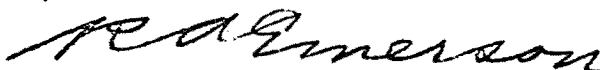


July 26, 1930

To Maize Geneticists :-

Earlier this year there were sent you chromosome maps based on a summary of linkage data in maize, but the summarized data could not be mimeographed in time to be of use to you before the planting season. Dr. Beadle now has these data ready and they are sent you with this to be added to the material sent earlier.

Sincerely,



R. A. Emerson

RAE:B

ENCLOSURES

LINKAGE DATA ON MAIZE

Note on Maps of Linkage Groups

On the map of the Ra Gl₁ linkage group, fr₂ is placed too far from gl₁. This distance should be about 10 units. A more probable location of the fr₁ gene is to the right of ij.

C - WX GROUP

ar	Argentia-finely striped leaf	Eyster 1929
au ₁	Aureau chlorophyll-yellow plant	Eyster 1929
au ₂	Aureau chlorophyll-yellow seedling	Eyster 1929
bp	Brown pericarp with a	Meyers 1927
C	Colored aleurone with A and R	East and Hayes 1911
d ₃	Dwarf plant	Suttle
de ₁₅	Defective endosperm	Brink 1927
gm _e	Germless ("gm ₁ " of Eyster)	Eyster 1929
I	Inhibitor for aleurone color	East & Hayes 1911
pk	Polkadot leaf	Eyster 1924
sh	Shrunken endosperm	Hutchison 1921
v ₁	Virescent seedling	Demerec 1924
v ₁₄	Virescent seedling	Phipps 1929
v ₁₅	Virescent seedling	Phipps 1929
w ₁₁	White seedling	Demerec 1926
wx	Waxy endosperm	Collins 1909
yg	Yellow-green plant	Jenkins 1927

Notes

- pk The 1929 data of Eyster on pk are not consistent with his earlier data. He makes the statement in his 1929 paper that pk and ar show relatively close linkage-- hence pk probably lies on the wx side of C.
- au₁ The location of au₁ to the right of sh is somewhat doubtful. Recombination values with C and sh are based on separate progenies. Neither au₁ or au₂ have been tested with yg for allelomorphism.
- v₁₄ Virescent-14 was shown by Phipps (1929) to be located in the C-wx group but his data was of such a nature that the location of the factor could not be determined.

Linkage Data

Genes X Y	Link. phase	Number of individuals					Recombina- tions		Authority
		X Y	X y	x Y	x y	Total	No.	%	
C Wx	R B	115	340	298	92	845	207	24.5	Bregger '18
	C B	858	310	311	781	2260	621	27.5	Bregger '18
	C B	371	115	125	397	1008	240	23.8	Kempton '19
	C B	2542	717	739	2710	6708	1456	21.7	Hutchison '22
						42511	9388	22.1	Stadler '25
					249663	67402	27.0	Collins &	
					302995	79314	26.2	(Kempton '27	
C Sh	C B	4032	149	152	4035	8368	301	3.6	Hutchison '22
	C B	10077	366	397	9866	20706	763	3.7	Eyster '29
	P B	638	21379	21096	672	43785	1310	3.0	Hutchison '22
					72849	2374	3.3		
Sh Wx	R B	1531	5991	5885	1488	14895	3019	20.3	Hutchison '22
F Sh	C B	9452	384	402	9377	19615	786	4.0	Hutchison '22
I Wx	C B	1487	584	547	1520	4138	1131	27.3	Hutchison '22
	R B	790	2217	2283	792	6082	1582	26.0	Hutchison '22
					10220	2713	26.6		
C V ₁	R B	300	676	711	294	1981	594	30.0	Demerec '24
Wx V ₁	R	70	84	40	3	197		7±	Demerec '24
C Pk	C S ¹	128	6	54	56	244		2	Eyster '24
	C S ²	148	5	128	92	373		2	Eyster '24
Sh Pk	R S ³	140	61	60	2	263		10	Eyster '24
	R S ³	382	173	173	11	739		24.5	Eyster '29
	R B ³	73	363	366	70	872	143	16.4	Eyster '29
Sh D ₃	R S	329	162	138	8	637		22.8	Demerec '26
	R S	268	112	144	20	544		33.2	Burnham
Wx D ₃	R S	265	132	147	0	544			Burnham
Sh W ₁₁	R S	487	193	161	16	857		31.2	Demerec '26
	C S	320	26	25	67	438		13.4	Demerec '26
Wx W ₁₁	R S	496	268	315	1	1080		5	Burnham
C Yg	C S					30817		20.5	Jenkins '27
	R S					3885		23.0	Jenkins '27
	R B	10	57	52	7	126	17	13.5	Jenkins '27
Sh Yg	R B	193	546	429	99	1267	292	23.0	Jenkins '27
	R S	2583	1212	1057	89	4941		28.6	Jenkins '27
Wx Yg	C B	397	289	297	412	1395	586	42.0	Jenkins '27
	R B	78	120	136	80	414	158	38.2	Jenkins '27
						1809	744	41.1	Jenkins '27
De ₁₅ Wx	C S	4075	461		1609	6145		19.4	Brink '27
De ₁₅ Sh	R S	2449	1146		1237	4832		16.5	Brink '27
Wx Bp	R B	9	56	49	9	123	18	14.6	Meyers '27
C Ar	R B ⁴	2178	4692	4166	1507	12543	3685	29.4	Eyster '29
Sh Ar	R B ⁴	1925	4763	4177	1221	12086	3146	26.0	Eyster '29
Sh Au ₁	C S	2108	311	310	492	3221		21.6	Eyster '29
C Au ₁	C S ¹	546	79	638	305	1568		26.5	Eyster '29
Sh Au ₂	R S ³	340	133	146	10	629		28.0 ⁵	Eyster '29
Sh Gm ₁	C S	2693	301	258	702	3954		15.3	Eyster '29
Wx V ₁₅	R S ³	297	128	139	2	566		19	Phipps '29
Sh V ₁₅	R S ³	366	171	172	5	714		20	Phipps '29
Sh V ₁₄	R S	768	387	307	16	1478		21.4	Beadle
Wx V ₁₄	R S	812	352	263	51	1478		39	Beadle

Notes

- 1 C and R segregating - 9:7 ratio
- 2 A, C and R segregating - 27:37 ratio
- 3 Ratio corrected for germination by author
- 4 See Three-point test data
- 5 Recombination value recalculated - author's calculation given as 39.7.

R-G₁ GROUP

List of Genes

df	Flint defective	Lindstrom 1925
g ₁	Golden plant	Emerson 1912
gm ₂	Germless	Demerec 1926
l ₁	Luteus seedling	Lindstrom 1917
l ₂	Luteus seedling	Lindstrom 1925
l ₄	Luteus seedling	Jenkins & Bell
li	Lineate leaves	Kempton 1920
Mt	Mottled aleurone ("S" of Kempton)	Kempton 1919
nl	Narrow leaf	Emerson
pg ₁	Pale green seedling	Brunson 1924
R	Aleurone color	East & Hayes 1911
v ₁₈	Virescent seedling	Phipps 1929
v ₂₀	Virescent seedling	Phipps 1929
w ₂	White seedling	Carver 1924

Linkage Data

Genes X Y	Link. Phase	Number of individuals						Recombina- tions		Authority
		X Y	X y	x Y	x y	Total	No.	%		
R G ₁	C B	200	55	58	174	487	113	23.2	Lindstrom '17&'18	
	C B	121	25	50	117	313	75	24.0	Lindstrom	
	C B	644	60	90	550	1344	150	11.2	Emerson	
	R B	29	81	86	18	214	47	22.0	Lindstrom '18	
	R B	114	612	635	120	1481	234	15.8	Emerson	
R L ₁	C S	303	2	5	121	431		1.6	Lindstrom '21	
G ₁ L ₁	R B	8	35	21	5	69	13	18.8	Lindstrom '18	
R Pg ₁	C S ²	1907	300	1053	686	3946		23.3	Brunson '24	
	R S	1199	506	445	32	2182		27.2	Brunson '24	
G ₁ Pg ₁	C S	628	59	57	146	890		14.6	Wentz	
Li ₁ Pg ₁	R S	194	71			265		45	Brunson '24	
R W ₂	C S	1329	171	202	402	2104		18.5	Carver '24	
	C S	648	74	81	157	960		17.8	Lindstrom '24	
	C S	2095	197	228	437	2957		16.6	Lindstrom	
	R S	43	16	22	2	83		30.8	Carver '24	
W ₂ L ₁	R S		815	210	10	1035			Lindstrom '25	
	R S ³		585	348	84	1017			Lindstrom '25	
	R S ⁴		560	318	70	948			Lindstrom '25	
	R S ⁵		380	402	115	897		22.0	Lindstrom '25	
W ₂ G ₁	R S	1424	651	605		2680		25.0	Lindstrom	
R L ₂	C S ²	837	197	582	277	1893		35.4	Lindstrom '25	
	C S	1277	270	323	247	2117		33.0	Lindstrom	
	R S	986	405	433	69	1893		33.9	Lindstrom '25	
	R S	1254	553	596	75	2478		33.0	Lindstrom	
L ₂ G ₁	R S	1904	673	866		3443		41.0	Lindstrom	
W ₂ L ₂	R S	935	420	328		1683		25.0	Lindstrom	
R Gm ₂	R S	2239	784	976	84	4083		31	Demerec '26	
	R S	6876	2947	1182	90	11095		27	Wentz	
Gm ₂ G ₁	R S	2810	873			3683		50 ±	Wentz	
Gm ₂ Pg ₁	R S	835	255			1090		50 ±	Wentz	
R V ₁₈	C ⁶	51	15	43	93	202		20	Phipps '29	
R V ₂₀	C B ⁶	77	10	80	152	319		12.5	Phipps '29	
G ₁ Li ₁	R B	148	817	924	111	2000	259	13.0	Hutchison	
	C B	222	45	50	211	528	95	18.0	Lindstrom	
						2528	354	14.0		
R Li ₁	C B	208	74	86	138	506	160	31.6	Hutchison	
	C B ⁶	460	191	282	374	651 ⁷	191	29.3	Hutchison	
G ₁ NI	C B	262	100	74	281	717	174	24.3	Emerson	
	R B	196	761	831	129	1917	325	17.0	Emerson	
						2634	499	18.9		
R NI	C B	385	164	199	316	1064	365	34.2	Emerson	
	R B	142	348	356	163	1009	305	30.2	Emerson	
						2073	670	32.3		
R L ₄	C S	471	114	101	68			36	Jenkins & Bell	
	R S	612	239	247	39			37	" "	
W ₂ L ₄	C S	3217	772	1196				35	" "	
	R S	2928	1536	1606				40	" "	
L ₂ L ₄	R S	1156	963					43	" "	

Notes

- 1 1918 data indicate complete linkage
 - 2 C and R segregating - 9:7 aleurone ratio
 - 3 w_1 and w_2 segregating
 - 4 w_2 and w_3 segregating .
 - 5 w_1 , w_2 and w_3 segregating
 - 6 C and R segregating
 - 7 First two classes only.
- df Lindstrom states that df and w_2 are very closely linked but presents no data.
- S Kempton (1919) postulated this spotting factor, located so as to give about 12.5% recombinations with R. Emerson (Unpub.) has additional evidence in support of this assumption.

SU - TU GROUP

List of Genes

de ₁	Defective endosperm	Mangelsdorf & Jones 1925
de ₁₆	Defective endosperm	Wentz 1925
Ga	Gamete - pollen tube growth	Mangelsdorf & Jones 1925
gl ₃	Glossy seedling	Hayes & Brewbaker 1928
S ₁	Colored scutellum	Sprague
su	Sugary endosperm	East & Hayes 1911
Ts ₅	Tassel-seed	Emerson
Tu	Tunicate ear	Collins 1917
v ₈	Virescent-seedling	Demerec 1926
wl	White-base leaf	Stroman 1925

Linkage Data

Genes X Y	Link. Phase	Number of individuals						Recombina- tions		Authority
		X Y	X y	x Y	x y	Total	No.	%		
Su Tu	C S	113	4	7	25	149		8.3	Jones & Gallas- tegui '19 Eyster '21 Emerson Eyster '22 Emerson	
	C B	430	175	169	406	1180	344	29.1		
	C B	749	341	244	664	1988	585	29.4		
	R B	1031	2498	2093	807	6429	1838	28.6		
	R B	63	215	164	57	499	120	24.0		
						10106	2887	28.6		
Su Wl	R S	44	19	11	1	75		25.0	Stroman '24 Carver '27	
	R S	4492	2018	1961	93	8564		22.0		
De ₁₆ Su	C S	20622	453		7201	28276		3.2	Wentz '25	
Su v ₈	C S	940	214	179	148	1481		32.4	Demerec '26	
v ₈ Tu	C S	450	1	Lethal		451		<1	Phipps	
De ₁ Su	R S	601	238	247	64	1150		39	Mangelsdorf & Jones '25	
Su Ts ₅	C B	657	102	51	522	1331	153	11.5	Emerson Emerson	
	R B	18	344	178	60	600	78	13.0		
						1931	229	11.9		
Ts ₅ Tu	C B	147	62	69	138	416	131	31.5	Emerson Emerson	
	R B	49	166	115	48	378	97	25.7		
						794	228	28.7		
Su Gl ₃	R B	78	271	255	82	686	160	23.3	Thomas	
Tu Gl ₃	C B	1093	107	168	1195	2563	275	10.7	Thomas	
Su S ₁	R B	141	221	229	130			37.6	Sprague	

Notes

- de₁₆ is used instead of de_{su} for sugary defective of Wentz.
- v₈ is very near Tu but whether to the left or right is unknown.
- Ga is to the left of su because it disturbs the Tu-tu ratio very little if at all in pedigrees in which it disturbs the Su-su ratio materially (Emerson Unpub.)
- de₁ is presumably to the left of Ga, because Ga is between de and su (Mangelsdorf and Jones 1925).

B-LG GROUP

List of Genes

B	Intensifier of plant color	Emerson 1918
fl	Floury endosperm	Hayes & East 1915
gl ₂	Glossy seedling	Hayes & Brewbaker '28
lg	Liguleless	Emerson 1912
sk	Silkless	Jones 1925
ts ₁	Tassel-seed	Emerson 1920
v ₄	Virescent seedling	Demerec 1924

Linkage Data

Genes X Y	Link. phase	Number of individuals				Total	Recombina- tions		Authority
		X Y	X y	x Y	x y		No.	%	
B Lg	C B	240	134	102	243	719	236	32.8	Emerson '18
	C B	642	291	282	620	1835	573	31.2	Emerson
	C B	2487	1469	1557	2609	8122	3026	37.2	Emerson & Hutchison '21
	R B	498	1085	1037	504	3124	1002	32.1	Emerson
						13800	4837	35.0	
B Ts ₁	C B	259	78	91	205	633	169	26.7	Emerson
	R B	30	106	159	20	315	50	15.9	Emerson
						948	219	23.1	
Lg Ts ₁	C B	117	52	72	74	315	124	39.4	Emerson
	R B	51	65	64	42	222	93	41.9	Emerson
						537	217	40.4	
B V ₄	C B	113	24	21	110	268	45	16.8	Demerec '24
V ₄ Lg	R B	412	501	521	366	1800	778	43.2	Demerec '24
	C B	292	216	203	299	1010	429	42.5	Beadle
						2810	1207	42.9	
B Sk	C B	993	78	30	928	2079	158	7.6	Anderson '29
	C B	339	19	26	298	682	45	6.6	Anderson
	R B	2	82	66	6	156	8	5.1	Anderson
						2917	211	7.2	
Lg Sk	R B	187	288	315	167	957	354	37.0	Anderson '29
	C B	148	60	67	133	408	127	31.1	Anderson
						1365	481	35.2	
Lg Gl ₂	R B	163	678	697	175	1713	338	19.7	Hayes & Brew- baker '29
Ts ₁ Gl ₂	R S	1191	450	435	48	2124		33.2	Hayes & Brew- baker
Gl ₂ Fl	R B	175	426	388	139	1128	314	27.8	Hayes & Brew- baker '29
B Fl	C B	607	109	142	593	1451	251	17.3	Beadle
	C B	135	41	33	136	345	74	21.4	Burnham
						1796	325	18.1	
Lg Fl	R B	376	417	453	339	1585	715	45.1	Hayes & Brew- baker
									Beadle
			210	285	320	195	1010	405	40.1
						2595	1120	43.2	
Ts ₁ Fl	R S	232	404	159	10	805		6.2	Hayes & Brew- baker
V ₄ Fl	R B	78	430	452	50	1010		12.7	Beadle

Y - PL GROUP

List of Genes

al	Albescent	with	Phipps
Bh	Slotched aleurone/ A c R i		Emerson
fi	Fine streaked leaves		Anderson 1922
ms ₁	Male sterile		Singleton & Jones
Pl	Purple plant color		Emerson 1918
sb	Slit Blade		Beadle 1930
sm	Salmon silks		Anderson 1921
v ₆	Virescent seedling		Carver 1927
v ₇	Virescent seedling		Carver 1927
w ₁	White seedling		Stroman 1924
w ₅	White seedling with w ₆		Demerec 1924
w ₆	White seedling with w ₅		Demerec 1924
y ₆	Yellow endosperm		Correns 1901

Linkage Data

Genes X Y	Link. phase	Number of individuals					Recombina- tions		Authority
		X Y	X y	x Y	x y	Total	No.	%	
Y Pl	C B	79	22	28	71	200	50	25.0	Emerson '18
		545	221	234	506	1506	455	30.2	Anderson '21
	R B	80	51	30	55	216	81	37.5	Anderson
		173	46	59	176	454	105	23.1	Hutchison
		367	880	897	372	2516	739	29.4	Anderson '21
		135	398	374	118	1025	253	24.7	Anderson
						5917	1683	28.5	
Pl Sm	C B	1076	145	146	994	2361	291	12.3	Anderson '21
		84	1014	971	76	2145	160	7.5	Anderson '21
						4506	451	10.0	
Y Fi	C B	353	0		many				Anderson '22
Y w ₅	C S	250	37	35	54	376		24.3	Demerec '23
Y (w ₅) (w ₆)	s ¹	349	12	60	33	454		(24.3)	Demerec '23
								(24.5)	
Y w ₁	C S	1020	237	259	191	1707		35	Lindstrom '24
	C S	1132	321	347	175	1975		42	Stroman '24
	R S	456	181	186	41	864		42	Stroman '24
Y v ₆	R S	467	225	209	12	913		23	Carver '27
Y v ₇	C S ₂	592	149	178	79	998		42	Carver '27
	C S ₂	445	277	106	116	944		36	Carver '27
v ₆ v ₇	R S	497	179	237		913		42	Carver '27
Bh Y	C B	144	51	118	210 ³	523	169	32.3	Anderson
Bh Pl	C B	58	1	26	47 ³	132		1.7 ⁴	Anderson
Y Al ⁵	C S	809	175	144	202	1330		26.5	Phipps
Pl Al	C S	166	25	126	31				Phipps
Y Ms ₁	C B					308	13	4.2	Singleton & Jones
						118	6	5.1	
	R B					426	19	4.5	
Pl Ms ₁	C S	73	15	14	18	120		27	Singleton & Jones
Ms Sb	C S	530	21	54	136	741		10	Beadle '30
Y Ms	R S	323	137	120	4	584		19	Beadle '30
Y Sb	R S	347	99	114	14	574		38	Beadle '30
Pl Sb	C B	91	76	76	65	308	152	49.4	Beadle '30
Y Si	R S	463	222	205	4	894		13.8	Fraser
Pl Si	C S	155	16	33	29	233		24.0	Fraser

Notes

- 1 w_5 and w_6 duplicate genes
- 2 Segregating for another v - not linked
- 3 Probably part of this class actually Bh
- 4 From Bh class
- 5 F_2 data in coupling

m_1)
 m_2) Stroman presents data which he interprets as showing linkage between m_1 and m_2 and also between m_1 and Y. His data are sufficiently extensive only to suggest that these factors may belong to this linkage group.

P - BR GROUP

List of Genes

ad	Adherent	Kempton 1921
an	Anther ear	Emerson & Emerson 1922
br	Brachytic	Kempton 1920
f ₁	Fine striped	Lindstrom 1918
gs	Green striped	Emerson 1912
P	Pericarp and cob color	Lock 1906
ts ₂	Tassel-seed	Emerson 1920

Linkage Data

Genes X Y	Link. phase	Number of individuals					Recombina- tions			Authority
		X Y	X y	x Y	x y	Total	No.	%		
P Ts ₂	C B	81	0	0	77	158	0	0.0	Emerson '20	
		1219	15	14	1174	2422	29	1.2	Emerson	
	R B	258	4	7	259	528	11	2.1	Brunson	
		0	94	92	2	188	2	1.0	Emerson	
						3296	42	1.3		
P Br	C B	204	153	154	165	676	307	45.4	Emerson	
		508	397	432	518	1855	829	44.7	Brunson	
	R B	70	71	76	44	271	124	45.8	Emerson	
								2802	1260	45.0
Ad Br	R S	217	91	85	4	397		22.2	Kempton '22	
	R B	86	188	178	71	523	157	30.0	Kempton '22	
P F ₁	C B	318	107	175	248	848	282	33.3	Emerson	
	C B	359	284	325	359	1327	609	45.9	Brunson	
	C B	125	77	111	89	402	188	46.8	Lindstrom	
	R B	85	132	163	77	457	162	35.5	Emerson	
						3024	1241	41.0		
Br F	C B	197	10	9	210	426	19	4.5	Emerson	
		636	33	48	610	1327	81	6.1	Brunson	
	R B	18	325	320	13	677	32	4.7	Emerson	
						2430	132	5.4		
Br Ts ₂	C B	146	125	119	138	528	244	46.2	Brunson	
F ₁ Ts ₂	C B	331	177	123	266	897	300	33.4	Emerson	
	R B	136	247	199	110	692	246	35.5	Emerson	
						1589	546	34.4		
Br An	R S	526	255	273	18	1042		25	Collins & Kempton	
		300	91	134	1	426		11	Emerson	
An P	R B	78	92	72	57	299	135	45.2	Emerson	
An G ₉	R B	5	14	15	2	36	7	19.4	Anderson	
	R S	915	312	271	16	1514		27	Emerson	
	R S	458	147	183	9					
	C S	24	2	8	6	40		23	Emerson	
						193		9	Emerson	
Br G ₈	R S	116	41	56	3	216		25	Emerson	

1

21 gs plants not classified for anther ear.

RA-GL₁ GROUP
List of Genes

Bn	Brown aleurone	Kvakan 1924
fr ₁	Frayed-1	Jenkins & Pope
fr ₂	Frayed-2	Jenkins & Pope
gl ₁	Glossy seedling	Kvakan 1924
ij	Iojap	Jenkins 1924
in	Intensifier of aleurone	Fraser 1924
pg ₃	Pale-green seedling	Demerec 1925
ra	Ramosa	Gernert 1912
sl	Slashed seedling	Brewbaker 1929
sr ₂	Striate (Same as iojap)	Brunson
v ₅	Virescent seedling	Demerec 1924

Linkage Data

Genes X Y	Link. Phase	Number of individuals						Recombina- tions		Authority
		X Y	X y	x Y	x y	Total	Nc.	%		
Bn Gl ₁	C B	177	63	54	192	486	117	24.1	Kvakan '24	
	C B	81	32	32	81	226	64	28.3	Beadle	
						712	181	25.4		
Gl ₁ V ₅	C B	106	9	6	120	241	15	6.2	Kvakan '24	
	C B	235	22	24	259	540	46	8.5	Beadle	
						781	61	7.8		
Bn V ₅	C B	83	31	29	98	241	60	24.9	Kvakan '24	
	C B	78	35	35	78	226	70	31.0	Beadle	
						467	130	27.8		
Bn Ra	C B	169	104	100	161	534	204	38.2	Kvakan '24	
Bn Pg ₃	C S	203	8	5	65	281		4.5	Demerec '25	
Y ₂ Gl ₁	C S	558	143	183	100	984		38.5	Hayes&Brewbaker '26	
Yp Gl ₁	C S	1351	188	225	375	2139		20.5	Hayes&Brewbaker '26	
Gl ₁ Sl	R B	313	860	1014	220	2407		22.1	Brewbaker	
Bn Sl	C B	1437	243	256	1403	3339	599	17.9	Brewbaker	
Ra Sl	R B	445	1157	1312	289	3203		29.7	Brewbaker	
Gl ₁ Ij	R B	97	289	342	63	791	160	20.2	Brunson	
	R B	11	63	63	12	149	23	15.4	Jenkins & Pope	
	C S	334	30	55	71	490	183	19.5	Jenkins & Pope	
Ra Ij	R B	251	1792	2004	180	4227	431	10.2	Jenkins & Pope	
Gl Fr ₁	C BS	454	62	271	196	893		17.8	Jenkins & Pope	
	C S	964	115	162	230	1471		20.8	Jenkins & Pope	
Fr ₁ Ij	R S	375	175	192	2	744		10.0	Jenkins & Pope	
Gl ₁ Fr ₂	C B	87	4	12	96	199	16	8.0	Jenkins & Pope	
	C BS	137	11	74	71	293		3.0	Jenkins & Pope	
	C S	3274	306	375	936	4891		15.1	Jenkins & Pope	
Fr ₂ Ij	RSB	256	287	101	35	679		35.7	Jenkins & Pope	
	RS	2886	1196	1170	109	5361		30.	Jenkins & Pope	
Fr ₁ Fr ₂	CS		6311		666	6977		38	Jenkins & Pope	
	RS		3142		164	3306		44	Jenkins & Pope	
Ra Im	RS	223	100	131	1	455		9.2	Fraser	

Notes

sl } These two genes are located at about the same place
fr } in the chromosome and result in somewhat the same
type of character. They may be identical or allelo-
morphic.

D₁ - PG₂ GROUP

List of Genes

cr Crinkly leaves Emerson 1921
d₁ Dwarf plant Emerson 1912
pg₂ Pale-green seedling Demerec 1924

Linkage Data

Genes		Link. phase	Number of individuals				Total	Recombina- tions		Authority
X	Y		X Y	X y	x Y	x y		No.	%	
D ₁	Pg ₂	R S	1364	584	580	65	2593		32	Demerec '24
		R S	402	165	167	16	750		30.3	Brunson
		R S	565	280	269	20	1134		25.2	Suttle
D ₁	Cr	R B	15	53	48	15	131	30	22.9	Emerson
		C B	518	102	107	482	1209	209	17.3	Emerson
								1340	239	17.8

PR - V₂ GROUP

List of Genes

bm ₁	Brown midrib	Eyster 1926
bt ¹	Brittle endosperm	Mangelsdorf 1926
bv	Brevis-semi-dwarf plant	Suttle (Unpub.)
f ₂	Fine-striped leaves	Eyster 1926
Pr	Purple aleurone	East and Hayes 1911
sc ₁	Scarred endosperm	Eyster 1926
tn	Tiny plant	Eyster 1926
v ₂	Virescent seedling	Demerec 1924
v ₃	Virescent seedling	Demerec 1924
v ₁₂	Virescent seedling	Phipps 1929
yg	Yellow green	Eyster 1926
ys	Yellow stripe	Beadle 1929

Linkage Data

Genes X Y	Link. phase	Number of individuals					Recombina- tions		Authority
		$\bar{X} Y$	$\bar{X} y$	x Y	x y	Total	No.	%	
Pr V ₂	R B	377	532	499	366	1774	743	41.9	Phipps '29
	C B	67	46	41	51	205	87	42.4	
						1979	830	42.0	
Pr V ₃	R B	123	296	320	102	841	225	26.8	Phipps '29
Pr V ₁₂	C B	61	15	4	75	155	19	12.4	Phipps '29
	C S	492	37	39	137	705		11.4	
Pr Ys	R	219	323	209	19	770		8.3	Beadle '29
Pr Bm ₁	R S	2288	966	939	77	4270		28.2	Jorgenson
Pr Bv	B B	343	832	987	163	2325		21.8	Li
Bv V ₃	R S	396	88	183	5	672		22.6	Li
Pr Bt	R S	792	394	352	13	1551		18.5	Burnham

Notes

bm Eyster (1926) states that bm shows about 20 per cent recombinations with Pr but presents no data.

f₂ } Eyster states that these genes belong to the Pr
 sc₁ } linkage group but presents no data.
 tn }
 yg }

A-TS₄ GROUP

List of Genes

a Anthocyanin pigment Emerson 1918
na Mana - dwarf plant Suttle
ts₄ Tassel-seed Phipps 1928

Linkage Data

Genes		Link. phase	Number of individuals				Recombina- tions		Authority	
X	Y		X Y	X y	x Y	x y	Total	No.		%
A	Ts ₄	C B	90	63	70	85	308	133	43.2	Phipps '28
		R B	262	351	372	333	1318	595	45.1	Phipps '28
						1626	728	44.8		
A	Na	R B _c	196	363	355	199	1113	395	35.5	Li

SUMMARY OF THREE-POINT LINKAGE TESTS IN MAIZE

Parent No. 1	Parental combinations		Recombinations				Coincidence	Authority		
	No. 1	No. 2	Region 1		Region 2				Regions 1 & 2	Total
C sh Wx	2538 5246	2708	116 229 3.4%	113	601 1227 18.3%	626	4 6 0.12%	2 6708	0.14	Hutchison '22
I Sh wx	2215 4495	2280	121 260 4.3%	139	669 1322 21.7%	653	2 5 0.08%	3 6082	0.09	Hutchison '22
yg C Sh	54 105	51	7 16 12.7%	9	3 4 3.2%	1	1 1 0.8%	0 126		Jenkins '27
C sh ar	4678 8816	4138	259 451 3.6%	192	1243 3234 25.8%	1986	14 42 0.34%	28 12543	0.33	Eyster '29
R G nl	96	117	3	16	35	16	2	7	292	Emerson
R g M	159	121	34	32	37	51	7	4	Emerson	
R g nl	238	219	43	43	61	88	12	13	Emerson	
	950		171 11.8%		288 19.8%		45 3.1%	1454	0.91	
Ts ₅ Su Tu	122	93	9	15	35	31	5	16	326	Emerson
Ts ₅ Su tu	163 491	113	9 45 6.4%	12	37 142 20.2%	39	2 26 3.7%	3 704	378 1.53	Emerson
Ts ₅ Su tu	163 276	113	9 21 5.6%	12	37 76 20.1%	39	2 5 1.3%	3 378	378 0.88	Emerson
Ts ₁ b Lg	111	71	24	17	48	35	6	3	315	Emerson
Ts ₁ B lg	57 296	57	20 82 15.3%	21	31 135 25.1%	21	7 24 4.5%	8 537	222 0.77	
Sk B Lg	148 279	131	13 21 5.1%	8	56 108 26.3%	52	0 2 0.5%	2 410	410 0.36	Anderson
Y Pl Sm	191	180	109	104	21	31	5	5		Anderson
Y pl Sm	436	377	165	206	45	50	5	1		'21
Y Pl sm	305	265	107	124	28	30	0	1		
Y pl sm	333 2498	411	183 1150 28.6%	152	66 330 8.2%	59	16 45 1.12%	12 4023	4023 0.40	
P Br F ₁	346 692	346	264 554 41.7%	290	20 55 4.1%	35	13 26 2.0%	13 1327	1327 0.75	Brunson
P Ts ₂ Br	141 276	135	3 8 1.5%	5	117 241 45.6%	124	1 3 0.6%	2 528	528 0.67	Brunson
Ts ₂ br F ₁	12 20	8	3 12 34.3%	9	0 3 8.6%	3	0 0 0.0%	0 35	35	Emerson
Bn Gl ₁ V ₅	83	98	22	23	9	6	0	0	241	Kvakan '24
Bn Gl ₁ V ₅	77 335	77	31 107 22.9%	31	4 23 4.9%	4	1 2 0.4%	1 467	467 0.32	Beadle

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