widely scattered and has been developed not only at the hands of the paleontologists proper but also by botanists. The work under consideration begins with a statement in regard to the bearing of paleobotany on a number of important theoretical and practical problems such as stratigraphy, sedimentation, the origin of coal, paleoclimatology and paleogeography. There follows an excellent account of methods of fossilization and preservation of fossil plants. In spite of its necessarily brief character this exposition is carried out in a masterly fashion. Following this is an account of the methods of collecting fossil plants. This is subdivided into older fossils and peat, each of which of course has its own particular methods of procedure.

A very important chapter is that which deals with methods of research. This is most comprehensive and covers bleaching, photography, the use of fluorescence and Roentgen rays. The investigation of peat and more recent material comparable with it also figures in the account. Naturally a very important part of this chapter deals with anatomical and microscopical investigation, and that must rank as one of the most important parts of the book since it treats in a thoroughly satisfactory way all the technical methods which have been developed in connection with the investigation of fossil plants, particularly those which are of more recent origin. Under this heading naturally come the preparation of thin sections, the preparation of polished surfaces, the use of etching methods and the preparation of relief surfaces. Under the heading of maceration the methods of Walton and Ashby, to some extent founded on those developed by Nathorst in earlier years, are described. Under the heading of preparation of thin sections the various new developments which have added greatly to our knowledge of fossil plants are satisfactorily described. This chapter ends with microchemical methods which are a comparative novelty in paleobotany but destined to have an important future.

The fifth chapter is especially devoted to coal and its constituents. It is of interest to note in this connection the author's open-mindedness which becomes apparent in his remarks in regard to Tertiary brown coal. He pointedly asserts that it is no longer possible to regard the brown coal deposits of the northern hemisphere as derived from formations comparable with the Dismal Swamp of America. This point of view is refreshing in relation to the extremely reactionary attitude of the mass of American geologists in regard to recent investigations on coal. One wonders if the United States will have the undesirable preeminence of being the last country to adhere to the *in situ* hypothesis of the origin of coal, just as it was the last country to adhere to the seed-bearing character of arboreal cryptogams such as the Lepidodendrids and Calamites. It has been wittily remarked that Oxford is the place where good German theories go when they die. As far as paleobotany is concerned, the United States appears at the present time to rival that ancient institution of learning.

The volume under review contains, in view of its size, a large number of illustrations which visualize not only the apparatus used in various paleobotanical investigations, but also results which have been obtained by the apparatus and methods described in the volume. The author is to be congratulated on producing a much needed and extremely valuable work which will be indispensable to all geologists and paleontologists who are in any way interested in fossil plants.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN INDIVIDUAL JACOBSEN GERMINATOR

THE Jacobsen apparatus for testing seeds has certain advantages over other methods which have led to its adoption, especially in Europe, in seed control stations. For forest seeds in particular it has proved the most satisfactory method. Its advantages may be summed up in the statement that it permits better control, and thereby standardization, of the physical conditions for germination, especially moisture and oxygen supply.

The apparatus as generally used consists of a large pan, ordinarily of zinc or galvanized iron, kept filled to a certain level with water. A constant level can be maintained conveniently by means of a Mariotte flask arrangement. Wicks attached to small cotton pads are supported on glass strips or on a perforated cover, and dip into the water. In some modifications, *e.g.,* Toumey's, other arrangements of wicking are used to furnish the water supply. The sample of seed is placed on a filter paper or special blotter in contact with the wick and covered by a small glass bell jar having a small aperture in the top. The distance between the seed and the water level determines the rate at which water can be supplied to the seed. Temperature is usually regulated by heating or cooling the water in the pan.

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

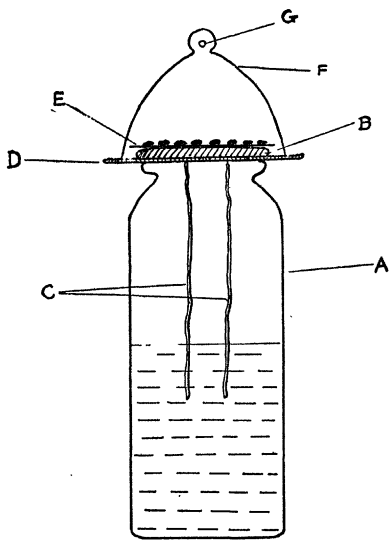

FIG. 1

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