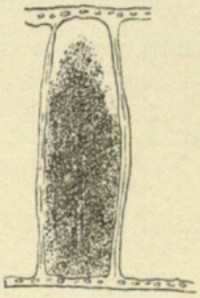
reddish-brown particles in the tracheides, vessels, and medullary parenchyma. It is presumed that it gained entrance to these tissues before the death of the tree and had therefore passed through the conducting elements and been absorbed by the living cells of the medullary rays. This tissue also contained starch both in the cells containing copper and those free from it. It is not easy to predicate in what form the copper was taken up by the plant, but probably as a carbonate, which would be reduced to the metallic state in the tissues. The large amount of the substance present rather supports Lehman's conclusions that it does not exert a marked injurious influence upon plants. Its occurrence throughout the annual rings indicates that it had been freely absorbed during nearly a decade. However, the death of the tree may have been finally caused by the influence of this substance.



Medullary cell of *Quercus macrocarpa*, containing particles of metallic copper.

Mr. J. B. Skertchly has found that *Polycarpæa spirostylis* F. von Mueller occurs in such close connection with the copper deposits of North Queensland in such an invariable manner that it may be used as indication of copper deposits in the soil or in solution in the streams near by. On this account he has named it the "copper plant," and notes also that in regions rich in copper it is the predominant member of the herbaceous flora.[3] It is of interest in this connection to note that Lehman found that the tissues of fowls feeding in regions rich in copper yielded 15.5–115^{mg} of this substance per kilo of dry matter. An investigation of the plants growing in the copper regions around Lake Superior, and near the dumping grounds of cities, would doubtless bring some interesting results as to the absorption of metals.—D. T. MacDougal, *University of Minnesota.*

FROST FORMATIONS.

The purpose of this note is to collect the records of observations of frost formations on plants not included in my résumé in this journal.[4]

A letter from Professor Trelease dated April 7, 1894 states that he had observed the formation of crystals of ice on *Verbesina Virginica*

[3] Tin Mines of Watsonville, Rep. by J. B. Skertchly, Assistant Geologist, Queensland. 1897.

[4] 19: 120. 1894.

at Bismarck, Missouri, in November of the previous year. He notes that "the air was rather moist. Temperature below freezing point in the shade. Soil moist. Plants recently dead. Plates (crystals of ice) noted about 2 to 5 P.M. on plants in shade — as though formed over night and melted elsewhere. At the same time similar crystals were seen on the soil and pebbles along paths."

Mr. F. E. Hand has observed the frost ribbons on *Cunila Mariana* in Kentucky.[5]

Mr. Valerio described the occurrence of such formations in Alabama as follows.[6]

> On January 27 the minimum temperature at this station was 14°. The next morning, going down the hillside by my house I noticed, on the dry grass and low brush, what at first sight I took for snow and nearer for bunches of cotton, but which on closer examination I found to be frostwork of a very peculiar shape and form, looking very much like fine stick or ribbon candy, or fine Venetian glass. These ribbons, beautifully curled and feather-like, came out from the stubs of the plants and, from a sample which I inclose, you will notice the bark was taken off the plants. The width of the frost ribbon was as the length of the cracks in the plant. They looked like fine shavings of a very white wood and crumbled at the touch.

Dr. Cleveland Abbe says concerning the formation of ice columns on soils:[7] "It is undoubtedly not only very common in our latitudes and soils, but is also quite an important item in agricultural soil physics." The formation of such crystals on the surface of the soil is due primarily to the freezing of the upper portion of the hygroscopic water on the soil particles and its elevation by the successive films of liquid water which replace it. A very ingenious and delicate experiment is suggested in imitation of this action. In regard to frost crystals on plants Dr. Abbe says: "When the outer air is frosty, while the sap is pressing up the body of the tree, a thin film of moisture may possibly be supplied from within as fast as the outer film at the surface of the crack may be frozen and lifted, and may thus form the exudation from the trees."

The notes given above establish quite clearly that the frost crystals which appear to exude from the tissues of dead plants are due to physical conditions quite similar to those found in soils, and to be in

[5] Monthly Weath. Rev. July 1897.

[6] Rep. Climate and Crop Service, Jan. 1895.

[7] Am. Meteor. Jour. 9:523. 1893.

no way connected with the activity of protoplasm. The well-known power of dead roots to take quantities of water would furnish the necessary supply of this liquid. That ice crystals can be formed elsewhere and almost anywhere in or on living woody plants has often been demonstrated, but such phenomena ensue under conditions differing widely from those offered by the soil or dead herbaceous plants. D. T. MACDOUGAL, *University of Minnesota.*

ANOTHER STATION FOR THOREA RAMOSISSIMA.

ON October 1, 1898, Mr. A. A. Hunter, collector for the botanical laboratory of the University of Nebraska, was fortunate enough to find good specimens of the curious and apparently rare alga *Thorea ramosissima* Bory, in Rock creek, a small stream near Lincoln, Nebraska. The plants were floating a little beneath the surface, along with other algæ, in swift-running water. Enough material was obtained for a thorough study of the structure of the free-floating part of the plant, and these have since been kept alive and growing in aquaria in the University plant houses. No specimens of the basal disk[8] have yet been secured, but as the station is not difficult of access it is hoped that these may be obtained next season, and the sexual organs studied. A preliminary paper is now in preparation by Mr. Hunter and G. G. Hedgcock, in which what is known of its structure and distribution will be discussed.— CHARLES E. BESSEY, *The University of Nebraska.*

[8] *Haftscheibe* or *Fuss* of Schmidle. Hedwigia 35 : 3. 1896.

MacDougal, Daniel Trembly. 1899. "Frost Formations." *Botanical gazette* 27(1), 69–71. https://doi.org/10.1086/327789.

View This Item Online: https://www.biodiversitylibrary.org/item/94861
DOI: https://doi.org/10.1086/327789
Permalink: https://www.biodiversitylibrary.org/partpdf/222936

Holding Institution
Missouri Botanical Garden, Peter H. Raven Library

Sponsored by
Missouri Botanical Garden

Copyright & Reuse
Copyright Status: Public domain. The BHL considers that this work is no longer under copyright protection.

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at https://www.biodiversitylibrary.org.

This file was generated 29 June 2023 at 18:22 UTC