began to issue comprehensive meteorological charts of the north Atlantic, somewhat similar to those discontinued by the United States Weather Bureau in August.

Dr. Julius Von Hann's first section of the third edition of his "Lehrbuch der Meteorologie" is now for sale by the publisher, C. H. Tauchnitz, of Leipzig, at 3.60 Marks.

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SPECIAL ARTICLES

MUTATION IN TOBACCO

Although recent work by Heribert Nilsson[1] and Davis[2] shows that the sudden changes which were observed in *Œnothera Lamarckiana* can be logically and simply explained by assuming a heterozygous parent, one should not conclude that this seriously weakens the general theory of the origin of new types by mutation. Even if the indirect evidence compiled by De Vries were also to be rejected, there remain a considerable number of mutations that have arisen in homozygous material of known ancestry. The truth of this statement is apparent if it is recalled that such a careful investigator as Morgan has witnessed the origin of over 150 such changes in *Drosophila*. Controlled botanical evidence is not as voluminous, though plant geneticists have all observed phenomena that seem best interpreted in this manner. For this reason we hope it is not out of place to describe the origin of a variation that appeared in 1912 in a field of Connecticut shade-grown tobacco, which seems likely to be of very great commercial value.

The variety of tobacco grown under cheesecloth cover in the Connecticut valley is called Cuban. It was first grown in this country in 1904 from seed which was brought from Cuba the previous year by Mr. William Hazelwood, of New York City. The crop of 1904 was very variable, but Hasslebring[3] has shown that this type of variability is due largely to the poor method of saving seed in Cuba. It is the result of a mixture of seed from various types of plants, for crossing seldom occurs naturally.

Individual plants were selected from the 1904 plot which was grown from Cuban seed, and self-fertilized seed produced by covering the seed head with a Manila paper bag. These individual selections were grown in row tests in 1905 and for succeeding years until 1909. The individual rows grown from self-fertilized plants presented a uniform appearance. Of the earlier types all proved of little commercial value except strain 13. One line known as 13–29 proved superior to all others in the value of the cured leaves. A considerable number of self-fertilized seed plants were saved from this line in 1908 and were used for commercial planting in 1910 at the Windsor Tobacco Growers' Corporation in Bloomfield, giving a crop of uniform appearance, in which no variations of importance were noted. A large quantity of seed was saved from this crop, although individual plants were not selfed, as it seemed very improbable that crossing would take place under the cheese-cloth cover, and even if some crossing took place, it was assumed that it would be between homozygous individuals. The Cuban variety was thus selfed for five generations, and in all probability for a sixth generation, and gave every evidence that it was of a homozygous nature.

In 1912 about one hundred acres, or over a million plants, were grown from the seed of the 1910 crop at the Windsor Tobacco Growers' Corporation. The general appearance of the crop this year was very uniform, but when clearing the field in the fall, one of the workmen was very much surprised to discover that one of the plants he had just cut down was very much taller than the others, and bore a large number of unpicked leaves. This plant was brought to the attention of the plantation manager, Mr. J. B. Stewart, who recognized the possibilities of such a plant. After systematic search two more such plants were discovered. These plants were carefully taken up and carried to the Connecticut Experiment Station greenhouse in New Haven. One of

[1] *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Band 8, Heft 1 u. 2, 1912.

[2] *Amer. Nat.*, Vol. 46, 1912.

[3] *The Botanical Gazette*, Vol. 53, 1912.

the plants survived, and bore 72 leaves, blossoming about January 1. Considerable seed was saved from both the terminal and lateral inflorescence of this plant.

In 1913 about 5,000 plants were grown from this seed. These plants were true to the new type in all external characters, and differed from the normal Cuban in having a somewhat lighter green shade to the leaves, in an absence of basal suckers (lateral branches), and in a practically indeterminate growth, whereas the normal Cuban variety produces a terminal inflorescence after producing from 16 to 25 leaves on the main stem. Twenty plants were brought to our greenhouse in New Haven; all but eight, however, were injured during transportation. The eight uninjured plants commenced to blossom about the first of November, the range of leaf counts per plant being from 62 to 80, with the greater number around 70. These data show that this tobacco mutant is breeding true, and unless it behaves in a different manner from other mutants, it should breed true in succeeding generations.

The cured leaves are very promising, resembling the normal variety. There is every reason to believe that this new type will prove of commercial value, as the yield per acre is at least fifty per cent. greater than the normal type. It has been named the Stewart Cuban.

The normal Cuban seed which was saved in 1910 was again used for planting in 1913, and over 200 acres, or two and one half million plants, were grown. Although search was made at the Windsor Tobacco Growers' Corporation, which grows over 100 acres, no mutating plants were discovered. Two mutants were found at other plantations where the 1910 Windsor Corporation seed was used, which presented the same habit of producing a large leaf number. Thus, five similar mutants from the same seed have been discovered, though it can not be stated that they did not all come from a single normal plant. The frequency of the appearance of this mutation is at the rate of about one plant in a million.

This mutation must have taken place after fertilization, *i. e.*, after the union of the male and female reproductive cells. If the mutation had taken place in either the male or female cell before fertilization, the mutant would have been a first generation hybrid, and would have given a variable progeny the following season.

Mutations of high leaf number have been observed in tobacco previous to this time. Several years ago a variant with a large leaf number was found in the outdoor Havana type at the farm of Mr. Alsop in Avon, and in 1912 a Havana plant which bore 72 leaves was found at the Olds Brothers' Plantation in Bloomfield. Six similar mutations were found at a Windsor farm, and one at another farm in Bloomfield this last season. It is of interest to know that these mutations occurred in a variety, the Connecticut Havana, which has been grown in Connecticut for a period of over fifty years, and which is very uniform in habit. That it has been observed in different sections and by different growers shows that the same mutation must have taken place several times.

A similar type bearing a large leaf number appeared in Maryland several years ago, and is grown commercially under the name of Maryland Mammoth. The Maryland type was, however, the result of a cross between two Maryland tobacco varieties. The mutations which have occurred in Connecticut can hardly be explained on the basis of the results of a cross.

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REAL AND APPARENT NITRIFYING POWERS

IN making bacteriological studies of soils one of the leading factors determined is the ability of the bacteria present to convert various forms of nitrogen into the nitrate condition. Comparison of this ability, as existing in different soils, is usually made under definite, more or less standard conditions. This factor is spoken of as the "nitrifying power" or "nitrifying efficiency."

Of recent years the tendency has been to employ the soil to be tested, or a standard soil, as the medium in which the organisms