on rhizomes is *Carex limosa,* or mud sedge, of northern America and Europe. (Other species of sedge which occur in acid-free substrata have similar root systems).

The rhizome of *C. limosa* is long, branched and has long internodes.[2] It is superficially placed in the substratum. The most striking structural feature is the internodal development of large chambers, which, in effect, are storage chambers for gases, especially for oxygen.

The adventitious root system is dimorphic, consisting of adventitious or main roots which are relatively slender and much branched, and main roots which are relatively thick and which may or may not bear laterals. There are, thus, really two kinds of thick roots, branched and not branched. The slender and thicker main roots have unlike origins. The slender roots arise at the base of flower shoots; the thicker roots are formed at the base of leafy shoots.

Root hairs occur abundantly on nearly all the roots. The thicker main roots have aerating tissue composed of 10 to 15 rows of intercellular spaces, arranged radially.

It has been observed (Metsävainio) that the roots with prominent intercellular spaces may penetrate deeply; those without it are usually superficial. The crucial structural difference between the two is evidently the presence or the absence of aerating tissue.

It will be recalled that other herbaceous hydrophytes also have well-developed intercellular spaces or chambers, for example, Elodea and Equisetum. Those of the former may, when the plants are in sunshine, contain much oxygen, derived from carbon assimilation. And, in certain scouring rushes the air chambers are the most prominent features both of the shoot and of the rhizome. It is because of this that the rhizome, as in *E. fuviatale,* may penetrate deeply in a wet, or saturated substratum. An analogous condition appears to obtain in some sedges which have aerating tissue not only in the rhizomes but also in the thicker main roots, and the origin of these roots at the base of the leafy shoots has, from this point of view, great significance. They may also be storage organs for oxygen, especially oxygen of internal origin.

From these and other considerations it is concluded that the slender and much branched main roots, without prominent intercellular spaces, and which are shallowly placed, derive the oxygen they require from the well-aerated soil atmosphere immediately around them. It, in fact, is because of this readily obtainable oxygen that these roots have laterals. The thicker main roots, on the other hand, which have aerenchyma, develop and live where the oxygen supply is limited, but they are able to secure the necessary amount from the rhizome and/or chlorophyll-bearing shoot. It is because of this that they live under poor conditions of aeration in spite of the relatively small water-absorbing and *oxygen*-absorbing surface.

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[2] K. Metsävainio, *Ann. Bot. Soc. Zoolog.-Bot. Fennicae Vanamo,* 1. Helsinki. 1931.

HARDINESS OF THE PAPER-MULBERRY TREE

A TREE that supplies paper to part of Asia and materials for clothing to many Pacific islanders was formerly much planted in the United States.

This curious tree *Broussonetia papyrifera* Vert. is said to be hardy up to New York City and also to sometimes escape and spread, naturally, though the sexes are in separate trees. "Is the female of the species more tender than the male"? was a question not to be answered by the Arnold Arboretum, as outside the climatic limit of this tree. Possibly some reader of SCIENCE may know the answer.

In Baltimore, Md., many of these trees flourished in yards, being introduced by Jesuit Fathers, it is said. But as far as known all the trees here are staminate or male and not capable of colonizing new localities. Yet in North Carolina one sees the strange flowers and the mulberry-like fruit that might spread seed to new regions. In Florida also female trees are found.

When, on different occasions, little female trees from Florida were planted in Baltimore, they flourished exceedingly all summer, but failed to survive the winter, as the male trees do.

It may be that this tree is exceptional and that both sexes are not equally hardy and thus the limits of its natural distribution would be set by one sex while artificially by man the other sex may be grown over a wider area. Is there such a physiological difference?

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THE GALTON LABORATORY

YOU were good enough (November 10) to reprint for the information of readers of SCIENCE, the letter of protest which I wrote to the London *Times* on the obstacles placed in the way of the Galton Laboratory continuing its researches. It is now possible to give a somewhat fuller view of the situation.

Many of the constituent institutions of London University are again active. The London School of Hygiene and Tropical Medicine, for example, situated only a few hundred yards from University College, along Gower Street, has its library and main departments open. I have been unable to ascertain, even if undergraduate teaching is supposed to be safer elsewhere, why research departments should be forbidden to continue at University College, which now stands nearly empty.

The Galton Laboratory has established its right to continued existence, though it has been forced to leave London. Sir John Russell was kind enough to find it