GENETICAL SOCIETY OF GREAT BRITAIN

ABSTRACTS of Papers read at THE HUNDRED AND EIGHTH MEETING of the Society held on WEDNESDAY 2nd APRIL 1952, at the UNIVERSITY OF LEEDS

WHAT IS *GERANIUM ANEMONEFOLIUM*?

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G. anemonefolium L'Hér. is endemic to Madeira and the Canary Islands. Material was introduced into this country in 1778. Plants collected in Madeira in 1949 were found to have $2n = 128$, whereas the published number for the species is $2n = 68$. This new count prompted the assembling of material from various botanic gardens and commercial firms. These plants exhibit a wide range of morphology and fall into two groups cytologically, those with $2n = 128$ and those with $2n = 68$.

A plant obtained from Kew under the name "*G. canariense*" resembles a gigantic *G. robertianum*. It is an annual and lacks the caudex typical of *anemonefolium* but its chromosome number is $2n = 128$, double that for *G. robertianum* ($2n = 64$).

Nevertheless a culture obtained from the Royal Botanic Garden, Edinburgh, resembling the Madeiran type in many ways, shows 68 chromosomes, while another stock obtained more recently from the same garden belongs to the category with the higher chromosome number.

Intercrossing of the specimens has been started, with limited success. *G. robertianum* is included in the crossing programme. It seems fairly certain that *G. anemonefolium* would be better classified in the section Robertiana Boiss., rather than as the sole species of a section Anemonefolia.

CYTOTAXONOMIC STUDIES IN THE PLUMBAGINACEAE

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In the tribe Staticeae, dimorphism of pollen and stigmata is found and in one section of the genus *Limonium* this appears to be linked with heterostyly. A preliminary survey of the family followed by a detailed survey of *Limonium* on this basis and an experimental taxonomic study of *Armeria* have revealed the necessity of a chromosome-survey of the tribe. This is now in progress. Many species of *Armeria* have been investigated, and so far, all have been found to be diploid ($2n = 18$) including the very widespread *A. maritima* Willd. This is in striking contrast to the remaining genera. In *Limonium* (where previous cytological results have been shown to be quite unreliable) diploids on 6, 7, 8 and 9 have been found, together with tetraploids on the last three basic numbers. $3n$, and aneuploid $3n$ and $4n$ numbers occur in apomictic species. Generally there is good correlation with morphologically based taxonomy. *Goniolimon* and *Acantholimon* contain tetraploid species ($2n = 32$) while *Limoniastrum monopetalum* Boiss. is a very high polyploid.

Apomixis occurs in the sub-sections Densiflorae, Dissitiflorae and Steirocladae. Sexual species are $2n$ or $4n$. *Limonium lychnidifolium* O.K. ($2n = 25$) is believed to have arisen by hybridisation between the sexual *L. ovalifolium*

O.K. ($2n = 16$) and the apomoctic *L. binervosum* C.E.S. ($2n = 35$). The variable *L. binervosum* is being investigated in detail together with the allied " species " which appear to be endemic to the British Isles.

THE PRESENT PROGRAMME OF NEW WORK ON THE CYTOLOGY OF THE PTERIDOPHYTA

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THE PRESENT STATE OF WORK IN *ASPLENIUM* AND *POLYPODIUM*

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THE *DRYOPTERIS SPINULOSA* COMPLEX IN EUROPE AND AMERICA

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EXPRESSION OF GENES AFFECTING A QUANTITATIVE CHARACTER IN TWO DIFFERENT ENVIRONMENTS

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One of the most important problems in animal breeding research is the question of how far a change of environment will alter the effects of the different genes controlling a quantitative character, since this determines the extent to which improvement made by selection in one environment will carry over into a different environment.

Genotype-environment interactions (changes in gene effect with change of environment) have a place in most gene models of quantitative characters, but no attempt seems yet to have been made to measure their relative importance. A simple approach to this problem can be made by an extension of the idea of genetic correlation, if we consider only two contrasted environments, in each of which animals may be reared and measured. This consists in estimating, by means of progeny tests or selection experiments, the correlation between the values which the character would be expected to have in animals of identical genotype reared in the two environments. Such an estimate can be obtained by comparing the four regressions of offspring phenotype on mid-parent phenotype, when each is reared in the two environments, or by an analysis of variance and covariance of progeny means. The method is used in analysing data on body-size in *Drosophila melanogaster* reared at 18° and 25°.

GENETIC ANALYSIS BASED ON MITOTIC CROSSING-OVER IN HETEROZYGOUS DIPLOIDS OF *ASPERGILLUS NIDULANS*

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Strains of *Aspergillus nidulans*, having diploid nuclei in their vegetative cells (hyphae) and teraploid nuclei in the zygotes have been produced by means of Roper's technique (*Experientia*, 1952) and investigated for the occurrence of " mitotic " crossing-over. The results are that: (1) mitotic crossing-over and segregation occur in this species, with varying frequencies in different strains and under different conditions; (2) mitotic crossing-over can be used for mapping the chromosomes, including the location of centromeres; and (3) in *A. nidulans*, the available knowledge—gained *via* standard

genetic analysis based on sexual reproduction—has made it possible to compare the sequences of certain loci, inferred from mitotic crossing-over, with the sequences of the same loci established in the ordinary way and to find agreement between the two. Clearly, however, genetic analysis *via* somatic crossing-over, based as it is on segregation and recombination is valid *per se*. Thus species of this and many other groups of micro-organisms lacking a sexual stage are now open to genetic analysis, provided: (*a*) it is possible to produce heterozygous diploid nuclei, and (*b*) these diploid nuclei undergo mitotic crossing-over. As regards (*b*), the high frequency of mitotic crossing-over in certain cases in *A. nidulans* and its high sensitivity to as yet unanalysed external and internal conditions suggest that crossing-over is a more general and fundamental feature of chromosome duplication than was hitherto suspected. In a species like *Aspergillus*, not normally diploid, mitotic crossing-over occurs frequently when a chromosome is provided with a partner with which to cross over. Perhaps the evolution of the diploid stage in groups where it now extends over most of the life cycle has required side by side the evolution of mechanisms to reduce crossing-over in mitotic cells and confine it to meiosis in the germ cells.

A preliminary analysis has been carried out of three diploid strains, each heterozygous in varying combinations for three out of five linked genes (*w*—26—ad_1—21—ad_2—7—*y*—5—*bi*, in this order) and other non-linked genes. Further tests of recombination in recombinants for certain markers suggest, as expected, that homozygosis for one locus goes with homozygosis for the loci distal to it but not necessarily for those proximal, or on a different arm, or on a different chromosome. Mitotic crossing-over does not seem to occur at random among all nuclei, but rather to be concentrated in certain nuclei. The technique is obviously applicable to the controlled " breeding " of asexual organisms of industrial importance.

THE INFLUENCE OF MINUTES UPON SOMATIC CROSSING-OVER IN *DROSOPHILA*

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Four second chromosome Minutes, two located on the left arm and two located on the right, were chosen to study the Minute influence upon somatic crossing-over. It was demonstrated that the Minutes increase the frequency of crossing-over above the control rate. In general the influence is restricted to the arm of the chromosome in which the Minute is located. However, a left arm Minute, M(2)S5, located within or close to the heterochromatic block adjacent to the kinetochore influences the right and left arms of the second chromosome non-preferentially. Moreover M(2)S5 and M(2)Z, the second left arm Minute, influence the second chromosome differentially, the region within which crossovers occur most frequently differing in the two cases.

Heat treatment significantly increases the crossover frequency above the rate at 25°C. In the presence of Minutes and high temperature some crossovers occur that would not have taken place under either single condition.

A sex-linked Minute significantly increased the rate of crossing-over of the second chromosome control rate, and the sex chromosome in turn was influenced by the autosomal Minutes. Heat treatment decreased the frequency of X chromosome crossing-over in the presence of the sex-linked Minute.