GENETICS SOCIETY OF AUSTRALIA

10TH ANNUAL GENERAL MEETING

UNIVERSITY OF QUEENSLAND

25-26 MAY 1961

PROGRAMME

INVENTORY OF PLANT AND
ANIMAL GENETICISTS AND
BREEDERS IN QUEENSLAND

ABSTRACTS

SCANNED FROM THE ORIGINAL

GENETICS SOCIETY OF AUSTRALIA

The meeting will be held in the Main Biology Lecture Theatre, Biology Building at the University of Queensland, at St. Lucia.

The Biology Building can be recognised as the only building (in the main D or circle) which is still under construction.

Telephone: 7 2021, Ext. 614

After Hours: 78 2574

G. McBride
Hon. Secretary

DR. R.D. BROCK   Meeting 10

THE GENETICS SOCIETY OF AUSTRALIA

10TH ANNUAL MEETING

25th - 26th May, 1961

SUBSCRIPTIONS for the 1961 Conference will be £1. This will cover morning and afternoon tea, supper and the social evening. Any surplus funds will be available for the incoming committee to cover pre-meeting expenses particularly postage.

TRANSPORT. Buses leave Roma Street for the University at St. Lucia, pass through King George Square and return to the centre of the city. The journey takes about 20 minutes each way.

All members booking accommodation through the Genetics Society are staying at Anzac House which is approximately 5 minutes' walk from the bus. (A taxi for 4 or 5 persons costs about the same as the bus).

AN INFORMAL DINNER will be held at the Cunningham Laboratory on Friday, 26th May at 7 p.m. All members and their wives are invited.

CAR TRIPS. Members of the Queensland Branch of the Society are arranging trips on Saturday, 27th May to enable visitors to see something of the country near Brisbane. North and South Coast beaches and rain forest areas may be visited. You are asked to notify the Secretary if you are interested.

ABSTRACTS. Copies of all abstracts received to date are enclosed. Speakers wishing to circulate copies of their talks or any tabular or other material are requested to supply these to the Secretary.

PROJECTORS. Speakers, please let the Secretary know what projection equipment is required for your talk.

G. McBRIDE
Hon. Secretary

Veterinary School,
ST. LUCIA, Brisbane.

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PROGRAMME

THURSDAY, 25TH MAY 1961

Chairman - Dr. W.R. Sobey

9.30 "Problem of cytological races in Morabine grasshoppers"

Professor M.J.D. White, Zoology Department, University of Melbourne.

9.55 "Experiments on the evolution of genes"

Dr. J. Langridge, C.S.I.R.O., Division of Plant Industry, Canberra.

10.20 Morning Tea.

Chairman - Professor L.D. Pryor

10.50 "The estimation of genetic variance caused by competition between varieties"

Dr. J.C. Skinner, Northern Sugar Experiment Station, Gordonvale, Queensland.

11.15 "Inter-specific hybridisation in Phalaris"

Dr. J.R. McWilliam, C.S.I.R.O., Division of Plant Industry, Canberra.

11.40 "Quantitative inheritance in Leucaena glauca"

Mr. S.G. Gray, C.S.I.R.O., Cunningham Laboratory, Brisbane.

12.05 "The inheritance of resistance to Blue Mould (Percuospera tabacina [Adam]), within the Genus Nicotiana.

Mr. H.W. Lea, Victorian Tobacco Growers Assn., Myrtleford, Victoria.

12.30 Lunch.

Chairman - Dr. R.N. Oram

2.00 "Non-random occurrence of inversion breaks in phyletic lines"

Dr. Marvin Wasserman (U.S.A.) C/- Zoology Department, University of Melbourne.

2.25 "A sex-linked inversion in a species of Chironomid"

Mr. Jon Martin, Zoology Department, University of Melbourne.

2.50 "The spread of genes in random mating control flocks"

Mr. J.W. James, Animal Husbandry Department, University of Queensland.

3.15 Tea.

3.40 "The effect of environment on response to selection for body weight in Tribolium castaneum"

Dr. H.W. McNary, Director of Poultry Husbandry, University of Sydney.

Chairman - Dr. R.N. Oram

4.05 "Maternal effects on Vibrissa growth"

Miss B. Kindred, C.S.I.R.O., Division of Animal Genetics, Sydney.

Chairman - Dr. E.M. Hutton

8.00 "Genetic conditions which promote or retard the formation of species"

Professor H.L. Carson, Washington University, St. Louis, Fulbright Scholar, Zoology Department, University of Melbourne.

FRIDAY, 26TH MAY

Chairman - Professor A.M. Clark

9.30 "Heterochromatin; a new look at an old puzzle"

Professor A.S. Fox, (University of Michigan), C/- C.S.I.R.O., Division of Animal Genetics, Sydney.

10.30 Morning tea

Chairman - Dr. D.L. Hayman

11.00 "The genetics of yield in soya beans"

Mr. D.E. Byth, C.S.I.R.O., Cunningham Laboratory, Brisbane.

11.25 "A study of variation in height and maturity in Timothy, Phleum pratense"

Dr. R. W. Downes, Department of Agriculture and Stock, Brisbane.

11.50 "The Action of a gene controlled enzyme in the evolution of Trifolium repens (L) populations"

Mr. H. Daday, C.S.I.R.O., Division of Plant Industry, Canberra.

12.15 "A genetic and molecular basis for heterosis in Arabidopsis and Drosophila"

Dr. J. Langridge, C.S.I.R.O., Division of Plant Industry, Canberra.

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2.25 "The molecular basis of S. Bromodeoxyuride inhibition of the production of infective vaccinia in human tissue culture cells"

Dr. C.I. Davern, C.S.I.R.O., Canberra (A.N.U.)

2.50 "Total additive genetic variance in the case of certain mating systems"

Dr. F.E. Binet, C.S.I.R.O., Poultry Research Centre, Werribee, Victoria.

3.15 Afternoon tea.

3.40 Business session.

4.40 Conclusion.

Informal Dinner at the Cunningham Laboratory,
St. Lucia.

INVENTORY OF PLANT AND ANIMAL GENETICISTS AND BREEDERS IN QUEENSLAND

Names	Projects	Location
	DEPARTMENT OF AGRICULTURE AND STOCK	
Mr. D. Rosser	Wheat breeding for yield, quality, and rust resistance.	Warwick.
Mr. R. F. Moore	Breeding hybrid sorghum.	Warwick.
Mr. J. A. Kerr	Breeding cowpeas and soya beans	Kingaroy.
Dr. R. W. Downes	Breeding and genetics of tropical pasture species.	Brisbane.
Mr. I. F. Martin	Breeding hybrid maize with special reference to resistance to cob rot and tropical rust.	Lawes.
Mr. H. M. Groszmann	Breeding French beans for stringlessness, disease resistance, and adaptation to cool conditions. Breeding passionfruit for disease resistance.	Brisbane.
Mr. G. W. J. Agnew	Breeding pawpaws for uniformity and productivity.	Nambour.
Mr. I. A. Bonner	Breeding tomatoes for seasonal production and resistance to wilt and nematode. Breeding strawberries for yield.	Redlands.
Mr. J. C. Johnson	Breeding French beans and tomatoes for combined disease resistance.	Brisbane.
Dr. G. I. Alexander	Inheritance of commercial characters in cattle with special reference to crosses with exotic breeds. Inheritance of bovine ocular squamous cell carcinoma.	Brisbane.
Mr. B. Moffat	Breeding poultry for commercial characters.	Animal Husbandry Research Farm, Rocklea, Brisbane.
Mr. C. P. McPhee	Testing animal breeding models using Drosophila. Social behaviour in beef cattle and genetic histories of pig breeds.	Animal Research Institute, Yeerongpilly, Brisbane.
	QUEENSLAND AGRICULTURAL HIGH SCHOOL AND COLLEGE, LAWES	
Mr. P. W. Grogan	Breeding hybrid maize with special reference to use of male sterility and resistance to lodging.	Lawes.
	BUREAU OF SUGAR EXPERIMENT STATIONS	
Mr. J. H. Buzacott	Breeding sugar cane for yield, sugar content, and resistance to disease and lodging.	Gordonvale.
Dr. J. C. Skinner	The genetics of quantitative characters in sugar cane.	Gordonvale.

INVENTORY OF PLANT AND ANIMAL GENETICISTS AND BREEDERS IN QUEENSLAND

Names	Projects	Location
	UNIVERSITY ZOOLOGY DEPARTMENT	
Dr. W. B. Mather, Mr. D. S. Angus, Miss R. Harlock and Miss R. Spurway	Evolutionary and population genetics of the genus *Drosophila* with special reference to:- (a) Chromosomal polymorphism in *Drosophila rubida*. (b) Speciation in *Drosophila serrata*. Teaching courses leading to a science degree given in Introductory Genetics, Genetics II, and Genetics III (advanced course in evolutionary, population, and biometrical genetics.) Final year Agricultural Science students specialising in plant breeding do Genetics II.	University, St. Lucia.
	UNIVERSITY ANIMAL HUSBANDRY DEPARTMENT	
Dr. G. McBride and Mr. J. W. James	Selection in poultry and *Drosophila*. Social behaviour in pigs, poultry, and cattle. Teaching course in animal genetics given to Veterinary and Agricultural Science students.	Veterinary Science School, St. Lucia.
Mr. U. Wyn Kyi	Inheritance of growth in poultry and genotype-environment interactions with antibiotics.	Veterinary Science School, St. Lucia.
	C.S.I.R.O. DIVISION OF TROPICAL PASTURES, CUNNINGHAM LABORATORY	
Dr. E. M. Hutton	Breeding and genetics of tropical pasture legumes with particular reference to the genera *Phaseolus*, *Glycine*, and *Indigofera*.	Mill Road, St. Lucia.
Mr. A. J. Pritchard	Cytogenetics and breeding in the genus *Sorghum* with special reference to *Sorghum almum*. Apomixis in *Paspalum*.	Mill Road, St. Lucia.
Mr. S. G. Gray	Breeding and genetics of the tree legume *Leucaena glauca*.	Mill Road, St. Lucia.
Mr. D. E. Byth	Breeding of summer pulse crops, with particular reference to inheritance of quantitative characters in the soya bean.	Mill Road, St. Lucia.
	UNIVERSITY BOTANY DEPARTMENT.	
Dr. H. T. Clifford	Experimental taxonomy of the Genus Banksia and Eucalyptus.	University, George St.
Dr. B. A. Barlow	Cytogenetical investigations in Australian wheat varieties.	University, George St.
Mr. T. A. Bull	Cytotaxonomy and phylogeny in Saccharum and allied genera.	University, George St.

THE GENETICS SOCIETY OF AUSTRALIA

Conference - May 25th and 26th, 1961

A B S T R A C T S

Quantitative Inheritance in *Leucaena glauca*.

- Mr. S. G. Gray, C.S.I.R.O., Cunningham Laboratory, Brisbane.

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_1s 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.

Chromosome mechanics of some X_1X_2Y sex chromosome systems.

- Professor M. J. D. White, University of Melbourne.

In early Tertiary times (probably in the Oligocene of Miocene) a translocation took place in a certain species of Praying Mantid. This was a translocation between a metacentric X chromosome and a metacentric autosome, and it converted an XO:XX sex chromosome mechanism into an X_1X_2Y: $X_1X_1X_2X_2$ one. Over 300 living species, included by taxonomists in at least 16 genera, are descended from that one species in which the translocation occurred.

In the X_1X_2Y species a trivalent is formed at meiosis in the male, in which the X_1R limb pairs with YL and the X_2L limb pairs with YR. Chiasmata are formed in very short distal pairing segments.

In the Australian species *Rhodomantis pulchella* a further translocation has occurred, between the tips of X_1R and X_2L, with survival of one of the original chromosomes and one of the

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In the Australian species Rhodomantis pulchella a further translocation has occurred, between the tips of X_1R and X_2L, with survival of one of the original chromosomes and one of the translocated ones. The effect of this is that X_1R and X_2L now both pair with the same limb of the Y, leaving the other limb free. The implications of this unique cytogenetic mechanism, from the standpoints of synapsis, chiasma formation and meiotic orientation will be discussed.

Genetic conditions which promote species formation.

- Dr. H. L. Carson, (C/- Department of Zoology, University of Melbourne.) Department of Zoology, Washington University, St. Louis, Missouri, U.S.A.

Selection may favor either the homozygous condition for a given allel or chromosomal structure (homoselection) or alternatively, it may favor the heterozygous condition (heteroselection). Homoselection appears to occur especially in natural populations which are small, inbred and have high recombination indices, such as marginal populations of continental polytpic species. The result is characterized by directional movement of gene frequencies and a tendency toward fixation of allels or chromosome structures in the homozygous condition. Genetic variability tends to be depleted and the population attains an adjustment based on genetically fixed adaptive features. Such divergent isolates provide ample opportunity for species formation. On the other hand, genetic adjustment through heteroselection leads to balanced polymorphism and stabilised gene frequencies. Under circumstances where dependence on heteroselection becomes partially or completely obligatory in a species, this condition will have a retarding rather than a promoting effect on species formation.

A sex linked inversion in a Chironomid.

- Mr. Jon Martin, Zoology Department, University of Melbourne.

An inversion in the third chromosome of the chironomid Ch. (Kiefferlurus) intertinctus was found to regularly show a frequency of heterozygotes in excess of 50 percent. When the material was sexed, the males were found to have a significantly higher frequency of heterozygotes than the females. It was also found that the common homozygote in the males was rare in females and vice versa.

An hypothesis to explain these results has been formulated.

Interspecific Hybridization in Phalaris.

- Dr. J. R. McWilliam, C.S.I.R.O., Division of Plant Industry, Canberra.

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.

The Effect of Environment on Response to Selection for Body Weight in *Tribolium castaneum*.

- Dr. H. W. McNary, Director of Poultry Research, Department of Animal Husbandry, University of Sydney.

Two populations of *Tribolium castaneum* were subjected to individual selection for increased body weight in two environments for nine generations. The experiment was replicated. Levels of relative humidity constituted the difference between environments. One population was selected at 70 ± 1 per cent relative humidity, the other at 40 ± 1 per cent relative humidity. A temperature of $91^{o} \pm 1^{o}$F. was maintained in both environments. These humidities were known to differ in their effect on the character body weight by about 10 per cent, body weight being greater in the higher humidity than in the lower. Population size and selection intensity were constant in populations within replications throughout the experiment.

Although selection was based on the ability to perform in only one environment, each population was tested in the opposite environment each generation. This was done by the use of pedigreed matings made each generation by choosing parents at random each generation from the populations under selection. These were manipulated in such a way that equal numbers of sibs were produced in the two environments. The procedure made possible an evaluation of performance in the opposite environment, intra-generation estimates of heritability based on variance components, heritability estimates by the technique of regressing progeny means on mid-parent values, examination of the genetic-environmental interaction through the sire-environment interaction, and estimates of genetic correlations, where performance in the two environments was regarded as two traits.

Good agreement between predicted and observed response to selection was obtained for those populations selected at 70 per cent relative humidity after a change in selection procedures produced relatively large selection differentials. Poor agreement for populations selected at 40 per cent relative humidity was largely attributable to inefficient selection procedures. Populations selected in the lower humidity gained as well in the higher humidity. The reverse was not true. Heritability of body weight was about the same in the two environments, being 48 per cent in the higher humidity and 44 per cent in the lower. Phenotypic variation in the lower humidity was roughly double that in the higher. Since heritability was about the same in the two environments, the conclusion is that the lower humidity would be the superior environment in which to select for increased body weight, regardless of which of the two environments might be used for rearing offspring.

A genetic and molecular basis for heterosis in Arabidopsis and Drosophila.

- Dr. J. Langridge, Division of Plant Industry, C.S.I.R.O., Canberra.

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

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Experiments on the Evolution of Genes.

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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*.

The action of a gene controlled enzyme in the evolution Trifolium Repens L. populations.

- Mr. H. Daday, C.S.I.R.O., Division of Plant Industry, Canberra.

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*.

The Problem of Cytological races in Morabine Grasshoppers

- Professor M.J.D. White, University of Melbourne

In at least six species of Australian Morabine grasshoppers we have the phenomenon of cytological races differing in respect of chromosomal fusions or dissociations or pericentric inversions in sex chromosomes. The evidence, although still incomplete, indicates that in these cases there is now, or was until human interference with the habitat, an exceedingly narrow zone of overlap between the two races. It is assumed that the zone of overlap is kept narrow by a combination of negative heterosis and low vagility. The chromosomal rearrangements concerned are assumed to have established themselves in the first instance in strongly isolated peripheral populations as a result of *homozygote* superiority. They are quite different in principle to rearrangements which give rise to balanced cytogenetic polymorphisms.

Estimation of genetic variance caused by competition between varieties.

- Dr. J.C. Skinner, Northern Sugar Experiment Station, Gordonvale, Queensland.

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

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$$\sigma^2_G = \sigma^2_g + \sigma^2_c + 2r\sigma_g\sigma_c$$

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

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

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.

The spread of genes in random mating control populations

- J.W. James, Department of Animal Husbandry, University of Queensland, Brisbane.

An expression is derived for the sampling variance of gene frequency in random mating control populations where the sampling is without replacement. The equation is rather complicated, but under the assumptions of constant size of breeding population and equality of sex ratio can be considerably simplified. The effective size of the population turns out not to be independent of the number of individuals available for sampling, but if this number is fairly large its effect may be ignored, and the effective size is approximately N + 1, where N is the effective size under sampling with replacement.

Changes in the proportions of genes from different ancestors as estimated from pedigrees are shown to be closely related to the effective population size.

The design of control populations is discussed in relation to the interaction of genetic drift and the error arising from sampling of phenotypes. Under some conditions genetic drift is a minor source of error.

The molecular basis of S. Bromodeoxyuride inhibition of the production of infective vaccinia in human tissue culture cells

- Dr. C.I. Davern, C.S.I.R.O., Canberra, (A.N.U.)

5-BUDR, an anolog of thymidine, where added to vaccinia infected K.B. cells prevents the production of infective particles. However, conjugated fluorescent-antibody partition the genetic variance for yield under competitive conditions (σ^2_G) into a portion due to true yield in pure stands (σ^2_g), a portion due to genetic differences in competitive ability (σ^2_c) and a portion due to covariance between true yield and competition. That is, G = g + c and

$$\sigma^2_G = \sigma^2_g + \sigma^2_c + 2r\sigma_g \sigma_c$$

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

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

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.

The spread of genes in random mating control populations

- J.W. James, Department of Animal Husbandry, University of Queensland, Brisbane.

An expression is derived for the sampling variance of gene frequency in random mating control populations where the sampling is without replacement. The equation is rather complicated, but under the assumptions of constant size of breeding population and equality of sex ratio can be considerably simplified. The effective size of the population turns out not to be independent of the number of individuals available for sampling, but if this number is fairly large its effect may be ignored, and the effective size is approximately N + 1, where N is the effective size under sampling with replacement.

Changes in the proportions of genes from different ancestors as estimated from pedigrees are shown to be closely related to the effective population size.

The design of control populations is discussed in relation to the interaction of genetic drift and the error arising from sampling of phenotypes. Under some conditions genetic drift is a minor source of error.

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5-BUDR, an anolog of thymidine, where added to vaccinia infected K.B. cells prevents the production of infective particles. However, conjugated fluorescent-antibody staining reveals that these cells produce virus specific protein, and that the viral DNA is capable of replicating after exposure to 5-BUDR. Indeed virus particles are formed in high yields.

Results are presented to show that vaccinia DNA incorporates 5-BUDR on replication, and that this incorporation, in addition to increasing the density of the DNA, probably leads to its fragmentation. These fragments, though capable of replication, only rarely, if at all, combine to form complete infective genomes.

On total additive genetic variance in the case of certain mating systems

- Dr. F.E. Binet, C.S.I.R.O., Poultry Research Centre, Werribee, Victoria.

Complementing the description of the manner of change of σ^2_H when F is changed but α and p are kept constant, an analogous description is given for σ^2_G. Three main kinds of this manner are shown to exist, viz: as F is increased, (i) σ^2_G might decrease throughout its entire range; (ii) decrease throughout small values of F and increase over the large values; (iii) increase throughout the entire range of F. It is shown that the conditions determining which of these alternative meanners is the relevant one are: (1) whether the more, or the less frequent allele is dominant; (2) the relationship between the degree of dominance and the difference of the frequencies of the alleles. It is noted that in the case of equal frequency of the two alleles (irrespective of the difference of the two frequencies) the manner denoted above by (iii) is the relevant one. For the cases, where the manner denoted by (ii) is relevant, the value of F at which the boundary between decrease and increase is placed, is determined by the two circumstances, denoted above by (1) and (2).

No assertion is made that the changes described take place under actual biological conditions in such a simple manner; it is practically certain that in most biological processes where F changes, a concomitant change of p and, possibly, sometimes also a change of α takes place. Nonetheless it is claimed that these descriptions contribute to the conceptual clarification of some aspects of biometrical population - genetics and of its applications.

Maternal effects on Vibrissa growth

- Miss B. Kindred, C.S.I.R.O., Division of Animal Genetics, Sydney.

Experiments in selection in the breeding of secondary vibrissae in the house mouse are being conducted on a stock in which the tabby and brown genes are segregating.

Maternal effects of mutant females on the vibrissa score of their progeny have been observed. These effects have been investigated in the selection stock, stock derived from it and tabby inbred backcross stock.

A Study of Variation in Height and Maturity in Timothy, Phleum Pratense.

- Dr. R. W. Downes.

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 some 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-parent 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.

The Inheritance of Resistance to Blue Mould (Peronospora tabacina Adam) Within the Genus Nicotiana.

- Mr. Harold W. Lea, Tobacco Growers' Association, Myrtleford, Victoria.

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 Domin. 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 N. 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.