

also summers of decidedly above-average temperature (see Table I), under which conditions immense quantities of this *Utricularia* appeared in certain places. The summer of 1926, however, was the culmination of a series of dry years in the Great Lakes region. The exceptionally low water of 1926 occurred during a year of subnormal temperatures. The same sort of underground parts were found but no flowers of *Utricularia resupinata* whatsoever appeared.

Since the Biological Station of the University of Michigan was established in 1909 there have been three summers of exceptionally low water. (1916, 1921, and 1926). During that same time there have been but 3 Julys which had a mean temperature above 70° F. (1916, 1917, and 1921). In but two of these years was there the combination of exceedingly low water and very high average July temperature, and only in these two summers did *Utricularia resupinata* flower.

This seems to furnish an excellent example of a rather simple relation between flowering and conditions of the habitat of a particular aquatic plant, namely that the combination of exceptionally low water and exceptionally high summer temperature is necessary for flowering, and, without both factors present, flowering does not occur in this region.

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INFLUENCE OF *CLADONIA* GROUND COVER ON THE ESTABLISHMENT OF SEEDLINGS

During a course of study dealing with the influence of ground covers of mosses and lichens on the establishment of seedlings in the sandy upland aspens in the vicinity of the University of Michigan Biological Station at Douglas Lake, Cheboygan County, Michigan, in 1926, under the direction of Prof. F. C. Gates, certain unusual occurrences took place, the recording of which is the purpose of this note.

Large areas between the trees are covered with ground mats of *Cladonia*, mostly *C. rangiferina*. There is no doubt that such a ground cover prevents the entrance of many plants because of the inability of roots to penetrate the mat, and because seedlings which germinate on top of the mat are almost certain to dry up in a short time. Seeds such as acorns, which may be cached by rodents, are the most frequent example. Those plants which can come up through the mat from rhizomes are usually the only ones to appear. The determinations of soil moisture that were made during the summer of 1926 under *Cladonia* and denuded areas showed without exception more moisture under *Cladonia* during dry spells, whereas, immediately after rainy periods, the denuded areas near the surface showed the greater quantity.

In part of the experimental work, seeds of lettuce (*Lactuca sativa*), radish (*Raphanus sativa*), and nasturtium (*Tropaeolum major*) were planted, some on the surface of the mat, and some beneath the mat, a part scattered on the ground and a part buried in the soil. Those that remained in the air, held by the mat, failed to germinate as this was a very dry summer. Some of those that remained suspended for a while later sifted down to the ground where some germinated. Those that were scattered directly on the ground and those that were buried germinated. Although the soil was rather dry, there is yet another factor which is effective in preventing the establishment of seedlings, namely heaving, which pulled the seedlings wholly or partly out of the ground. This was noticed in those seeds whose cotyledons became enmeshed in the *Cladonia*. Under the very dry conditions of that season, the *Cladonia* was very dry, but with occasional morning dews which it soaked up it expanded. Where the cotyledons were caught in the *Cladonia*, this expansion was sufficient to pull some of the seedlings wholly out of the ground, and to pull out others sufficiently to break their root connections. In this manner the *Cladonia* mat was able to prevent the establish-

ment of these seedlings in spite of the fact that the moisture in the soil under the mats was sufficient for germination.¹

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CONSTRUCTION OF A PSYCHROMETER FOR SMALL SPACES¹

The Psychrometer

In connection with biological work, both in the field and laboratory, it is often desirable to have the relative humidity as well as other physical data pertaining to the environment. The standard sling psychrometer as employed by the Weather Bureau is a very precise instrument, but under certain conditions some features of its construction render it unsuitable. To swing the instrument requires a space of at least a yard which must be free from all obstructions. The model which is described in this paper may be operated in a small space to obtain a reading at a certain point on a plant, or inside a cabinet or cage of relatively small dimensions.

A perusal of the supply house catalogs fails to disclose any psychrometer of this type, and it remains for the worker interested in such apparatus to construct one for himself. Most of the types in use involve some whirling device. There are a few points to bear in mind in the selection and assembly of such an apparatus. The whirling device must be sturdily constructed, and must operate with a minimum of friction if the psychrometer is to give service over a period of time.

Clements has described an egg beater type in which the thermometers were mounted by means of wiring to the frame of the beater after removal of the rotating plates. He claims this yields satisfactory results. This was the type first used by the author; but because of stiffness in operation, and the rapidity with which the gears wear, it was discarded.

After trials of several different types of egg beaters and cream whippers all others have been discarded in favor of a model available at most hardware stores. Figure 1 shows the device as sold for household use.

In purchasing this device for the construction of a psychrometer certain features of its construction should be inspected. It is advisable to test its operation to see that it turns easily and smoothly, also to test the play between the gears, and the attachment to the frame. It is also advisable to see that the nut on the end of the rod has not been stripped. This examination requires only a moment and may prevent much annoyance later.

Construction of the Psychrometer

The set-up shown in figure 3 is the result of several models, and is the most satisfactory one yet devised, possessing greater simplicity and solidity than any of its predecessors.

The mounting medium consists of sections of rubber stoppers, the lower one being part of a No. 13 stopper, while the smaller piece is obtained from a No. 10. The stopper is cut into two pieces about 5/16 inches thick, the central part being discarded. The cutting is very easily done by means of a hack saw with a fine blade. The rubber stopper is soaked in water previous to cutting, and the saw cut is flushed out several times during the operation.

¹Field experimentation in the normal summer following (1927), and in the wet summer of 1928, have demonstrated that this heaving of seedlings is a phenomenon of very dry seasons—an added difficulty in such seasons.—FRANK C. GATES.

¹Published with the approval of the Director as Paper No. 842 of the Journal Series of the Minnesota Agricultural Experiment Station.