H. Schouteden has published another fascicle of his work on the Hemiptera of the Congo.[4] A list is given of all the species now known from that region, nearly 300 in all. The plates illustrate the new species.

Nathan Banks

SPECIAL ARTICLES

THE POSSIBLE EFFECT OF CEMENT DUST ON PLANTS

A short time ago my attention was called to an extraordinarily abundant deposit of light gray dust on all sorts of exposed surfaces out of doors in one of the valleys not far from San Francisco. This dust was declared to come from the manufactory of Portland cement owned and operated by the Cowell Lime & Cement Co., near Concord, California. Unfortunately the manufacturing plant was shut down during the time in which both of my visits fell, so I did not myself see that the dust came from those works and only from there. I have, however, no reason to doubt its source, the attorney, manager and other officials of the Cowell Company admitting that they lose much cement as dust.

The light gray dust forms, where reasonably undisturbed, a film of increasing thickness over everything out of doors. This film adheres to some surfaces much more closely than to others, according to the smoothness, hairiness, stickiness, moistness of the surface. It could not be entirely blown off any surface which I saw, but the rain which fell in the interval between my two visits washed it off some surfaces, but not by any means all. Where the dust fell on undisturbed soil it could be readily recognized because of its color and shade: it is a light gray, whereas the soil is brown. Although the roads are lighter in color than the fields, since they are partly macadamized with a light gray stone, they too are darker than the dust. The origin of the dust is, therefore, clearly not entirely from the roads or fields.

In composition the dust presents some interesting characters under the microscope. It is evidently composed of fine particles of at least three different sorts. One of these is translucent crystalline fragments, fairly numerous. Another sort, less numerous, consists of somewhat larger opaque and fairly rounded particles. By far the largest number, however, are minute granular particles which cohere in irregular masses, often of considerable size. The masses of coherent granular particles enclose and in a way bind together the particles of other sorts. The granular material readily dissolves, with effervescence, in hydrochloric acid, even dilute, but the other particles remain on the slide, under the microscope, undissolved. Acetic acid similarly affects the dust when applied to small quantities on the slide under the microscope. From this it is evident that the dust consists largely of some readily decomposed carbonate.

This dust more or less completely covers the foliage of the native and cultivated plants in a considerable area, extending, as I observed, to a distance of over six miles from the cement works. It is carried on the winds and, as is so common in this part of California, the winds prevail in very definite directions according to the season of the year. In consequence, the dust goes in one direction mainly during the summer, and leaves the remainder of the valley free. It is more abundant on the windward than the leeward side of scattered trees, of orchards, etc. It covers the upper surface of many leaves, such as oak, willow, grape, prune, plum, quince; but such glossy leaves as peach, lemon, orange do not hold it against a breeze. It adheres also to the under side of many leaves, especially if the under side is less smooth than the upper. On fruits it is also evident, especially on dark or dark-skinned sorts, and it can not be removed from them without also rubbing off the bloom; it will not simply drop off if they are dipped or washed in water.

The market value of property has naturally been influenced by this excess of dust; the salability of land within the affected district being greatly decreased, and the market for otherwise fine table grapes covered by a deposit of grit is altogether a limited one.

On the other hand, it may be questioned

[4] *Ann. Musee du Congo Belge, Zool.*, Ser. III., Sec. II., Tome I., fasc. 1, pp. 88, 2 col. plates, 1909.

how great or even what may be the injury to vegetation. Bearing in mind that leaves are the parts of the more highly developed plants in which food is made under the influence of light, and through which that exchange of gases takes place which corresponds with the more mechanical part of the process of respiration in our own bodies, we see at once that these functions of leaves may be interfered with by dust. The exchanges of gases in food-manufacture and in respiration take place mainly through the openings, known as stomata, in the epidermis of leaves. If these openings are stopped or are closely covered, obviously the passage of gases through them will be correspondingly more difficult, slower and less adequate. This will be possible, however, only if the particles of dust correspond in shape, size and position to the stomata, or are so compacted on the surface of the leaves as to cover them. Examination shows that some of the particles are small enough to clog the stomata and that they do so on the leaves of oak (*Quercus lobata*), fruit-trees and grape-vines. The coarser particles form more or less extensive crusts, thus covering over the stomata. Although naturally most of the dust settles on the upper side of the leaves, the lower side does not entirely escape the clogging or crusting over of its pores. But on neither the upper nor the lower surface is the covering of dust so thick and opaque as greatly to interfere with the passage of light to the inner tissues of the leaves.

The effect, then, of an accumulation of dust on the surfaces of leaves constitutes mainly a mechanical interference with the proper exchange of those gases concerned in respiration and in food-manufacture in plants. There is no evidence that the dust on these leaves has exercised any corrosive or otherwise poisonous influence on the tissues, and so far as my preliminary tests indicate, there is no evidence of the presence of injurious substances in the dust. The effect of the dust is mainly, if not wholly, mechanical. But, interfering with the supply of food-materials and with the proper aeration of the plant-body, it must be more or less injurious.

Furthermore, whatever the effect of the dust may be on leaves already grown and developed, it is certain to be greater on young and growing leaves. The cement plant in question has been in operation only a few months, since the season's foliage was developed. The effect on young parts is not known. It may be anticipated, however, that the *setting* of this material on the rough or hairy surfaces of young and growing leaves would not only interfere with the exchange of gases above mentioned and absolutely necessary to the health of plants, but would offer a mechanical hindrance to growth which would lead to distortions more or less serious.

Perhaps it will be objected that what I have said is not probable, in the light of experience elsewhere. For example, Haselhoff and Lindau express the opinion that cement dust does no harm to vegetation:[1] but they speak of the rains which wash off the foliage at frequent intervals during the German summer. In this part of California, on the other hand, conditions are quite different. There is practically no rain after the leaves of deciduous plants have developed, although there may have been abundant rain before then. The leaves are not washed off frequently; usually they are not washed off at all throughout the season. In this part of California there are frequent summer fogs which give very valuable moisture to vegetation.[2] These fogs would affect ordinary dust very little, if at all, but they would tend to *set* dust containing or largely composed of cement. In dry weather cement dust will tend to blow away, especially in high wind, but it will be held more or less firmly, in spite of wind, on leaves roughened by hairs or made sticky by the wounds of aphids. Any moisture, whether from the plants themselves or from the air, which does not come with sufficient force to *wash*, will tend to fix the dust, forming a more or less permanent crust. Indeed, the rain which fell with considerable force on one occasion between my two visits removed far less dust from the surface of

[1] Haselhoff & Lindau, "Die Beschädigung der Vegetation durch Rauch," Leipzig, 1903.

[2] See a forthcoming paper by me in *The Plant World* on the botanical conditions of this region.

plants than I had expected. The leaves of grape were fairly cleaned, but the fruit was not, and the effect on the leaves of plum, prune and oak was slight: the dust was on them in quantity. This rain, furthermore, came unusually early.

The climatic conditions here being so different from those elsewhere, I feel compelled to expect the results which I have indicated, unless the operation of the cement manufactory is so modified as to check the discharge of dust in quantity.

George J. Peirce
Stanford University, Cal.,
October 1, 1909

THE ALGÆ OF THE ITHACA MARSHES

Investigations on the fauna and flora of the marshes of the upper Cayuga Lake Basin during the past summer were continued at the Biological Field Station of Cornell University. Various studies were in progress. The writer undertook the study of the algæ. His investigations were made in connection with the work of Dr. J. G. Needham, and were directed toward the solution of the problem of the algal food supply of herbivorous aquatic animals that are used as food by fishes. No local data being available, a preliminary study of the algæ of the marshes was undertaken. With little variety of conditions, a great number of species was not to be expected; however, nearly all the genera of the commoner fresh-water algæ were represented, and perhaps a more thorough search would supply the missing ones. Over seventy genera were found, but the species were not all carefully worked out, owing to the unsatisfactory state of their literature. Material for future work on them has been preserved and will be worked over later.

The genus *Chætophora* is especially abundant in this region, and is represented by four species, three of which, *C. elegans, C. incrassata* and *C. pisiformis,* are very common. The dominance of this genus, and the fact that it is used extensively as food by aquatic animals that have importance as food for fishes, lead us to expect that it will be of some economic value and a special study of its habitat and capabilities of increase will be made in the future. The study of the optimum conditions for the development of several species of *Spirogyra, Mougeotia* and *Chætophora* was undertaken in order to facilitate the cultivation of these algæ, should they prove of economic importance. The results from these experiments, and from observations carried on in nature, lead us to believe that such forms might with proper facilities be raised on a large scale with good results; perhaps in such quantities as Dr. Needham's previous studies of artificially reared may-flies indicate may be demanded.

A beginning was also made in the study of the periodicity of the marsh algæ. It is hoped that facilities may be provided in the future for carrying on observations continuously for several years, as this seems to be the only way in which exact information concerning the ecology of the algæ can be obtained.

An interesting Phycomycete, parasitic on *Volvox globator,* was discovered during August, and this fungus will be described after further work has been done on its life history.

H. A. Anderson

THE MOLECULAR CONSTITUTION OF SOLIDS[1]

According to the author, it is supposed and generally so stated, owing to complex movements and forces supposed to be present in solid bodies, there must be special difficulties to which it is due that the molecular thermodynamics and kinetics of solids can not be fully accounted for on the same basis as those of the gaseous bodies.

The present paper is calculated to show that the supposed difficulties are largely imaginary and that there are a notable number of solid and liquid substances, for which, according to the calculations and tables presented by the author, no essential difference exists regarding the mode and kinetic energy of the motion of their molecules as compared with those of gaseous bodies.

[1] Abstract of paper presented at the regular meeting of the Chicago Academy of Sciences, July 27, 1909.