and together with other

*Cladonia* is much more abundant than on the Lancashire dunes. The species noted were as follows:—

<i>Pteris aquilina</i> L., dominant.	<i>Bellis perennis</i> L.
<i>Anmophila arenaria</i> Link „	<i>Taraxacum officinale</i> Weber.
<i>Brassica monensis</i> Huds. (rare).	<i>Matricaria inodora</i> L.
<i>Viola ericetorum</i> Schrad.	<i>Jasione montana</i> L.
<i>Arenaria Lloydii</i> Jord.	<i>Calystegia Soldanella</i> Br.
<i>Cerastium tetrandum</i> Curt.	<i>Myosotis collina</i> Hoffm.
<i>C. semidecandrum</i> L.	<i>Thymus Serpyllum</i> L.
<i>C. viscosum</i> L.	<i>Plantago Coronopus</i> L.
<i>Polygala oxyptera</i> Reichb.	<i>P. lanceolata</i> L.
<i>Erodium cicutarium</i> var. <i>glutin- osum</i> Clav.	<i>Carex arenaria</i> L.
<i>Ononis maritima</i> Dum.	<i>Aira caryophyllea</i> L.
<i>Trifolium dubium</i> Sibth.	<i>A. præcox</i> L.
<i>Lotus corniculatus</i> L. var. <i>crassi- folius</i> Pers.	<i>Anthoxanthum odoratum</i> L.
<i>Sedum anglicum</i> Huds.	<i>Agrostis alba</i> L.
<i>Galium verum</i> L.	<i>Festuca ovina</i> L.
<i>Valerianella olitoria</i> Poll.	<i>F. rubra</i> (aggr.).
	<i>Bromus hordeaceus</i> L.
	<i>Botrychium Lunaria</i> Sw.

## BRYOPHYTA.

<i>Ceratodon purpureus</i> Brid.	<i>Brachythecium velutinum</i> B. & S.
<i>Dicranum scoparium</i> Hedw.	<i>B. purum</i> Dixon.
<i>D. scoparium</i> var. <i>orthophyllum</i> Brid.	<i>Campthothecium lutescens</i> B. & S.
<i>Barbula convoluta</i> Hedw.	<i>Hypnum cupressiforme</i> L.
<i>B. Hornschuchiana</i> Schultz.	<i>H. cupressiforme</i> L. var. <i>tecto- rum</i> Brid.
<i>Tortula ruralis</i> Ehrh.	<i>Hylocomium splendens</i> B. & S.
<i>T. ruraliformis</i> Dixon.	<i>H. splendens</i> var. <i>gracilius</i> Boul.
<i>Bryum pendulum</i> Schimp.	<i>H. squarrosum</i> B. & S.
<i>B. capillare</i> L.	<i>H. triquetrum</i> B. & S.
<i>B. roseum</i> Schreb.	
<i>Brachythecium albicans</i> B. & S.	

## LICHENES.

<i>Peltigera canina</i> Hoffm.	<i>Cladonia fimbriata</i> var. <i>conista</i> Nyl.
<i>Cladonia alpicornis</i> Flöerke.	<i>C. pityrea</i> Flk.
<i>C. pyxidata</i> Fr. var. <i>pocillum</i> Fr.	<i>C. furcata</i> Hoffm.
<i>C. chlorophæa</i> Flk.	<i>C. pungens</i> Flk.
<i>C. fimbriata</i> Fr. f. <i>exilis</i> (Ach.).	<i>Bacidia muscorum</i> Mudd.

In addition to the above, the following three lichens were found growing on pieces of weathered old leather lying on the dunes:—

*Lecanora Hageni* (Ach.). *Buellia phacodes* Köerb.

*Rinodina exigua* Gray f. *demissa* Stiz.

IV. *The Marram with Heather Association.*—As the landward border of the preceding association is reached, the bracken begins to fail, and intermixed with it are a few plants of *Calluna vulgaris*. Further on this becomes more abundant, and is accompanied by a small quantity of *Erica cinerea* and *Rosa spinosissima*. In



conjunction with a diminished quantity of Marram grass these plants dominate the rest of the ground. This slopes rapidly upwards, and soon becomes ordinary heathland, characterized here by the occurrence of *Ulex* and *Calluna*. The *Ulex* is the last plant to enter the dune formation, and only appears at about the point where the Marram disappears. In the list of plants of this association given below, those only are tabulated which occur on what may be termed the dune-heath, viz. that portion in which the ericetal species are accompanied by *Ammophila arenaria*. Where the Marram disappears and furze becomes a common associate of the heather, which occurs as the sand thins out over the boulder clay, the flora belongs to a different formation. Time did not allow of a careful examination of this heathy tract, which has no equivalent on the Lancashire coast, where the sand-hills gradually merge into dune-pasture and cultivated ground.

The following species, all noted within the range of the Marram grass, belong to this association:—

<i>Calluna vulgaris</i> , dominant.	<i>Senecio Jacobaea</i> L.
<i>Pteris aquilina</i> , „	<i>S. sylvaticus</i> L.
<i>Ammophila arenaria</i> , „	<i>Arctium</i> (minus Bernh.?).
<i>Rosa spinosissima</i> , subdominant.	<i>Centaurea nigra</i> L.
<i>Erica cinerea</i> , „	<i>Leontodon autumnalis</i> L.
<i>Ranunculus bulbosus</i> L.	<i>Campanula rotundifolia</i> L.
<i>Erophila verna</i> E. Meyer.	<i>Lycopsis arvensis</i> L.
<i>Viola ericetorum</i> Schrad.	<i>Veronica officinalis</i> L.
<i>Polygala oxyptera</i> Reichb.	<i>Euphrasia curta</i> Wettst.
<i>P. serpyllacea</i> Weihe.	<i>Thymus Serpyllum</i> L.
<i>Cerastium viscosum</i> L.	<i>Plantago lanceolata</i> L.
<i>C. vulgatum</i> L.	<i>Rumex crispus</i> L.
<i>Geranium molle</i> L.	<i>R. Acetosella</i> L.
<i>Ononis repens</i> L.	<i>Luzula multiflora</i> DC.
<i>Medicago lupulina</i> L.	<i>Anthoxanthum odoratum</i> L.
<i>Trifolium repens</i> L.	<i>Aira caryophyllea</i> L.
<i>Lotus corniculatus</i> L.	<i>A. præcox</i> L.
<i>Vicia angustifolia</i> L.	<i>Cynosurus cristatus</i> L.
<i>Conopodium denudatum</i> Koch.	<i>Dactylis glomerata</i> L.
<i>Anthriscus vulgaris</i> Bernh.	<i>Lolium perenne</i> L.
<i>Bellis perennis</i> L.	<i>Festuca ovina</i> L.

#### BRYOPHYTA.

<i>Polytrichum juniperinum</i> Willd.	<i>Climacium dendroides</i> var. <i>depauperatum</i> Boul.
<i>Campylopus fragilis</i> B. & S.	<i>Brachythecium purum</i> Dixon.
<i>Dicranum scoparium</i> Hedw.	<i>Hypnum Schreberi</i> Willd.
<i>D. scoparium</i> var. <i>orthophyllum</i> Brid.	<i>H. cupressiforme</i> L.
<i>Ceratodon purpureus</i> Brid.	<i>H. cupressiforme</i> var. <i>ericetorum</i> B. & S.
<i>Tortula ruralis</i> Ehrh.	<i>Hylocomium squarrosum</i> B. & S.
<i>Fumaria hygrometrica</i> Sibth.	<i>H. triquetrum</i> B. & S.
<i>Webera nutans</i> Hedw.	<i>Ptilidium ciliare</i> Hampe.
<i>Bryum inclinatum</i> Bland.	<i>Frullania Tamarisci</i> Dum.

## LICHENES.

<i>Peltigera canina</i> Hoffm.	<i>Cladonia fimbriata</i> var. <i>conista</i> Nyl.
<i>P. rufescens</i> Hoffm.	Nyl.
<i>P. physodes</i> Ach.	<i>C. gracilis</i> Hoffm.
<i>Cetraria aculeata</i> Fr.	<i>C. furcata</i> Hoffm.
<i>Cladonia pyxidata</i> Fr.	<i>C. furcata</i> var. <i>corymbosa</i> Nyl.
<i>C. pyxidata</i> var. <i>pocillum</i> Fr.	<i>C. pungens</i> Nyl.
<i>C. chlorophæa</i> Flk.	<i>Cladina sylvatica</i> Nyl.
<i>C. fimbriata</i> Fr. f. <i>exilis</i> (Ach.).	<i>C. uncialis</i> Nyl.
<i>C. fimbriata</i> var. <i>tubæformis</i> Fr.	<i>Bilimbia ligniaria</i> Massal.
	<i>Lecidea uliginosa</i> Ach.

## THE ORIGIN OF SPECIES.

[The following is an abstract of a paper on "The Origin of Species by Crossing" read at a meeting of the Linnean Society on the 19th of February, by Dr. J. P. Lotsy, of Haarlem. The paper was illustrated by diagrams, lantern-slides, and dried specimens.]

WE have in all questions of evolution to gather our facts from individuals, because species as well as varieties are abstractions, not realities. Nobody is able to show you a species or a variety; all he can do is to show you one or more individuals which he believes to belong to the species or variety under discussion.

Of *individuals* we know two kinds: homozygotes and heterozygotes. The first are stable; the latter segregate, earlier or later, into new homozygotes. The offspring of a homozygote is identical with its parent, with the exception of mere temporary non-transmittable modifications. If this be true, selection in the progeny of a definite homozygote can have no effect. That it has no effect has been proved by Johannsen. A homozygote consequently is absolutely stable and produces offspring which is genetically identical with it. Yet not all homozygotes are the same, there are many different kinds of homozygotes: homozygote beans, homozygote Antirrhinums, &c.

All these different kinds of homozygotes we may call with Johannsen genotypes, because they differ in genetical constitution, and we can then say that the world is populated—with the exception of heterozygotes—by a large number of sharply-defined absolutely stable genotypes. Under such conditions evolution may well seem impossible; fortunately, the behaviour of the heterozygotes shows us that it is quite possible.

A careful study of the descendants of a heterozygote shows us that it segregates in the next or later generations in a number of individuals, part of which are heterozygous, but part of which are homozygous, and that these homozygotes belong to different genotypes.

A heterozygote consequently gives birth to a smaller or larger number of different genotypes.