

GENETICS SOCIETY OF AUSTRALIA

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UNIVERSITY OF QUEENSLAND

25-26 MAY 1961

SELECTED ABSTRACTS

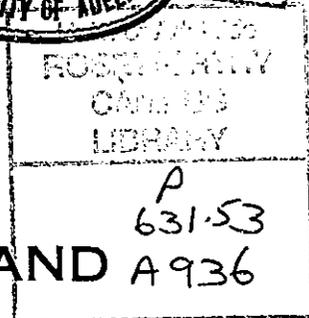
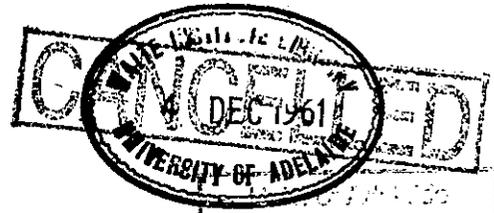
TITLES OF OTHER PAPERS

SCANNED FROM THE AUSTRALIAN

PLANT BREEDING AND GENETICS

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THE GENETICS SOCIETY OF AUSTRALIAConference - May 25th and 26th, 1961.A B S T R A C T SS.G. GRAY: Quantitative Inheritance in *Leucaena glauca*.

*Leucaena glauca* comprises a number of fairly uniform and stable varieties which may be grouped into three broad types differing in growth habit, vegetative vigour, and time of flowering. Inter-varietal differences are mainly quantitative.

Measurements of plant characters were analysed in order to define varietal differences and select parents for crossing.

A series of inter-varietal crosses has been made, using five varieties as parents.  $F_1$  progenies have been measured for size characters, and in a majority of observations the  $F_1$  means approximated the values for the higher parental lines. Heterosis occurred in some instances.

Growth type appears to be inherited on a monogenic basis, tallness being dominant or partially dominant.

Evidence for differences in combining ability is being examined in a diallel series. Comparison between  $F_1$ s and parental lines as measures of the potential value of crosses, is being studied.

Methods of assessing forage yield, and methods of selection for quantitative characters, are being studied in  $F_2$  and  $F_3$  material.

J.R. McWILLIAM: Interspecific Hybridization in *Phalaris*

The techniques and results of crossing *Phalaris tuberosa* and *Phalaris arundinacea* are presented. Also the cytogenetics and performance of the  $F_1$  hybrids and their allopolyploid derivatives are discussed in relation to the evolutionary significance, and their potential for plant improvement.

J. LANGRIDGE: A genetic and molecular basis for heterosis in *Arabidopsis* and *Drosophila*.

Experiments with *Arabidopsis* have shown that the degree of heterotic expression for a character is a function of the temperature. This is so, also, for the available experimental data from *Drosophila*. An explanation of heterosis, based on temperature-sensitive alleles has been formulated and tested with *Arabidopsis*.

J. LANGRIDGE: Experiments on the Evolution of Genes.

The evolution of the higher taxonomic groups requires the origin of new genes and new enzymes, as well as quantitative changes in the level of gene action and losses of genes by mutation. At present there is no knowledge as to how new genes arise, largely because bona fide examples of mutation involving qualitative changes in gene function have not been found. Preliminary experiments, designed to provide information on this question, have been made with the glycosidases of Escherichia coli.

H. DADAY: The action of a gene controlled enzyme in the evolution Trifolium repens L. populations.

The geographical distribution of Ac, Li gene frequencies in Trifolium repens was found to be correlated with the winter isotherms (Daday, Heredity, 1954, 1958). The present paper concerns the interaction between substrate (lotaustralin - Ac) and enzyme (linamerase - Li), its environmental sensitivity, its effect on the metabolic processes of cells and its relation to the mechanism of gene cline formation in T. repens.

J.C. SKINNER: Estimation of genetic variance caused by competition between varieties.

When the same sugar cane varieties were compared in three-row and in single-row (4 sett or single-stool) plots, the genetic variance for yield was greatly increased by competition in the single-row plots. A mathematical model representing competitive situations in plots of different sizes was used to partition the genetic variance for yield under competitive conditions ( $\sigma_G^2$ ) into a portion due to true yield in pure stands ( $\sigma_g^2$ ), a portion due to genetic differences in competitive ability ( $\sigma_c^2$ ) and a portion due to covariance between true yield and competition. That is,  $G = g + c$  and

$$\sigma_G^2 = \sigma_g^2 + \sigma_c^2 + 2r\sigma_g\sigma_c$$

$$27 = 15 + 5 + 7 \quad \text{for ratoon 54-sett plots}$$

$$99 = 15 + 59 + 25 \quad \text{for ratoon 4 sett plots}$$

The genetic correlation between true yield and competition ( $r$ ) was +0.42 in the above trial and ranged between + 0.19 and + 0.55.

Statistical methods for calculating missing plot values, optimum plot size, and ordinary significance tests are shown to be invalid for small plots unless competition is considered, and failure to consider the effects of competition may lead to serious errors in studies of biometrical genetics and selection.

R.W. DOWNES:            A Study of Variation in Height and Maturity in Timothy, Phleum pratense, in the United States.

Diallel crossing groups of superior timothy clones were set up. Crosses were made by permitting mutual pollination between pairs of clones under cages. Maturity differences among clones were considered to contribute to some self-fertilization when single crossing was attempted by this method.

Single-cross and S1 progeny from 1959 seed, as well as propagules of parent clones, were grown in the field. Each was represented by a population of 40 plants. These were evaluated for maturity and height in 1960.

Differences between reciprocal single crosses were detected by statistical tests applied to population means and variances. This indicated that single-cross progenies contained some selfed plants. However, the mean of reciprocal single crosses approximated the mid-parents values. This suggested that genes with additive action controlled expression of height and maturity.

Combining ability estimates were derived from single-cross means. Midparent values were also used to estimate combining ability of parent clones in terms of additive gene action. Deviations of single cross combining ability estimates from those based on midparents indicated the effect of non-additive gene action and selfed plants in progenies. This effect was small.

It was concluded that parental phenotypes give a good indication of the expected height and maturity of progeny and although some self-fertilization occurs when single crosses are attempted, it is not of great practical consequence.

H.W. LEA:                The Inheritance of Resistance to Blue Mould (*Peronospora tabacina* Adam) Within the Genus *Nicotiana*.

Blue Mould (*Peronospora tabacina* Adam) has been a serious disease of tobacco in Australia and America. In 1957 it appeared for the first time in Europe, and last year destroyed the major part of the crop there.

Attempts to produce commercially acceptable resistant varieties have until recently failed. This paper describes a study leading to the production of the world's first commercially acceptable resistant variety.

Only slight resistance has been found naturally in any variety of *N. tabacum* L. Results from attempts to produce resistant mutants by high frequency radiations have not been promising.

Immunity to high resistance to blue mould is known to exist in three species native to the American Continent and in more than nine

species which are indigenous to Australia.

Interspecific hybridisation between N. tabacum and seven resistant/species was effected. Excepting for N. gossei Lomin. resistance was found to be due to polygenic, partially dominant inheritance.

Resistant varieties, leaf of which has been accepted commercially, have been selected from the fourth backcross of N. tabacum variety Hicks with the amphidiploid N. debneyi-tabacum. Resistance appeared to be due to a major factor, and one or more other factors, and is partially dominant. Another line selected from the same pedigree but at the level of the third backcross had recessive resistance thought to be due to double recessive inheritance.

The commercial resistant varieties cytologically resemble tabacum var Hicks. There is no evidence of alien chromosome substitution. Very small segments of N. debneyi appear to have been translocated onto chromosomes of N. tabacum. Translocation and breaking up of undesirable characteristics linked with resistance was probably helped by the use of two very dissimilar varieties of N. tabacum, which probably have very different gene arrangements and chromosome structures.

D.E. BYTH:                    Photoperiodic Responses to a Range of Soyabean Genotypes.

The nine varieties included in this investigation were selected from a wide range of latitudinal origins and possessed very diverse types of plant growth and habit under field conditions in S.E. Queensland. These varieties were subjected to a range of photoperiodic treatments. Various plant characters were measured on each plant at the time of the appearance of the first flower.

In all the plant characters considered, significant differences were shown to exist between varieties and between photoperiodic treatments. In each case, the interaction of photoperiodic treatment and varieties was highly significant, indicating that varietal development was radically altered by small differences in the length of day.

Two distinct types of varietal response to photoperiod exist. The height of the plant at flowering was largely determined by two factors. These were the photoperiodic treatment and the time taken to reach flowering. The height at flowering was influenced by these factors to a different degree in the various varieties, one group of varieties being more greatly influenced by photoperiodic treatment while in the other group, the time taken to flower had a greater influence on height at flowering than did photoperiodic treatment.

These results suggest that a certain threshold was required before a flowering response could occur. In one group of varieties this

was attained early in development so that the flowering response to photoperiod could occur immediately. Conversely, in the other group of varieties, a proportionately longer time was necessary to reach this threshold with the result that the flowering response to photoperiod was delayed.

## 2. Titles of other papers presented.

- M.J.D. WHITE: (1) Problem of cytological races in Morabine grasshoppers.  
(2) Chromosome mechanics of some  $X_1X_2Y$  sex chromosome systems
- M. WASSERMAN: Non-random occurrence of inversion breaks in phyletic lines
- J. MARTIN: A sex-linked inversion in a species of Chironomid.
- J.W. JAMES: The spread of genes in random mating control flocks.
- G. McBRIDE: Some genetic aspects of social behaviour
- B. KINDRED: Maternal effects of Vibrissa growth.
- H.L. CARSON: Genetic conditions which promote or retard the formation of species.
- A.S. FOX: Heterochromatin; a new look at an old puzzle.
- C.I. DAVERN: The molecular basis of S. Bromodeoxyuride inhibition of the production of infective vaccinia in human tissue culture cells.
- F.E. BINET: Total additive genetic variance in the case of certain mating systems.