tage of it to secure an abundance of specimens at little or no cost.

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SPECIAL ARTICLES.

EFFECT OF DRYING UPON LEGUME BACTERIA.

THE almost simultaneous appearance of Bulletin No. 270 of the Geneva (New York) Experiment Station and Farmers' Bulletin, No. 240 of the United States Department of Agriculture, the one stating that cultures of nodule-forming bacteria dried on cotton were worthless for practical purposes and that the failure of these cultures was inherent in the method of their preparation, the other stating that the Department of Agriculture did not consider cultures dried on cotton entirely satisfactory and would instead distribute liquid cultures hermetically sealed, has perhaps naturally resulted in unwarranted and unfairly severe criticism toward the cultures dried on cotton.

The most misunderstood feature in the deterioration of dried or partially dried cultures is the distinction between the effect of desiccation *per se* and the effect of small quantities of moisture present for some length of time, either because of slow drying or because of absorption of water vapor from a humid atmosphere after the cotton had been thoroughly and rapidly dried. It has, therefore, been considered desirable to publish at once an explanation of the simple paradox that the rapid drying of cultures of nodule-forming bacteria causes a relatively insignificant injury to them, while the partial drying of similar cultures will cause them to deteriorate and die rapidly. The time of danger to a drying culture is the time of high concentration of the soluble substances. This condition necessarily obtains when the culture is almost dry. Whether one wishes to base his explanation chiefly upon the antiseptic action of concentrated sugar and salt solutions[1] or upon the deleterious action of by-products[2] which must also be highly concentrated in the almost dry culture, it is necessary to admit that the longer a given culture is exposed to these adverse conditions the fewer bacteria will be able to survive; and as the necessary corollary, the more often a properly dried culture is allowed to become moist the greater will be the deterioration of that culture.

This explanation is deduced from the following facts:

1. Cultures of nodule-forming bacteria have been rapidly dried, kept in a desiccator for thirty days, sixty days and ninety days, and revived with no apparent difference in the three series.

2. Cultures dried as above have been exposed to moist air for ten days and for twenty-four days. In some cases contaminations destroyed the proper organism; in others complete sterility obtained; in a few cases a few organisms remained in cultures otherwise sterile.

3. Cultures ten days old were evaporated in vacuo, and into the concentrated broth heavy inoculations were made. These tubes were sterile at the end of seventy-two hours.

4. Our regular sugar-broth was made up approximately twenty times as concentrated as our regular formula, and this medium was heavily inoculated with actively growing cultures. By the end of seventy-two hours these tubes were sterile.

5. A culture has been placed on cotton, half of which was placed in a sterile petri dish, to make drying very slow, half was dried rapidly and kept over calcium chlorid. After twenty-five days the cotton in the petri dish was sterile; the cotton from the desiccator was a pure culture in good condition, containing numberless organisms.

We may summarize briefly as follows:

The nodule-forming bacteria of the Leguminoseæ may be dried rapidly and kept in a dry condition for long periods,[3] and may then be revived successfully.

Cultures properly dried may be killed by exposure to moist conditions.

[1] Sternberg, 'Manual of Bacteriology,' 1893, p. 156.

[2] John Golding, *Journal of Agricultural Science*, Vol. I., Pt. 1, p. 59–64.

[3] See also Bulletin No. 71, Bureau of Plant Industry.

Slow drying will kill a culture that will remain in good condition after rapid drying.

A highly concentrated medium comparable to that which the almost dry cultures must endure will kill the bacteria in question in an exposure of a few days.

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CURRENT NOTES ON METEOROLOGY.

HELM CLOUDS IN NORTH CAROLINA.

In the *Monthly Weather Review* for October, 1905, Frank W. Proctor mentions the occurrence of standing clouds in atmospheric waves at Waynesville, N. C. (see also Science, May 1, 1903, page 712). This place is surrounded on three sides by high and steep mountains, and the topography is favorable for the formation of such clouds. On the day when the observation was made the wind was southwest, and blew across the mountain range which forms the head of the valley. A large dense standing cloud was formed over the mountains, carried down on the lee side for a short distance, and was seen to evaporate at its leeward edge as fast as it developed to windward. About a quarter or a half a mile to leeward, at the same level approximately, and separated from this main cloud by a clear space, there was a second, detached, standing cloud of good size, also forming to windward and evaporating to leeward like the primary cloud. The wind at the level of the clouds was blowing at the rate of twenty miles an hour, yet the clouds were stationary, dissolving as rapidly at one side (lee) as they formed at the other (windward). Mr. Proctor's account of these helm clouds in the mountains of North Carolina is the second mention of this phenomenon. The first was made by Professor W. M. Davis (*Bull. Geogr. Soc. Phila.*, III., No. 3, 1903).

DAILY MARCH OF TEMPERATURE IN THE TROPICS.

Hann has undertaken an extended investigation of the daily march of temperature in the tropics, the first part of which has been published ('Der tägliche Gang der Temperatur in der inneren Tropenzone,' *Denkschr. k. Akad. Wiss., math.-naturw. Kl.*, Vienna, 1905, Vol. LXXVIII.). The reason for taking up this study is found in the fact that the mean temperatures of many stations in the tropics are placed too high because of the application of inaccurate corrections in computing the true means. The present work is to be regarded as an extension of that of Dove, published in 1846 and in 1856 ('Ueber die täglichen Veränderungen der Temperatur der Atmosphäre,' *Abhandl. Berl. Akad.*), and includes the latest available observations from stations between the equator and latitudes $\pm 15°$ N. and S., in Africa, the West Indies, Central and South America, southern Asia, northern Australia and the tropical oceans.

RAINFALL OF MEXICO.

A report on the 'Regimen of the Rainfall of Mexico,' in the twelfth volume of the *Annals of the Association of Engineers and Architects of Mexico,* by Romulo Escobar, brings to light an interesting fact. Most of the stations show a steady diminution in rainfall for a long period of years, but this decrease has already begun to be followed by an increase. Our gulf states from Texas to Alabama and Tennessee have shown a similar decrease, but the expectable increase has not been observed everywhere, owing, as Professor Abbe believes, to the frequent changes in the rain gauges and their exposures. It is to be noted with satisfaction that in this report on Mexican rainfall there is no indiscriminate comparison of a long record at one station with a short record at another, the rainfalls being averaged for each station by lustra, so that mean annual rainfalls for the same period may be compared (*Mo. Wea. Rev.*, Oct., 1905).

NOTES.

According to a list recently published in *Petermann's Mittheilungen* (1905, p. 91) it appears that out of forty-four universities and technical schools using the German language, thirteen recognized meteorology as worthy of special mention in their courses of instruction offered during the past summer semester.