and zoologists of the pure biological sciences, foresters and economic entomologists of the applied sciences, and climatologists and geographers, whose work is closely connected with ecology. Beginning with the study of statics, the description of conditions as they exist, the science progressed rapidly into dynamics, the investigation of the behavior of plants and animals and the development of the communities in which they live. Now, by refined observation and precise experiment, ecology seeks to discover the fundamental causes which control the natural existence of living things. As ecology has broadened in its scope, so also has it deepened; as it has included questions of greater and more fundamental biological importance, so has it attracted investigators in larger numbers and of greater ability; as the products of ecological research have become more numerous and more scholarly, so has the necessity grown for adequate means of publication.

Ecology, the official publication of the Ecological Society of America, is the latest addition to American biological periodicals. Yet it does not add to the number of scientific journals, for it is a continuation of the old and useful *Plant World,* which for several years has been largely ecological. At the St. Louis meeting of the affiliated scientific societies the Plant World Association most generously turned over its magazine, free from all liabilities, to the Ecological Society. But the new title, the new cover, the new volume number, the new editorial board, and above all the opening of its pages to articles on all branches of ecology, stamp it as a distinctly new periodical. *Ecology* begins its career under favorable circumstances. As the official organ of a growing society it is not wholly dependent on a subscription list for its financial stability. It is printed by the New Era Printing Company and managed through the Brooklyn Botanic Garden, the editorial control remaining with the society, undoubtedly fortunate arrangements. Its editorial board, headed by Major Barrington Moore, comprises fifteen men chosen from the leading ecologists of the country and representing a wide diversity of interests and activities.

The first two numbers set a high standard and illustrate the broad scope of the science. The editor-in-chief contributes a short article on the scope of ecology; Ellsworth Huntington correlates atmospheric conditions with the prevalence of influenza and pneumonia; A. E. Douglass describes a new method of correlating tree-growth with precipitation; C. E. Esterly describes experiments on the behavior of a copepod in relation to its diurnal migration; W. E. Praeger contributes a note on the ecology of herons; E. T. Wherry, using his new method of determining soil acidity, discusses the distribution of plants around salt marshes; and J. V. Hoffmann describes the establishment of a Douglas fir forest. In the second number E. B. Powers publishes the results of his experiments on the influence of temperature and concentration on the toxicity of salts to fishes; W. H. Burkholder discusses the effect of soil temperatures on healthy and diseased bean plants; C. C. Forsaith describes the anatomical reduction in alpine plants from the higher White Mountains; and there is presented the first part of an extensive report on the ecology of the plants and animals of Mount Marcy, New York, by Messrs. Adams, Burns, Hankinson, Moore and Taylor, comprising the committee on cooperation of the Ecological Society. From the foregoing it is evident that the first numbers contain material of interest to climatologists, marine biologists, zoologists, botanists, agronomists and foresters as well as to geographers, and even to the medical profession.

Ecology is an illustrated quarterly, octavo; a volume of four numbers will contain 300 or more pages.

H. A. Gleason

SPECIAL ARTICLES

CHROMOSOMAL DUPLICATION AND MENDELIAN PHENOMENA IN DATURA MUTANTS

There are 12 separate and distinct mutants of the Jimson weed (*Datura Stramonium*) which have recurred with more or less frequency in our cultures of this species during the past six years. The majority of these 12 mutants have been already briefly described or figured elsewhere.[1]

The twelve have certain characteristics which distinguish them from the normal stock from which they arose. They are of feebler growth than normals and have a relatively high degree of pollen sterility, while pollen from normals is relatively good with less than 5 per cent. obviously imperfect grains when examined in unstained condition. The breeding behavior of the twelve is peculiar in that the mutant character is transmitted almost entirely through the female sex. Usually about one quarter or less of the offspring only from a given mutant reproduce the parental mutant type. The pollen entirely fails to transmit the mutant character, or transmits it only to a small percentage of its offspring. This is concluded from the fact that normal female plants crossed with mutant pollen produce no mutant offspring or only a small percentage, and from the fact that the pollen of any of the 12 mutants seems to be no more potent in reproducing the mutants than pollen from normals.

Another type of mutant, provisionally called "New Species" because of the difficulty or impossibility of crossing it with normals has relatively good pollen and breeds true.

A study has been begun by the present authors of the relationship which exists in *Datura* between the cytological condition and the related phenomena of mutation and Mendelian inheritance. The cytological findings are based on counts of over 350 groups of chromosomes. We can confirm the report of others as to the presence of 12 pairs of chromosomes in the somatic cells of normal jimsons. The somatic number is accordingly twenty-four in contrast to the gametic number twelve. Chromosomal counts from the first division of pollen mother cells show that the gametic number in all the 12 mutants is apparently 12 and 13 giving a calculated somatic number of 25 instead of the 24 found in normals. Whereas in normals all the gametes have 12 chromosomes, in our dozen mutants presumably half the gametes have 12 and half have 13 chromosomes. Apparently in the 13-chromosome gamete the extra chromosome is brought in by a duplication of one of the regular twelve.

The suggestion lies near at hand that each of our 12 mutants is associated with, if not actually determined by, the duplication of a different individual chromosome to make up the calculated total of 25 characteristic of their somatic cells.

If each of our dozen mutants is characterized by the presence of an additional chromosome in a definite one of the 12 chromosome sets, it should be possible by breeding tests to identify the mutant which has as its extra chromosome the one which carries the gene for any particular Mendelian character. This we apparently have been able to do for two of the twelve sets.

The mutant *Poinsettia* (1) which appears to be caused by a duplication of one of the chromosomes carrying determiners for purple or white flower color will serve as an example. *Poinsettia* plants have 2 chromosomes in all the sets except in the one carrying the gene for flower pigmentation, which has three. Considering only the latter, we may have *Poinsettia* mutants, as regards their purple pigment, either triplex PPP, duplex PPp, simplex Ppp or nulliplex ppp.

A duplex purple *Poinsettia* with the formula PPp should, if the chromosomes assort at random, be expected to form egg cells of the following types: 2P + p + pp + 2Pp. The pollen grains should have the same constitution; but, since the *Poinsettia* character fails to be carried by the pollen to any significant extent, the effective male gametes are 2P + p. Combining male and female gametes in selfing we expect the following zygotes: 4PP + 4Pp + pp + 2PPP + 5PPp + 2Ppp. The zygotes with 2 chromosomes in the set are normals, the zygotes with 3 chromosomes are *Poinsettia* mutants. We should have

[1] Blakeslee, A. F., and Avery, B. T., "Mutations in the Jimson Weed," *Jour. of Heredity*, X., 111–120, Figs. 5–15, March, 1919.

therefore among the normals 8 purples to 1 white, and among the Poinsettias 9 purples to no whites. The expectation of an equal number of normals and mutants is practically never realized, probably because of differential mortality in early stages favoring the normals.

A simplex purple heterozygote with the formula Ppp should have the following female gametic formula: P + 2p + 2Pp + pp. Its effective male gametes should be P + 2p Selfing a simplex purple heterozygote therefore should give offspring showing a ratio of purples to whites in normals of 5:4 and in the *Poinsettias* of 7:2. Several *Poinsettia* plants of these two heterozygous purple types have been selfed and found to give color ratios in their offspring in close agreement with the calculated values above. When *Poinsettia* mutants are made heterozygous for the other known Mendelian factors, segregation occurs in normal manner giving the customary 3:1 ratio for the characters involved, in both normals and *Poinsettias.*

Two of the 12 mutants have each a single varietal type, which may be due to factors modifying the expression of the more typical complex. In addition two new mutant forms have arisen each of which in appearance seems to be a combination of two of the typical 12 recurrent mutants. It has not been possible as yet to count their chromosomes nor to study their breeding behavior.

We have discussed the duplication of a single chromosome from only one of the 12 sets, producing mutants with 25 somatic chromosomes, with 3 chromosomes in one set and 2 chromosomes in the other 11. We have obtained in addition the duplication of a single chromosome from each of the 12 sets producing a mutant triploid for all the 12 homologous sets.

The duplication may bring about a doubling of all the chromosomes, producing Gigas-like tetraploid mutants—the "New Species" type already mentioned. Such tetraploid plants have presumably 48 chromosomes in somatic cells and 24 in the gametes. From a study of the color ratios in over eight thousand offspring from tetraploid plants, it is possible to assert with some confidence that independent assortment of the chromosomes in the homologous sets of such tetraploid mutants is the rule. Selfed duplex purple heterozygotes throw 35 purples to 1 white, while the back-cross gives a ratio of 5:1. Simplex purple heterozygotes on the other hand give 3:1 ratios when selfed and 1:1 ratios when back-crossed.

Evidence is at hand which indicates that we may have plants with other of the theoretically possible combinations of chromosomes than those mentioned in the present paper.

The significance of the findings in *Datura* in relation to the peculiarities in inheritance in *Gigas* and other mutant types in *Œnothera* will be pointed out later. It is hoped that it may be possible to publish in the near future a series of more detailed papers on the phenomena of chromosomal duplication in the *Daturas.* The present preliminary publication will suffice to emphasize the distinction which must be kept in mind between chromosomal mutations and mutations affecting only single genes.

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The fat soluble A. vitamine and xerophthalmia: A. D. EMMETT and MARGUERITE STURTEVANT. The authors agree with McCollum that xerophthalmia is a disease which is due primarily to a lack of the fat-soluble A. vitamine. Experiments with rats fed on different planes of nutrition, all with the same precautions as to sanitation, eliminate the idea that xerophthalmia is primarily infectious as Bulley claims. The disease can not be cured by local treatment. It responds quickly to treatment *per os* with extracts containing the fat-soluble A. vitamine. It is not contagious. It is primarily a deficiency disease which in turn may bring about secondary infectious conditions.

Biochemical changes in the flesh of beef animals during partial starvation: C. R. MOULTON. Fat