HOYER'S SOLUTION AS A RAPID PERMANENT MOUNTING MEDIUM FOR BRYOPHYTES

LEWIS E. ANDERSON[1]

Hoyer's solution is a rapid permanent mounting medium which has been in general use for many years by entomologists and more especially acarologists. It has been found to be quite satisfactory for mounting small insects and mites, specimens of which have been preserved for more than twenty years at the U. S. National Museum without deterioration.[2] It is also used extensively by mycologists who have employed it in making permanent whole mounts of fungi. Several years ago I mentioned the problem of making permanent mounts of mosses and liverworts to Dr. Leland Shanor, a distinguished mycologist of the University of Illinois, and he suggested that Hoyer's might prove satisfactory as a mounting medium for bryophytes. Since then the solution has been tested on a considerable variety of mosses and liverworts by myself as well as some of my colleagues and the results to date have been particularly encouraging. Inasmuch as I have seen no mention of Hoyer's solution in bryological literature it seems desirable to call attention to its usefulness for bryophytes.

The formula for Hoyer's solution is as follows:

Distilled water	50 cc.
Gum arabic (U. S. P. Flake)	30 grams
Chloral hydrate	200 grams
Glycerin	20 cc.

The ingredients should be mixed in the above order at room temperature. The mixture should not be heated during the mixing operation. Gum arabic goes into solution slowly and for that reason U. S. P. flake is specified. In this state it enters solution much more readily and with a minimum of bubbles. The product marketed as "crystals" is satisfactory, although it requires considerably longer to go into solution. Powdered gum arabic should be scrupulously avoided as it is extremely difficult and messy to work with. I prefer to mix the flaked gum arabic in an electric rotary magnetic mixer. It requires a relatively longer time but reduces the volume of air bubbles. Any mechanical means of stirring is satisfactory, however. It is not necessary to filter the final mixture in spite of the fact that it may appear to need it. The solution can be allowed to stand for several hours and the seemingly large number of

[1] Department of Botany, Duke University, Durham, North Carolina.

[2] Baker, Edward W. and G. W. Wharton. 1952. An Introduction to Acarology. The Macmillan Company, New York.

bubbles will disappear. Its keeping qualities are excellent for it can be stored on the shelf indefinitely in airtight bottles. The final mixture should appear clear with only a faint tinge of yellow. There should be no sediment. A poor grade of gum arabic may result in a mixture which is decidedly yellowish to reddish and probably should not be used.

Plants can be transferred to Hoyer's directly from water. It is highly advisable to soak dried plants thoroughly in water before they are placed in the mounting medium. If dried plants are mounted directly penetration will be uneven and an objectionably large number of air bubbles and "unwetted" areas will be noticeable on the plants. After the cover glass is applied no further treatment is required except to keep the slide in a flat position until the medium hardens. Some workers recommend heating the slide almost to the boiling point after the cover slip is applied. This is said to speed up the hardening process, but I can see little difference between unheated slides and those which have been heated.

Not infrequently, as with all mounting media, when large coarse stems or leaves are mounted some of the solution will evaporate before the outer edge hardens and effects a seal around the cover glass. This can be avoided to some extent by using a superfluous amount of the medium so that it is present in excess at the edge of the cover glass. If large air spaces do develop additional solution can be pipetted under the edge of the cover glass. In persistent cases the cover glass should be ringed with asphaltum or other suitable substance.

Hoyer's solution has been tested on a large and fairly diverse number of species of mosses, but the oldest slides are now only 2.5 years old. There is no certainty, therefore, that they will not deteriorate over a longer period of time as many mounting media seem to have a habit of doing. Some caution should therefore be exercised in its use. I have observed ill effects in only two genera of mosses out of the large number that have been tried. These oddly enough are *Mnium* and *Tortella*. The leaf cells of certain species in both genera tend to shrink unevenly and become distorted.

It is an extremely satisfactory mounting medium for hepatics. Dr. H. L. Blomquist and Dr. R. M. Schuster have mounted a very large number of liverworts in Hoyer's and to date there is no evidence whatever of any signs of deterioration. In addition, Dr. Blomquist has mounted a large number of species of *Sphagnum* and all the slides are holding up satisfactorily.

Hoyer's solution is an extremely effective clearing agent, so it is especially useful for mounting opaque or dense plant parts such

as peristome teeth, exothecial cells of the capsule, densely papillose cells, stems, etc., where a clear sharp image of cellular detail and outline is ordinarily difficult to obtain. It is an extremely satisfactory medium for mounting material that is to be drawn or photographed.

Perhaps this is the place to express a note of caution concerning a rapid permanent mounting medium that in recent years has been recommended and used successfully for many plants and plant parts as well as certain insects. This medium utilizes polyvinyl alcohol (PVA) in combination with generous portions of lactic acid. PVA is marketed in powder form by Du Pont under the trade name "Elvanol." I have tried this mounting medium on a fairly large scale for bryophytes and it is completely unsatisfactory for either mosses or liverworts. After a few months plants mounted in PVA gradually begin to shrink and distort and in time they become virtually unrecognizable.

FIRST REPORT ON LICHEN GROWTH RATE AND SUCCESSION AT ATON FOREST, CONNECTICUT

MASON E. HALE JR.[1]

As part of a broad program of lichen studies, a number of permanent stations have been set up in Aton Forest, a research area in northwestern Connecticut. The lichen flora of this area has already been published upon (Hale, 1950) along with descriptions of the Forest. The object of the present investigation is to determine the growth rates of some common lichens and at the same time trace the development of various lichen communities. This report presents the basic methods of study and significant results over a period of three years.

ROCK STATIONS.—The extensive gneiss outcrops at "The Ledges" and at "Hickory Hill" provided excellent undisturbed locations. Seven quadrats, each 21 × 27 cm. (567 cm.^{2}) with drilled holes at the corners, were established in September, 1949. In 1949 and in August, 1952, outlines of the thalli were traced directly on thin plastic sheets, from which growth and coverage were measured in the laboratory. Although all stations were photographed in 1952, main reliance is being placed on the tracings. Some of the results for the period 1949–1952 are given in table 1. The measurements of radial growth were far more difficult than anticipated since every portion of a thallus margin appeared to

[1] University of Wichita, Wichita, Kansas.