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BRIEFER ARTICLES.

A METHOD OF PRESERVING THE GREEN COLOR OF PLANTS FOR EXHIBITION PURPOSES.

For many purposes, especially when intended for museums, classes in botany, pharmacy, etc., it is very desirable to preserve, as far as possible, the natural appearance of plant specimens. Where the purposes for which the material is to be used will permit its preservation in a dry state, the natural colors may generally be well preserved for some time by rapid drying. This is true of nearly all colors both of leaves and flowers. Such material, however, is likely to slowly fade, especially if it is not kept perfectly dry and well protected from strong light. Where the material is to be kept in fluid media, such as alcohol, formalin, gelatin, glycerin, etc., it is impossible in most cases to preserve the natural colors except by resorting to special methods.

The method about to be described will not preserve the colors of flowers. It is effective only in cases where some shade of green is to be preserved, that is, where the distinctive color depends on the presence of chlorophyll in all or in certain cells. Usually it will also effectively preserve the browns, reddish browns, and yellows, such as occur in injured or diseased portions of stems, leaves, or fruits.

The principle involved is to bring about a combination of the chlorophyll in the cells of the plant with copper. The resulting compound, copper phyllocyanate,¹ is practically insoluble in any of the ordinary preserving media except strong alcohol, and is not destroyed by light. If the work be properly done the resulting green can scarcely be distinguished from the normal chlorophyll green. The amount of copper phyllocyanate in each cell will be proportionate to the quantity of chlorophyll which it contained, so that contrasts and shades due to this difference will be clearly brought out.

The most difficult part of the process is to get the copper into the

¹ TSCHIRCH, A., *Das Kupfer vom Standpunkte der gerichtlichen Chemie, Toxicologie, und Hygiene*, pp. 27-55. 1893.

cells before the chlorophyll escapes or breaks down. In order to accomplish this, the air on the surface, and as far as possible in the intercellular spaces of the tissues to be treated, must either be removed by immersion in 90 to 95 per cent. alcohol for fifteen or twenty minutes, according to the size and penetrative resistance of the specimen, or else be freed by placing in water and removing the air with an air pump. Soaking for some time in boiled water after the latter has cooled is also effective. Good results may be obtained by combining all these methods. When the tissues are reasonably free from air the specimens should be placed in a dilute (5 per cent.) glycerol solution containing enough dissolved copper sulphate or copper acetate to give it a marked bluish tint. The solution should be boiled before using to free it from air. At the time of using, enough formalin should be added to make the solution about 1 per cent. The specimens should be left in this until all of the green parts have been penetrated by the copper and have assumed a bluish green color. They should then be removed to a dilute glycerin-formalin solution free from copper. This will gradually dissolve all the copper not in combination with chlorophyll and thus bring out the natural shades and variations. After thorough washing and clearing in this latter solution the material may be preserved, without change, in glycerin-formalin solution or any of the common media except strong alcohol.

For class use and exhibition purposes the specimens are best mounted in glycerin gelatin. Flat specimen jars with parallel sides and clear glass may be used, or in many cases better results may be obtained by mounting the specimens between glass plates of sufficient size. Old negative plates are good for this purpose. These are made into mounting chambers by cementing narrow strips of glass between the two sides and one end, the other end being left open. The most satisfactory cement found for this purpose is Canada balsam, boiled until when cool it will be hard but not brittle. Before the cell is made the glass should be thoroughly cleaned, as it is difficult to clean the inner walls afterwards.

When the cell is prepared the material is shoved in between the plates and arranged as desired. Two per cent. formalin is then added to the warm glycerin gelatin and this is poured in at one side to the bottom, from which it rises and surrounds the specimens. Any bubbles adhering to the specimens may be disengaged with a knitting needle or a fine, stiff wire, and the material finally arranged before the

gelatin hardens. The plates should be sufficiently close so that the specimen will be held in place by friction against the glass while the gelatin is hardening. The amount of space required for different specimens is easily regulated by the thickness of the glass separating the plates. Modifications of this method can easily be made to meet the requirements of the material. The formalated gelatin hardens in a few hours, but it is best to allow the preparation to remain open at the top from twelve to twenty-four hours, filling in more gelatin if necessary. Finally, when the top has hardened and dried down about one-fourth of an inch, the space left should be carefully cleaned out and filled in with hot, hard balsam, which should make the seal perfectly air-tight. After this the mount should be cleaned, bound with lantern slide binders, and labeled.

The formula for the glycerin gelatin used is 20 parts of best quality French or other clear gelatin, 10 parts glycerin, and 100 parts water. Steam the mixture until the gelatin is melted, then cool down to 55° C., and add the white of one egg to about every 200^{cc}. After this is thoroughly incorporated steam again for about thirty minutes, or until the egg albumen is thoroughly cooked and white. Stir occasionally during this last steaming to insure complete coagulation of the egg. Now add malic or some similar acid to make the mixture neutral or slightly acid to litmus, and after carefully incorporating this strain while hot through cloth, and then filter through paper. In case it is desired to keep any of the glycerin gelatin in stock add, before filtering, one part salicylate of soda to each 100 parts of the mixture, or else keep the stock flask sterile by occasional steaming. I use the latter method.

As before mentioned, the formalin is not added to the stock gelatin, but to what is used in making each preparation at the time of filling or imbedding. When once the gelatin is hardened by formalin it is insoluble in water and cannot be melted even at boiling temperature. The formalin, of course, also makes it antiseptic. If the formalin is permitted to evaporate from the gelatin the latter may again become fluid.

Other formulas for glycerin gelatin may be used instead of the one described. Some prefer to use a larger quantity of glycerol and less water, which has an advantage, in that the mixture so prepared is less liable to dry out.

In conclusion the writer wishes to disclaim any originality in the

principles herein involved. The method is merely the application of well-known facts to economic ends.—ALBERT F. WOODS, *Division of Vegetable Physiology and Pathology, United States Department of Agriculture.*

A CASE OF ECBLASTESIS AND AXIAL PROLIFICATION IN LEPIDIUM APETALUM.

(WITH PLATE IX)

THE teratological specimen of *Lepidium* described below was collected by Mr. F. S. Collins at Malden, Mass., in August. Noting its remarkable character Mr. Collins has kindly referred it to the writer for examination. The plant is about 4^{dm} high, much branched, and already destitute of its lower leaves, so that it lacks some of the most characteristic features for specific identification. However, the cotyledons are distinctly incumbent, as shown in *fig. 12*, and the terminal racemes, which have normal fruit, show the orbicular pods and approximate regularly spreading pedicels characteristic of *L. apetalum* Willd., to which the plant is confidently referred. Most of the flowers show no sign of petals whatever, while in others there are rudimentary petals, as shown in *fig. 11*. These, however, have been found in normal specimens of *L. apetalum*, and therefore raise no appreciable doubt as to the identification. As mentioned above, the terminal racemes of the main axis and of several of the branches are entirely normal in their appearance. On the other hand, the numerous lateral racemes are all greatly modified. They are much looser, and the slender pedicels spread at various angles, instead of being regularly divaricate as in the normal racemes; but what is more conspicuous is the modification of the fruit from an orbicular pod to a long clavate or pear shaped body, which is not sessile in the calyx, but borne upon a filiform ascending stipe, in some cases nearly equalling the pedicels of the flowers.

The microscopic examination of one of these racemes shows a series of teratological modifications of the floral organs. Some of these changes are good examples of well recognized teratological phenomena, namely, ecblastesis and axial proliferation, while others are too irregular for any very satisfactory classification or morphological interpretation. A cursory search in literature for records of similar monstrosities in the genus *Lepidium* has disclosed only a single mention of such