Certain difficulties have been met with by the writer during continuous prolonged operation of the apparatus described above. In spite of frequent changes of water, corrosion of the zinc or galvanized iron results in the formation of a scum which interferes with the normal absorption of the wicks and makes frequent changing of them necessary. Wicks are very likely to go dry when they become encrusted with this matter. Coating the pan with an acid-proof paint and frequent changes of water do not obviate the trouble entirely.

In experiments in germinating seeds in various buffered solutions, when it was essential to avoid contact with metals which might alter the solutions, glass bottle germinators were improvised which have proved to have several advantages. Large-mouthed bottles or mason jars having a top 8 cm or less in outside diameter are suitable; flat or ground edges are preferable, but not necessary. The jar (A) is filled with

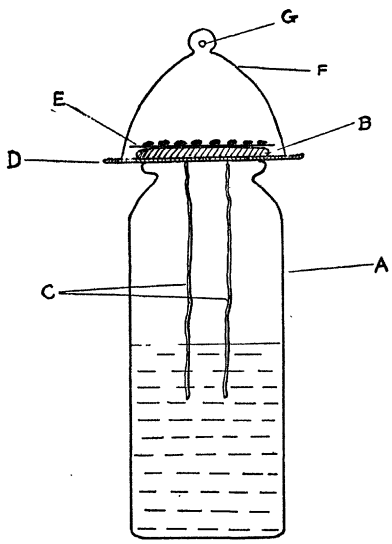

FIG. 1

water or solution to a predetermined level marked on the glass. The knitted cotton pad (B) with wick (C) attached is supported on a small glass disk (D) having a 2.3 cm hole in the center. Such disks, known as bobeches, are used on candlesticks to catch drip, and can be purchased from china stores for 10 cents each. The bobeche is prevented from slipping by coating the top of the bottle with thick desiccator grease. The filter paper (E) bearing the seed sample is covered by a small bell jar (F) having a perforation (G) in the apex. If necessary, this can be prevented from slipping on the bobeche by sealing with grease.

As an alternative any appropriate vessel can be used, covered with a perforated glass or porcelain plate. Having holes drilled especially is usually more expensive than using the ready-made bobeches. An inverted glass funnel with the stem filed off can be substituted for the bell jar with perforation. Just as in other forms of the Jacobsen apparatus the rate of moisture supply is regulated by the height of the absorbing pad above the water surface. The vessel should be sufficiently deep to accommodate the space desired.

The advantages of this type of germinator may be summarized as follows. (1) Each apparatus is a unit, fulfilling the conditions of the Jacobsen apparatus in a minimum of space.

(2) Since the moisture supply is completely enclosed, loss by evaporation is restricted to the germinating medium, from which water vapor diffuses out of the hole in the bell jar. This loss is so small that a concentration of salts on the surface is avoided. Water loss is so small that tests have been run a month without essential change in water level.

(3) The wick leading to the germinating pad is at all times in a saturated atmosphere, protected from dust and dirt. The entire apparatus may be sterilized in an autoclave before sowing the seed. Covering the jar with black paper will also aid in preventing bacterial action.

(4) The entire system being of glass and clean cotton, chemical action is minimized.

(5) In the case of the use of solutions made up with CO_2-free water, the enclosed reservoir increases the time they may be maintained unchanged.

(6) Individual units are more convenient to move about while tests are in progress. They may be placed in ovens under different temperatures and removed to others during part of the day to provide alternating temperatures; they may be immersed in cooling solutions for chilling treatment; light and dark may be alternated, etc. In other words, seeds may be tested with the mobility characteristic of petri dish cultures, without losing the superior control obtainable with the Jacobsen system.

As disadvantages may be mentioned the danger of breakage and the greater care necessary in changing wicks because of the less stable containers. Uniformity of moisture conditions for a large number of duplicate samples might possibly be obtained better under one common container. This would require specially made, more expensive apparatus.

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DETECTION OF FUNGUS MYCELIUM IN MILDEWED COTTON FABRICS

IT is sometimes difficult and time-consuming to demonstrate the presence of mold mycelium in mildewed

cotton or cotton fabrics by ordinary microscopical examination in cases where surface growth is not present. In such cases, and also when it is necessary to determine the extent of infection, differential staining followed by microscopical examination is desirable. For this purpose, Bright[1] recommends the use of cotton blue or picronigrosine for staining, mounting the material in Canada balsam, and examining with the 2/3 inch (16 mm) objective. Color filters may be used to obtain greater contrast.

We have found that the Pianese IIIb stain,[2] which is used by plant pathologists in studying sections of tissue infected by fungi, is also a good differential stain for the above purpose. This stain contains martius yellow, malachite green and acid fuchsin.[3] The material under examination is washed in water or alcohol (preferably alcohol), stained for 15 to 45 minutes, washed in water, decolorized in acid-alcohol and dried, after which it may be mounted for examination in Canada balsam or gum damar. Cotton fibers stain green and the fungus mycelium a deep pink, a color filter not usually being necessary for contrast. A good source of light is important.

With this stain the presence of fungus mycelium in raw cotton and undyed yarns and fabrics is easily and quickly demonstrated. It is desirable in heavy fabrics to tease the fibers apart before mounting. Dyed cloth is sometimes more difficult to examine, but fungus, if present, can usually be demonstrated.

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[1] T. B. Bright, *Jour. Mic. Soc.*, 141, 1925.

[2] R. E. Vaughan, *Ann. Mo. Bot. Gard.*, 1: 241, 1914.

[3] H. J. Conn, "Biological Stains," second edition, 1929.

SPECIAL ARTICLES

CHANGING THE CHIRP-RATE OF THE SNOWY TREE CRICKET OECANTHUS NIVEUS WITH AIR CURRENTS

IT has long been known that the intermittent chirping rate of the snowy tree cricket varies rather consistently with changes in air temperature; Margarette W. Brooks,[1] of Salem, Massachusetts, was the first observer to present in a scientific magazine an account of the rate as affected by different temperatures. Strangely enough, although many scientific discussions have followed up to the present time, every one has consistently failed to make any reference to her pioneer discussion, even though little has been added since her day.

While the rate of chirping unquestionably shows a marked temperature correlation rising and falling with similar changes in temperature trends, the crickets are very erratic organic clocks and show various discrepancies in their rates which have never been explained. Every individual cricket, like every clock or watch, must be regarded as a specific mechanism with specific modes of behavior. These have become geographic correlations in some instances so that in different portions of their range the rates of chirping appear to be physiologically established racial behaviors, as pointed out by Fulton.

Careful observations even in the same locality reveal occasional discrepancies from the expected rate which have never been satisfactorily explained. A. F. Shull[2] in 1907 studied these tree crickets very intensively in Michigan, Ohio and New York. He found that observed air temperatures did not explain the entire situation and found that a higher rate now and then may accompany a somewhat lower temperature. In my own studies I have likewise found that on different evenings with air temperatures at 70° the rate may range from 121.7 to 133.7 chirps per minute.

These variations have puzzled me not a little, and during the summer of 1929 I made a few preliminary tests with air currents. A small electric fan was purchased and a snowy tree cricket showing a ready willingness to chirp when confined in a room was placed on some raspberry shoots in my sleeping room where outside air currents could not introduce errors. Using a stop watch a number of counts were then made of its normal chirping rate for these conditions to establish a system of channels. Following this, a current of air was directed upon the cricket from the fan placed about 6 feet away so that it produced an evident motion in the foliage surrounding it. Almost immediately the cricket responded to the air currents by accelerating at once its chirping rate in a very evident manner.

After counts had been made the fan was turned off and the cricket allowed to chirp for a few minutes until the normal rate of chirping in still air could be resumed. The return from the higher rate seemed to require a somewhat longer time than was required to establish it when the fan was turned on.

[1] "Influence of Temperature on the Chirp of the Cricket," *Popular Science Monthly*, 20: 268, November, 1881, to April, 1882.

[2] *Canadian Entomologist*, 39: 213–225.