the field it would pass from one to another of those remaining on the outside of the nest and offer the new nectar which was eagerly accepted. From five to a dozen individuals would thus be fed before passing inside the nest where it was lost to sight.

This and other species of *Nectarina* are discussed at length by R. du Buysson in Annales de la société entomologique de France, Vol. 74 pp. 537-566.

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SCIENTIFIC BOOKS

Geodetic Operations in the United States, January 1, 1912, to December 31, 1921. By WILLIAM BOWIE. Pp. 26, illustrated. (Washington, Government Printing Office, 1922, 20 cents).

This is a report which was presented in Rome in May, 1922, at the meeting of the section of Geodesy of the International Geodetic and Geophysical Union. It is reviewed from the point of view of a scientist. Otherwise the reviewer might call attention more directly to certain points in the report which are of interest to any one who would like to see all of the United States mapped well and soon.

The perusal of this publication, showing the contributions to geodesy by the Coast and Geodetic Survey in the past ten years, arouses admiration for the rapid progress which has been made in spite of the delays and disturbances due to war. The rate of accumulation of new observations for use in geodesy has been greater in the United States in this decade than in any previous decade. Along with this progress in observing there have also been notable improvements in instruments and methods.

One hundred and twenty-four determinations of the intensity of gravity, corrected for topography and isostatic compensation, were available in the United States before 1912. In the past ten years 162 such determinations have been added, making the total now available 286. This is a very substantial addition to the data of geodesy.

There are two lines of attack on the problem of determining the figure and size of the earth and on all associated matters such as isostasy. These two lines together are substantially the whole of geodesy. The primary data for one line of attack are observed values of the intensity of gravity as given by pendulum observations. The primary data for the other line of attack are observations of the relative directions of gravity at various places as given by astronomic determinations of the latitude, longitude and azimuth of points connected with continuous triangulation. The preceding paragraph shows that the available data for the first mentioned line of attack has been more than doubled in the United States in the past ten years. The paragraphs which follow give some of the points from the report which show that the strength available for the second line of attack mentioned has also been greatly increased on this continent in the past decade.

During 1912-1921 102 determinations of astronomic azimuth scattered widely over the United States have been made. The total number of such azimuth determinations before 1912 was 285. Similarly in this decade more than one fourth has been added to the number of determinations of astronomic longitude in the United States and 124 determinations of astronomic latitude have been made. To the network of primary triangulation in the United States which existed before 1912 there has been added in the last decade arcs of an aggregate length of 4,659 miles, or more than 66 degrees of a great circle on the earth's surface. Clarke's classical computation of the figure of the earth in 1880 depended on arcs measured by various nations of an aggregate length of only 89 degrees. In connection with the new triangulation of the past decade 20 new base lines have been measured with probable errors of one part in a million as a rule.

The accuracy with which the figure and size of the earth may be derived from a given continuous network of triangulation and the connected astronomic determinations increases very rapidly as the extreme dimensions of the network are increased. Within the decade under consideration, by cooperation on the part of Canada and Mexico, the continuous triangulation has been extended from the United States far into each of these countries and the computations are made on one standard datum.

This renders it possible to deal with the triangulation of all three of these countries in one grand computation,—a possibility not equalled anywhere else in the world at present.

More than 15,000 miles of precise leveling has been done in the United States in the past decade, all of the highest standard of accuracy. The total for the United States previous to 1912 was 30,000 miles, of which a part was of a lower grade of accuracy than the recent work. This leveling is primarily for engineering purposes for the control of surveys upon which good maps depend. But in due time the reviewer believes it will be found of much value to science as a means of measurement of the slow geological changes in the relative elevation of different parts of the earth's surface. Such changes may be detected at the coasts by direct reference to the mean surface of the sea. In the interior of a continent the precise leveling, repeated for this purpose, will furnish the only means for determining changes in relative elevation comparable in accuracy with the shore studies just referred to.

Among the more important improvements in apparatus made in the past ten years may be mentioned: (1) improvements in the precise leveling instrument, which many years of use had already shown to be the best instrument for its purpose in the world; (2) improvements in the precise level rods; and (3) improvements in the half-second pendulum apparatus and its auxiliaries intended to enable one to make the observations more rapidly and economically without any reduction of accuracy.

The brief statements which have been made show the character of the information given in the report, and some of the reasons why all who are interested in geodesy should have a copy. The report contains numerous especially well prepared maps showing the places at which each of the various classes of observations—astronomic observations, triangulation, gravity determinations, precise leveling—have been made. It also contains the best available summary, in several separate topical lists, of the bibliography of geodesy and closely related subjects in the United States in the past decade.

JOHN F. HAYFORD

SPECIAL ARTICLES

A HAPLOID MUTANT IN THE JIMSON WEED, "DATURA STRAMONIUM"

THE normal Jimson Weed is diploid (2n) with a total of 24 chromosomes in somatic cells. In previous papers[1] the finding of tetraploids (4n) with 48 chromosomes and triploids (3n) with 36 was reported, as well as unbalanced mutants with 25 chromosomes represented by the formula (2n + 1). The finding of two haploid or 1n plants, which we are now able to report, adds a new chromosomal type to the balanced series of mutants in *Datura*. This series now stands: 1n, 2n, 3n, 4n. Since a series of unbalanced mutants has been obtained from each of the other balanced types by the addition or subtraction of one or more chromosomes, it is possible that a similar series of unbalanced mutants may be obtainable from our new haploid plants, despite the great unbalance which would thereby result.

The haploid individuals were two from a number of plants of abnormal appearance secured in an attempt to induce chromosomal irregularities by the application of cold as a stimulus. The large amount of bad pollen consistently found in its flowers—80 per cent. and more empty grains have been counted—indicated, even before chromosome counts were made, that we were not dealing with a mutant of a previously known type. A detailed study of the assortment of chromosomes and of the possible breeding behavior is being undertaken. The cytological data so far as obtained, however, may be briefly summarized.

The late prophase, or metaphase, of the first division in pollen-mother-cells shows 12 unpaired chromosomes only. The cortex of the lateral roots also shows 12 chromosomes.

The 12 chromosomes in the pollen-mother-cell undergo a "reduction" into 3+ 9, 4+ 8, etc. These reduced groups divide in the second division forming usually 4 nuclei and subsequently 4 cells. The resulting young pollen grains with less than 12 chromosomes apparently all abort.

[1] SCIENCE, 1920, N. S. 52: 388-390; *Amer. Nat.*, 1921, 55; 254-267; *Amer. Nat.*, 1922, 56: 16-31.