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Objekttyp: **Article**

Zeitschrift: **Veröffentlichungen des Geobotanischen Institutes Rübel in Zürich**

Band (Jahr): **1 (1924)**

PDF erstellt am: **11.09.2024**

Persistenter Link: https://doi.org/10.5169/seals-306662

The change in habitat of certain plants

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To the British Ecologist one of the striking features of interest in Continental Vegetation is the change in habitat which certain species exhibit under the altered climatic conditions. Changes which are all the more marked by contrast with the constancy in relation to habitat which other species maintain. No better illustration of constancy in Switzerland and Britain could be found than in the marked floristic affinity between the vegetation of the dry Heaths of Suffolk and the xerothermic 'Continental' type of vegetation presented by the area of low rainfall in the neighbourhood of Zernez. The annual rainfall in the latter region is 730 mm as compared with 571 mm on the Suffolk Heaths. If we consider the lower average summer temperature of this portion of the east of England (ca. 16 ° 5 C.) as compared with that at Zernez (21 ° C.) it will be realised that the effective rainfall is similar in the two regions. Amongst the species met with at Zernez the following are also extremely characteristic of the sandy Suffolk 'Heaths': *Veronica spicata*, *Scleranthus perennis*, *Artemisia campestris*, *Medicago falcata*, *Phleum Boehmeri*, *Onopordon acanthium*, *Koeleria gracilis* etc.

When we turn to the vegetation of calcareous soils we find that certain species maintain their preference for this soil type alike in Britain and Switzerland. Notable examples are furnished by *Sesleria coerulea* characteristic of the pastures on the mountain Limestone of Britain, by *Dryopteris Robertiana* a notable feature of the Limestone pavements in Yorkshire, and by *Helleborus foetidus* and *Dryas octopetala.*

Or again, amongst species characteristic of soils poor in lime *Pteridium aquilinum*, *Asplenium septentrionale*, *Allosorus crispus*, *Rumex acetosella*, *Salix herbacea*, *Digitalis purpurea*, *Sarothamnus scoparius*, *Sieglingia decumbens*, *Oxyria digyna* and *Vaccinium myrtillus* are all equally silicicole in Switzerland and Britain. The talus of siliceous rock fragments which is so pre-eminently the home of *Allosorus crispus* in Switzerland is equally its characteristic habitat in North Wales and Scotland. For *Ru-*

mex acetosella it has been shewn that *in the absence of competition* this species can flourish on soils rich in calcium but it would be extremely rash to assume that one and the same explanation is applicable to all calcifuge species. Indeed it is highly probable that, as the writer has indicated for the calcicole habit (Journ. Ecology 1920), the problem of calcifugy is very complex.

The resemblences of habitat cited above merely serve however to render more pronounced the occurrence of those species which appear to occupy very diverse habitats in the two countries.

It is of course well recognised that towards the limits of their geographic range many species may exhibit a more strictly limited range of habitat conditions than in the central part of their area of distribution. It is indeed to be expected that the depressed vigour associated with unfavourable climatic conditions should render species peculiarly susceptible to edaphic changes.

The British Flora contains a considerable proportion of the so-called 'Southern' Element which in the south-east reach their north-western geographical limit. Many such species are met with on the dry, warm, well aerated calcareous soils of the chalk downs. This calcicole flora is probably a composite one, whose elements exhibit a preference for calcareous soils for various reasons, of which one is related to the physical texture and thermic properties.

It is not therefore to be wondered at that several of the species of this southern flora which are restricted to calcareous soils in Britain exhibit no such limitation in the drier Swiss climate where the requirements of these species would appear to be satisfied provided the soil is well aerated and the water content low.

Notable examples of such species which are calcicoles in Britain but occur on either siliceous or calcareous soils in Switzerland are *Silene nutans*, *Carlina vulgaris*, and *Galium cruciatum* all of which are met with on the dry siliceous slopes near Tirano.

Anthyllis vulneraria is in Britain found on chalk and limestone soils and on sand dunes which are likewise calcareous owing to comminuted shells. In Switzerland however *Anthyllis*

vulneraria appears to be indifferent in this respect and the same would seem to be true of *Coeloglossum viride* which in the Bernina region grows on both calcareous and siliceous soils.

Much less easy to comprehend are those instances of species which are chiefly found on calcareous soils in Switzerland but appear to be indifferent in Britain. Such are, for example, *Arctostaphylos uva-ursi*, *Carex rupestris*, *Thalictrum alpinum*, *Carex humilis*, *Melittis melissophyllum*. All these are stated to be more or less marked calcicoles in *Switzerland* (cf. SCHRÖTER, Bodenzeigende Pflanzen der Schweiz 1910) but shew no such preference in Britain. Indeed the last named species is found almost entirely on soils which are very poorly supplied with calcium. *Carex humilis* and *Melittis melissophyllum* attain their northern limit in Britain but the other three species are northern types which approach their southern limit in Switzerland. It is easy to see a probable explanation for the restriction to calcareous soils of a southern species towards its northern limit, it is difficult on the other hand to see any advantage occuring to a northern species on such a soil at the southern limit of its geographical range.

Certain apparent anomalies of distribution to be seen in Switzerland are probably the outcome of leaching and the stratification of natural soils (cf. SALISBURY, Journ. Ecology 1920).

Thus whilst on the steeper slopes of Mount Pilatus the vegetation is characteristically calcicole, on some of the very gentle slopes and isolated grassy hummocks the vegetation was seen to contain silicicolous elements such as *Nardus stricta*, *Astrantia minor* etc. A similar and even more pronounced example was seen towards the lower part of Monte Salvatore where calcifuge species such as *Pteridium aquilinum*, *Calluna vulgaris* occur growing on leached soil in juxtaposition to the calcicole vegetation around. There is no question however that the roots of the *Calluna* must have penetrated to the unleached soil below rich in calcium, a fact which those who maintain the physiological *necessity* of a low proportion of calcium for the growth of the cells of this species would do well to consider.

The reverse effect was noted in the Val del Fain where the lower part of the valley is formed through non-calcareous

rocks. Owing however to the leaching out of bases from the calcareous rocks above and their transport in surface drainage the vegetation exhibits an increasing proportion of calcicole elements as the calcareous rocks are approached.

Such instances as these emphasise the necessity of actual soil determinations and the unreliability of conclusions based on the character of the underlying rocks from which the soils are derived.

The occurrence of *Hippophae rhamnoides* high up on Mount Pilatus and also as a constituent of a lowland fen was in marked contrast to its occurrence in Britain where it is entirely coastal being restricted to sand dunes in the later phases of their succession; the only obvious feature in common to all these habitats is the high content of mineral salts especially carbonates. This too may perhaps be the explanation of the presence in the same lowland fen growing in water-logged soil (with *Rhynchospora alba*, *Parnassia palustris*, *Menyanthes trifoliata*, *Peucedanum palustre* etc.) of *Herminium monorchis* a species which in Britain usually occurs on dry chalk slopes.

Another plant whose distribution strikes the English Botanist as somewhat peculiar is *Chenopodium bonus-henricus*. This plant in Britain is essentially a species of waste places and rarely occurs above 400 meters; yet in Switzerland it is found not uncommonly at high altitudes.

It would be easy to extend our comparison but the few examples cited are sufficient to emphasise the interest of both the resemblances and the differences in the habitats of species in the two floras; they further serve to shew the large field of enquiry, almost untouched as yet, on the interaction of soil and climate. The Plant community may be regarded as a 'resultant' of the total complex of environmental factors. As the combination of these factors varies and their relative intensities change, so too, one or more become of greater or less importance in determining the survival of species, and by the study of the change in habitat of species with extended range we may hope to gain considerable insight into the relative importance of the various conditions with which the presence of a particular species is normally associated.