Review

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NOTICES OF PAPERS OF GENERAL ECOLOGICAL BEARING

ALGAL ECOLOGY

Petersen, J. B. · "Studier over Danske Aërofile Alger." *Mém. Acad. Roy. Sci. et Lettres d. Danemark*, 7 ser., Sect. Sci., **12**, No. 7, 1915, pp. 272—352. (French résumé, pp. 353—379.)

This—one of the most important contributions on aërophilous Algae that has yet appeared—is a systematic study of the forms encountered in diverse terrestrial habitats in Denmark. In view of the more or less cosmopolitan character of algal societies, a somewhat detailed abstract will not be out of place. The author's work is divided into two sections, one dealing with the Diatomaceae, the other with the Chlôrophyceae.

As regards the former, the author arrives at the following general conclusions. There is a definite aerial association of Diatoms, composed largely of species different to those found in aquatic habitats, although a certain number of amphibious forms have been encountered (e.g. *Achnanthes linearis*, *Denticula tenuis*, *Pinnularia intermedia*, *P. subcapitata*, etc.). It is noteworthy that nearly all the aerial Diatoms belong to the Pennatae, subfamily Raphideae, i.e. are forms endowed with the power of movement. It is suggested that this enables them to survive periods of drought, since such forms will be able to seek out regions of greater humidity. All the aerial Diatoms are of small or very small dimensions (the largest being *Hantzschia amphioxys* var. *genuina*, with a length of 80 μ), a fact which is especially apparent when the aërophilous species are compared with the hydrophilous ones of the same genus. It is thought that the customary small size is related to an increased power of withstanding desiccation.

The author gives the following epitome of the distribution of terrestrial Diatoms:

(a) *On granite rocks*: *Eunotia gracilis*, *Navicula contenta* var. *biceps*, *N. mutica* var. *elliptica*, *Melosira dickiei*, *Achnanthes coarctata*, etc.

(b) *On calcareous rocks* (near the sea): *Denticula subtilis*, *Navicula atomus*, *Nitzschia kuetzingiana*, *N. inconspicua*, etc.

(c) *On the soil of cornfields and gardens*: *Achnanthes coarctata*, *Amphora normanii*, *Hantzschia amphioxys*, a considerable number of species of *Navicula* and *Nitzschia*, *Stauroneis agrestis* n. sp., *S. aerophila* n. sp., etc.

(d) *On woodland and forest soils* Diatoms are often absent, especially where there is much decaying foliage or the soil is sandy. The species recorded are: *Navicula fontinalis*, and other species, *Pinnularia borealis*, *P. brebissonii*, etc.

(e) *On the dry soils of heaths, moors, etc.*, Diatoms are absent, but in the swampy regions one encounters *Pinnularia subcapitata*, *P. borealis*, *Eunotia gracilis*, etc.

(f) *On thatched roofs*: a luxuriant Diatom vegetation, composed chiefly of *Hantzschia amphioxys* vars. *genuina* and *xerofila*, *Pinnularia borealis*, *Navicula mutica* vars., *Achnanthes coarctata*.

(g) *On moist walls*: *Hantzschia amphioxys* vars., *Navicula atomus*, *Nitzschia kuetzingiana*.

In the case of the Chlorophyceae, the author divides the aërophilous forms into a number of societies, according to the conditions of humidity. Those exposed to the least desiccation grow directly on the soil or on objects lying on the soil; these receive a certain amount

of moisture from the underlying layers and from the dew deposited at night. The aërophilous forms found on rocks, on the trunks of trees, or on dead wood are exposed to more intense desiccation, which reaches its maximum in the case of those growing on the upper branches and leaves of trees, where the drying effect of the wind is especially felt. From the ecological point of view, therefore, aërophilous Green Algae can be classified as follows:

1. Growing directly on the soil or on objects rising but little above the soil-surface:

(a) On the soil itself: the Green Algae vary according as the soil is acid in its reaction, or alkaline or neutral. In the former case the most characteristic forms are *Zygonium ericetorum*, *Mesotaenium violascens*, and two species of *Coccomyxa*, whilst neutral or alkaline soils are always inhabited by *Mesotaenium macrococcum*, and by species of *Hormidium* and *Vaucheria*. Species of *Prasiola* are especially found in localities rich in nitrogenous matter. All such forms growing directly on the soil appear only to prosper where there is not much competition with other vegetation.

(b) On rock-surfaces (near the sea): on granite rocks, where the usual covering of Lichens is absent, the author found *Mesotaenium chlamydosporum*, *Cylindrocystis brebissonii*, *Pleurococcus* sp., *Coccomyxa dispar*, *C. naegeliana*, etc. According to him poor illumination, excessive humidity, and the effect of adjacent towns on the atmosphere are the essential conditions favouring Algae to the exclusion of Lichens in such habitats. On calcareous rocks the author found *Coccomyxa olivacea* n. sp., *Trentepohlia aurea* and Cyanophyceae.

(c) On thatched roofs, which are regarded as presenting similar conditions of humidity: *Cystococcus humicola*, *Dactylococcus bicaudatus*, *Hormidium flaccidum*, *Mesotaenium* spp., *Pleurococcus* spp., *Prasiola* spp., *Stichococcus bacillaris*, *Trochiscia hirta*, and Cyanophyceae.

2. Growing at a slight distance ($\frac{1}{2}$ metre at the most) above the soil, so that moisture can be derived from the latter by capillarity, as well as from dew:

(a) On stony substrata, a distinction being drawn between granite (with sp. of *Pleurococcus*, *Prasiola*, and *Trentepohlia*, *Hormidium flaccidum*, etc.) and walls.

(b) On dead wood there is often luxuriant algal growth, consisting in the main of *Coccomyxa dispar*, *C. naegeliana*, *Dactylococcus bicaudatus*, *Stichococcus mirabilis*, *Hormidium flaccidum*, *Prasiola* spp., *Trentepohlia aurea*. At heights exceeding $\frac{1}{2}$ metre, one finds species better able to withstand desiccation, viz. *Pleurococcus vulgaris*, *P. naegeli*, *P. lobatus*, *Trochiscia hirta*, *Chlorella ellipsoidea*, *Stichococcus bacillaris*, *Trentepohlia odorata* var. *umbrina*, etc.

3. Growing at various heights on trees. In many cases Lichens inhabit the trunks and branches so densely that no Algae can prosper, but the latter obtain the upper hand in the interior of dense forests, where the feeble intensity of the light probably interferes with the development of the Lichens, and near villages and small towns. In large towns Algae do not flourish in such situations, probably because of the products of combustion of coal; in Copenhagen only *Pleurococcus lobatus* and *Cystococcus humicola* were observed.

(a) At a height up to $\frac{1}{2}$ metre above the soil, Algae are practically always found, even when the higher levels are occupied by Lichens, the most typical forms being *Pleurococcus* spp., *Stichococcus bacillaris*, *Trochiscia hirta*, *Dactylococcus bicaudatus*, *Hormidium flaccidum*. Such vegetation (together with *Prasiola* spp.) flourishes especially near human habitations.

(b) On the trunks at a height above $\frac{1}{2}$ metre: *Mesotaenium macrococcum*, *M. chlamydosporum*, *Pleurococcus* spp., *Coccomyxa* spp., *Trochiscia hirta*, *T. granulata*, *Cystococcus humicola*, *Chlorella ellipsoidea*, *Hormidium crenulatum*, *Prasiola muralis*, *Trentepohlia* spp., etc. Certain facts seem to indicate that the kind of tree influences to some extent the species of Algae found upon the trunk.

(c) On the ultimate branches and the leaves of trees. No Algae are usually encountered

on the very young shoots, but in the second season *Cystococcus humicola* and *Pleurococcus lobatus*, sometimes together with young individuals of *Trentepohlia*, are found beneath the exfoliating epidermis and in the young lenticels. In the case of Conifers *Pleurococcus lobatus* has even been found on the needles of the more protected branches, but in all other cases the author sought in vain for phyllophilous Algae.

Fritsch, F. E. "The morphology and ecology of an extreme terrestrial form of *Zygnema* (*Zygogonium*) *ericetorum* (Kuetz.), Hansg." *Annals of Botany*, **30**, 1916, pp. 135—149.

The author deals with a form of *Zygnema ericetorum* inhabiting certain bare areas on Hindhead Common in Surrey. As a result of the extremely inhospitable substratum, it is thought, the usual characters of the terrestrial form of this Alga are developed to a very pronounced extent and some of these appear as adaptations to the habitat. The Hindhead Alga may be said to be permanently in the akinete-condition, its cells agreeing in many respects with the resting-cells of other (aquatic) species of *Zygnema*. The outer portion of the wall is strongly thickened and mucilaginous and is shown to play a part in protecting the cells during periods of drought and in bringing about a rapid recovery on the reappearance of favourable conditions. The cells contain numerous fat-globules which form a dense layer just beneath the cell-wall on the commencement of desiccation. Some little time after moistening the dry filaments, the regular peripheral disposition of these globules disappears. The function of the globules is not altogether clear, but their disposition evidently shows a marked response to the varying conditions of the habitat.

Dry filaments of the Alga recover practically instantaneously when placed in water; further, there is no marked difference between the osmotic pressure of moist cells and those subjected to dryness, nor is there a greater percentage of dead cells in filaments that have been kept dry for months than in those that have been in water for the same length of time. All these features are regarded as indicating extreme adaptation to drought.

Griffiths, B. M. "The August Hleoplankton of some North Worcester-shire Pools." *Journ. Linn. Soc., Botany*, **43**, 1916, pp. 423—432.

The author collected Plankton from a number of pools in the Kidderminster district, situated partly in the basin of the Stour and partly in the valley of a small stream flowing into the Severn. The pools showed marked peculiarities in their respective floras and included many forms which are rare in the Plankton of the large lakes. In those through which a considerable stream flows and which are subject to little contamination, Volvocaceae (*Pandorina*, *Eudorina*) are the dominant forms, whilst Spring Grove Upper and Wilden pools, which are supplied respectively by spring and river water, were dominated by Protococcales. Two other pools which are much contaminated harboured *Microcystis aeruginosa* and other Myxophyceae. Peridineae were especially encountered in Stanklin Pool. Only one collection was made from each pool, so that no general conclusions can be drawn.

Baker, S. M. and Bohling, M. H. "On the Brown Seaweeds of the Salt Marsh. Part II. Their Systematic Relationships, Morphology, and Ecology." *Linn. Soc. Journ., Botany*, **43**, 1916, pp. 325—380.

The conspicuous Fucaceous vegetation of the salt-marsh flora is regarded as originating from the attached Fucaceous vegetation of the rocky shore, this being brought about either by direct vegetative budding from detached thallus-fragments or by the modification of young plants germinating on the marsh. The modifications produced by the new conditions are of the same general type in all the five species found on the salt-marsh; these modifications are prevalence of vegetative reproduction, dwarf habit, absence of an