GENETICAL SOCIETY OF AUSTRALIA

1ST ANNUAL GENERAL MEETING

UNIVERSITY OF SYDNEY

18-19 AUGUST 1952

PROGRAMME

NOTES ON FORMATION OF SOCIETY
INCLUDING OFFICE BEARERS

SELECTED ABSTRACTS

NOTES FROM ANZAAS SECTION K

SCANNED FROM THE AUSTRALIAN
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THE AUSTRALIAN PLANT BREEDING AND GENETICS NEWSLETTER

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NUMBER 1

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NOVEMBER 1952

taken in each State on this matter.

Are C.A.B. plant breeding abstracts located at each centre where plant improvement work is in progress? If not, what action is being taken?

Has a date and place for the next conference been decided? If so, it should be published in this Newsletter.

Unless specific and satisfactory answers can be given to these questions within the next issue or so of the Newsletter, we are in danger of having agreed to a series of resolutions that represent nothing but pious thoughts promptly to be forgotten. This Newsletter could be a very useful instrument in the hands of plant breeders and geneticists to ensure that adequate attention is being paid to their Conference resolutions. This, then, becomes a plea for action and information from correspondents and others interested.

G. M. E. Mayo

A.N.Z.A.A.S.

Editorial licence has been used to select certain features of this Association's most recent gathering in Sydney from 20 - 27th August.

1. The Genetical Society of Australia

On August 18th and 19th prior to the A.N.Z.A.A.S. meeting in Sydney, there was an informal gathering of geneticists and others interested in Genetics in the Veterinary Science Building of Sydney University, as the guests of Dr. J. M. Rendel.

The following papers were read and discussed:-

S. Smith-White	Cytology of Epacridaceae
F. Moewus	Induction of mutation in *Chlamydomonas*
O. H. Frankel	Sterility of basal florets in Speltoid wheat
M. Hutton	Physiological effects of polyploidy (see summary p. 26)
D. G. Catcheside	Genetics of *brevistylis* in *Oenothera*
A. S. Fraser	The first sex-linked gene in the house mouse.
I. A. Watson	Breeding for rust resistance in wheat - Is it worthwhile?
R. H. Hayman	Fleece rot
F.H.W. Morley	General and specific combining ability in poultry.
P.G. Schinckel	Inheritance of birth coat characters in merino sheep
P.R. MacMahon	Wool Survey
H. Turner	Reproduction and wool production in sheep.

In view of the success of the meeting the formation of a Genetical Society of Australia was discussed and agreed to. The following executive committee was appointed.

Dr. J. M. Rendel (Chairman)
Dr. O. H. Frankel
Prof. D. G. Catcheside
Dr. A. M. Clark
Dr. A. S. Fraser (Secretary)

The Society intends as a beginning, to hold meetings consecutively with A.N.Z.A.A.S.

D. G. Catcheside

2. Summaries of selected papers given to the Genetical Society

a. Induction of Mutation in Chlamydomonas by extracts of irradiated Chlamydomonas

by F. Moewus

Normal amphibian eggs were injected with Cytoplasm of irradiated eggs. Whilst controls showed no change, structural changes occurred in the nuclei of those treated.

In Chlamydomonas the ability to become motile is controlled by at least 12 genes. As soon as one gene mutates, immobility results.

Cells grown on agar were exposed to a dose of 10,000 r, ground with sand and distilled water and allowed to stand for 24 hours at 5°C. During this period peroxides produced by the irradiation should be destroyed by the catalase present. The extract was then centrifuged and filtered. Normal cells were treated with the filtrate. After 24 hours, 12,000 single cells were isolated and 2 -3 weeks later clones had grown to a visible size on agar. These were transferred to water and tested for motility.

Of 11,006 clone cultures obtained, 10,962 showed normal motility and 44 no motility. These 44 clones were subcultured and observed over 3 months. They were each crossed to a normal motile clone. Of 43 successful crosses, 42 segregated 1:1 with respect to motility. One gave a more complex ratio and may represent a double mutant.

A control experiment with 8375 clones gave no mutants so that the estimated induced mutation rate is 0.391%. In 1940 an experiment involving 1088 cells exposed directly to 6000 r gave 1 mutant, representing an estimated MR of 0.092%.

J. Mathieson

b. <u>Reduction Processes in Flower Fertility in Hexaploid Wheat</u>

by O. H. Frankel

A series of mutants in speltoid wheat with a reduction of the basal florets of the spikelet was described. Analogies between these mutants and progressive sterility phenomena in the family *Gramineae* were suggested. Recent genetic results - as yet incomplete - show that a complex multifactorial system, with incomplete dominance of fertility, is responsible for the sterility phenomena. It is suggested that basal sterility otherwise unknown in the *Hordeae* has evolved and has been retained as a "ghost" character under the protection of the *vulgare* segment in chromosome ix.

TABLE 1

F_2 (VULGARE X SPLETOID): SEGREATION FOR SPELTOID CHARACTER.

	OBSERVED			EXPECTED				
	V	Het.	Speltoid	V	Het.	Speltoid	X^2	P
$VxSt_F$	192	468	235	224	447	224	10.69	<0.01
$YxSt_F$	107	278	129	129	256	129	5.63	0.05
$BrxSt_F$	21	31	17	17	35	17	1.30	0.5
$RFxSt_F$	28	64	45	34	69	34	1.98	0.3
$VxSt_1$	284	561	247	273	546	273	7.41	0.02
$YxSt_1$	366	814	431	403	805	403	5.31	0.05
$BrxSt_1$	35	81	33	37	75	37	1.02	0.7
$RFxSt_1$	23	50	48	30	61	30	14.41	<0.01
$VxSt_2$	24	56	67	37	73	37	31.45	<0.01
$YxSt_2$	21	32	76	32	65	32	81.08	<0.01

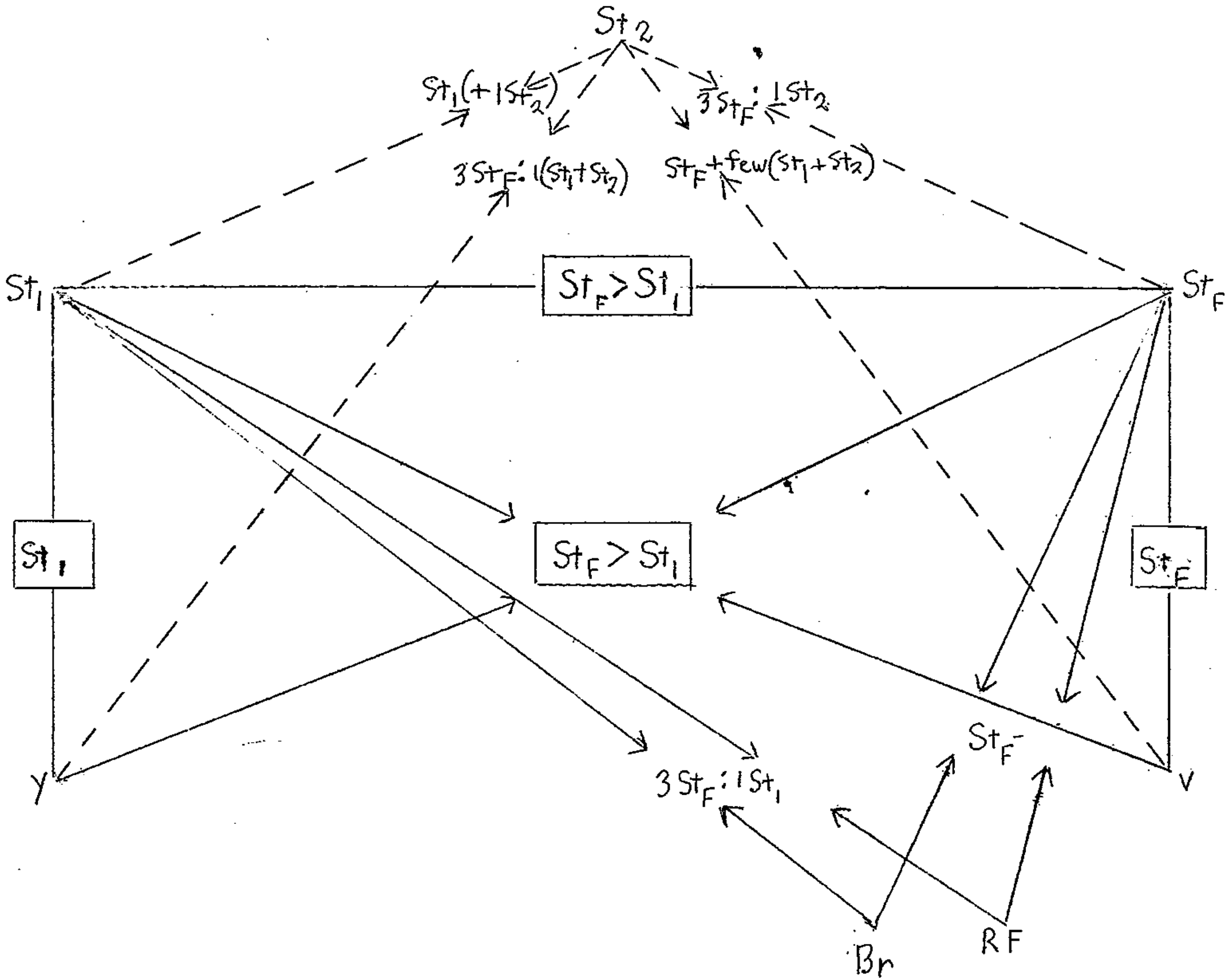
V Victor
Y Yeoman
Br Browick
RF Red Fife
St_F Speltoid, Basal fertile
St_1 Speltoid, first flower sterile
St_2 Speltoid, first & second flower sterile

TABLE 2. FERTILITY PER CENT. IN F_2 – SPELTOID FRACTIONS

Sterile ←——————————————————————————→ Fertile

ITS		0	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100
	1st	–	–	–	–	–	–	–	–	–	–	5	2
	2nd	–	–	–	–	–	–	–	–	–	–	2	5
	1st	–	–	–	–	–	–	–	–	–	–	5	3
	2nd	–	–	–	–	–	–	–	–	–	–	1	7
	1st	–	–	–	–	–	–	–	–	–	–	4	5
	2nd	–	–	–	–	–	–	–	–	–	–	2	7
	1st	–	–	–	–	–	–	–	–	–	1	4	5
	2nd	–	–	–	–	–	–	–	–	–	1	7	2
	1st	–	–	–	–	–	–	–	–	–	–	5	15
	2nd	–	–	–	–	–	–	–	–	–	–	3	17
	1st	10	13	5	1	–	–	–	–	–	–	–	–
	2nd	–	–	–	–	–	–	–	–	–	1	9	19
	1st	17	1	–	–	–	–	–	–	–	–	–	–
	2nd	–	–	3	3	2	7	1	2	–	–	–	–
2													
tF	1st	–	–	–	–	–	–	1	–	1	–	3	10
	2nd	–	–	–	–	–	–	–	–	1	–	5	9
tF	1st	–	–	–	–	–	–	1	1	1	4	14	14
	2nd	–	–	–	–	–	–	–	–	–	2	15	18
t_1	1st	1	2	1	–	–	2	5	–	1	–	7	11
	2nd	–	–	–	–	–	–	–	–	–	5	14	12
t_1	1st	2	6	3	1	2	–	1	1	3	3	9	11
	2nd	–	–	–	–	–	–	–	–	–	2	15	25
2	1st	2	–	1	–	1	–	1	2	3	8	24	19
	2nd	–	–	1	–	–	–	–	–	3	10	24	21
2	1st	9	–	–	–	2	2	1	–	–	1	16	22
	2nd	4	–	1	–	–	–	–	–	1	5	26	16
St_2	1st	13	3	2	1	4	2	7	3	10	18	22	9
	2nd	4	1	5	–	3	1	1	2	3	9	30	34
x St_2	1st	33	35	14	12	2	1	–	–	–	–	–	1
	2nd	–	–	1	–	–	–	–	–	2	15	47	34

F_2 OF SPELTOID CROSSES AND SPELTOID FRACTIONS OF VULGARE x SPELTOID CROSSES



O. H. Frankel

c. Genetics of brevistylis in Oenothera. by D. G. Catcheside

This gene, one of the classic mutations found by de Vries, is exceptional amongst those studied in Oenothera in showing segregation independently of either gametic complex in all complex interchange heterozygotes in which it has been studied. It has been located in the distal part of segment 12 of chromosome 11.12 by means of trisomic segregation tests, including the use of a tertiary trisomic. This location is confirmed by the phenotype of certain zygotes formed from non-disjunctional gametes produced by an interchange heterozygote.

D. G. Catcheside

d. Breeding for Rust Resistance in wheat - Is it worthwhile?
by I. A. Watson

The origin of new physiologic forms of rusts in Australia have so far been explained tentatively on the basis of mutation, but no such mutations have yet been produced in the laboratory. Designating the most recent "races", "biotypes" or what-have-you's as Nos. 1, 2, 3 and 4 and dividing the wheat-growing districts of N.S.W. broadly into "North" and "South", the distribution of isolates in the respective areas has been as follows:-

	1	2	1 and 2	3	4	3 and 4	Total
South	19	7	2	1	-	1	30
North	-	-	-	85	8	2	95

Since wheats of the Northern Areas are mainly of the resistant (or previously resistant) varieties, while those grown in the Southern areas are for the most part susceptible varieties (as rust is not such a major problem as in the North) the results of the survey lend weight to the hypothesis of mutation in the fungus (assuming type 1 → 2 → 3 → 4) accelerated by the "screening" effect or selective pressure caused by the widespread use of resistant varieties.

A series of experiments have been carried out inoculating a fully susceptible variety with a known mixture of rust races, and examining the composition of the rust population after 5 passages, the idea being to examine relative aggresiveness of races under conditions equally favourable to them all. Results were as follows:-

Composition of Original Inoculum		Composition of Inoculum after 5 passages	
Race 1	66%	72%	There were 3 separate experiments
Race 3	34%	27%	
Race 1	58%	74%	
Race 2	33%	25%	
Race 4	9%	1%	
Race 3	34%	95%	
Race 4	65%	5%	

The pathogenic range of race 4 > 3 > 2 > 1, and the results thus show no correlation between wider pathogenic range and ability to compete on a variety susceptible to all.

Suggestions for future breeding work were put forward,

(a) Concentrate on mature-plant resistance
(b) Use of genes operative over wide geographical areas against many different races
(c) Use of combined resistances rather than single genes

Logical objections to (a) might be that mature-plant res. might also succumb if exposed to a sufficient bulk of inoculum and to (b) that the Kenya 117A gene had a very wide geographical res., but broke down as soon as it was used in commercial varieties in Kenya Colony.

Each of the 4 latest types of rust can be explained on the basis of a single mutation from a previous type, and all 4 give similar reactions on Stakeman's 12 differentials.

M. V. Carter.

3. Summaries of selected Papers given to section K of A.N.Z.A.A.S.:-

a. Cereal Rusts by W. L. Waterhouse

Dealt first with general concepts of plant pathology, the interaction of a host, a parasite, and the environment.

Drew attention to various examples of environmental effects e.g. Effect of temperature and light on wheat stem rust infection; of powdery mildew infection of wheat altering stem rust resistance to susceptibility.

Occasional barberry plants do occur in N.S.W. and could be of great importance in the origin of new rust races.

The work carried out at Sydney University on wheat stem rust was briefly reviewed, the results of the wheat leaf and stem rust surveys over the period 1927 - 1951 were tabulated, and the changes in the rust strains present and their relative importance were pointed out.

The picture with oat stem rust is simpler as only four races are present.

In this work seven different mutations which resulted in changes in the pathogenicity of strains under observations have occurred. One of these mutations resulted in an additional change in the colour of the uredospor

The speaker suggested that work at present needing attention can be tabulated as follows:-

1. Life History studies

   (a) Uredospore: importance of latent infection
   (b) Germination of Teleutospores

2. Continuation of strain survey
3. Studies on the genetics of races.
4. Origin and production of mutations
5. Studies of what constitutes resistance

N. C. Crowley

b. Linseed Rusts by H. B. Kerr

A survey of physiological specialisation of Melampsora lini (Pers.) Lev. in Australia was commenced at Sydney University in 1940, using Flor's original series of 16 differential hosts, together with Argentines F_7 and F_{11}. Koto and a selection of Walsh were added recently.

The uredospores are stored in small glass phials at 3.5°C. Good germination may usually be obtained after eight months by floating the spores on an aqueous extract of linseed seedlings. A comprehensive storage test of several races at different temperatures and humidities emphasises the critical importance of humidity between 3.5°C and 10°C.

Fifteen races had been differentiated by 1949, when work was temporarily curtailed owing to suspected impurity of the differential hosts. Since then 3 major races have been detected, attacking Ottawa 770B, Walsh and Bolley Golden respectively.

Genetical studies of the differential series commenced in 1948 as a basis for future breeding work, confirm the major division of Australian rusts into two classes, Punjab-attacking (race A) and non-Punjab attacking (race K). The former have an extensive geographic and limited host range, and a capacity to survive and cause infection at high summer temperatures. The latter have had a restricted geographic range (none have been found among the few collections received from Queensland and N.S.W.), extensive host range, and cannot survive higher summer temperatures in the uredospore stage.

The resistance factors detected by Flor, using American rusts, also operate against race K. Additional factors not detected by Flor operate against race A rusts. Seed from F_1 plants back-crossed to the universally susceptible F_{257} is now used in preference to F_2 to reduce the amount of work and obtain a more uniform genetic background for the study of gene interactions.

The excised shoot technique has been adopted in all this work. Plants may be rapidly increased clonally, and tested with many races under standardised conditions, etc.

H. B. Kerr

c. Clover Rusts by B. D. H. Latter

The two principal clover rust species are *Uromyces flectens* (microcyclic) and *Uromyces trifolii* (macrocyclic). The latter is subdivided into 3 subspecies:-

Uromyces trifolii trifolii-repentis on White clover;
Uromyces trifolii fallens on Red and Zig-zag clovers;
Uromyces trifolii hybridi on Alsike clover

Five species of *Trifolium* have been found rusted in Australia.

Rust	Host species
1. *U. trifolii trifolii-repentis*	*Trifolium repens*
2. *U. flectens (repentis)*	*T. repens*
3. *U. flectens (fragiferi)*	*T. fragiferum*
4. *U. trifolii (glomerati)*	*T. glomeratum*
5. *U. trifolii fallens*	*T. pratense*
6. *U. trifolii subterranei*	*T. subterraneum*

Subterranean clover rust:- Samples were collected from 27 localities throughout the subterranean clover areas of Australia. Three physiologic races were differentiated, which give the following reactions on 7 subterranean clover varieties.

Test variety	Reaction to physiologic race		
	"A"	"B"	"C"
Clare	R	S-	R
Dwalganup	R-	S	R-
Madrid	S	S+	S
Mt. Barker	S+	S+	S+
Mulwala	I	I	I
Tallarook	S	S	S
Yarloop	R+	S+	R-

Only 3 of 70 subterranean clover varieties tested possess complete resistance to both races "A" and "B". These are Baulkamaugh North, Mulwala, and Wenigup.

B. D. H. Latter