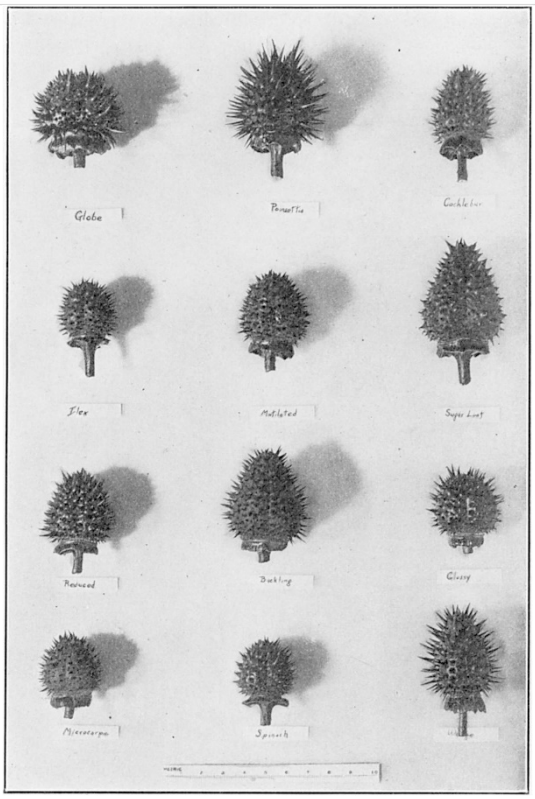
Aneuploidy

Chromosomal mutants of Datura

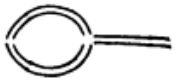
Blakeslee 1921

Albert Francis Blakeslee
(1874-1954)

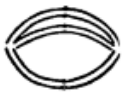


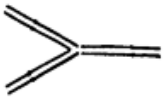
Blakeslee and Avery, 1919

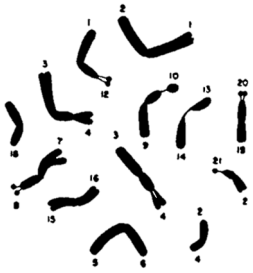
Blakeslee 1921 & 1922



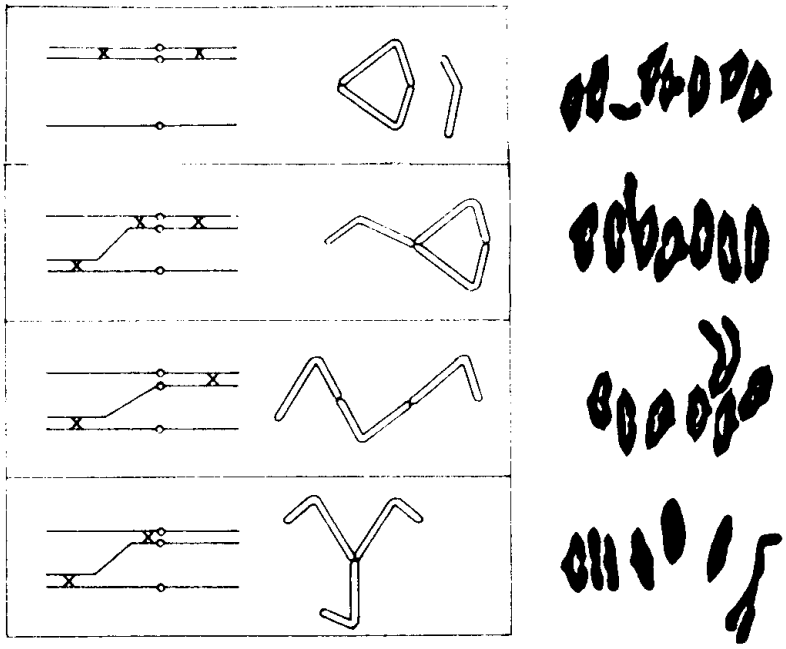
Belling 1920







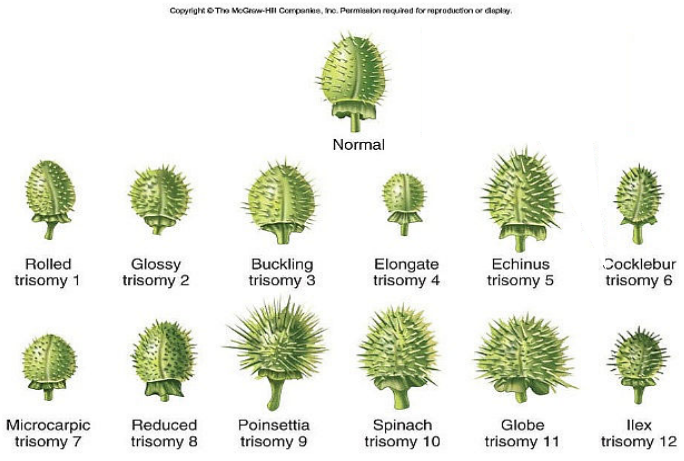
1º Trisomics

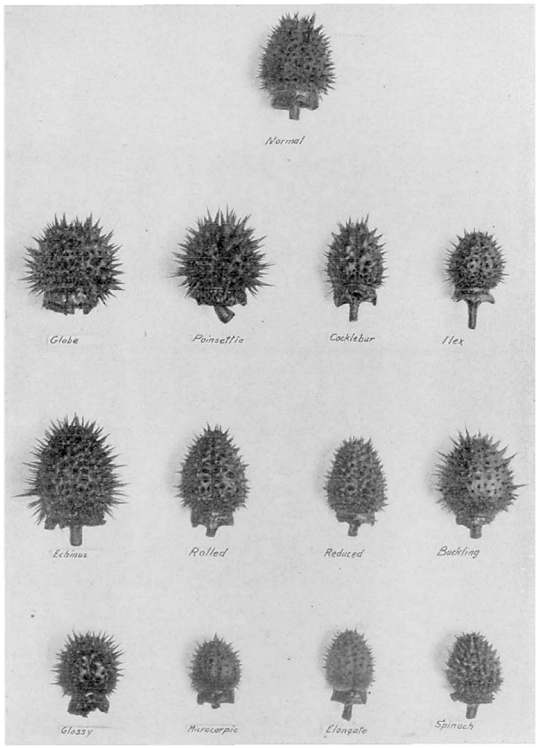


Meiotic configurations of primary trisomics of rye (from Sybenga, 1972)

Primary trisomic series

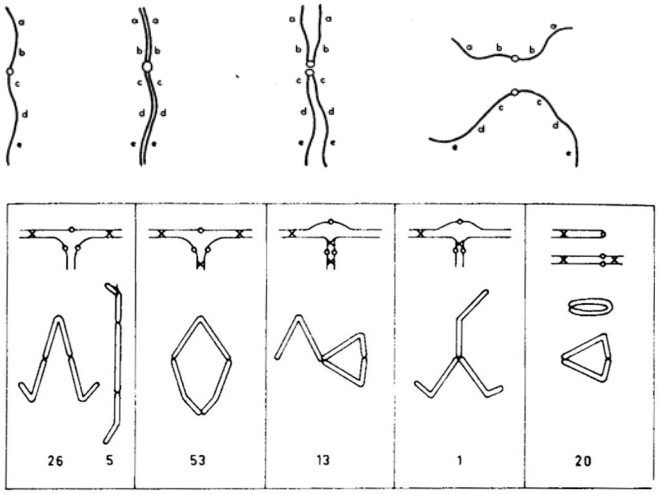
Blakeslee & Belling, 1924





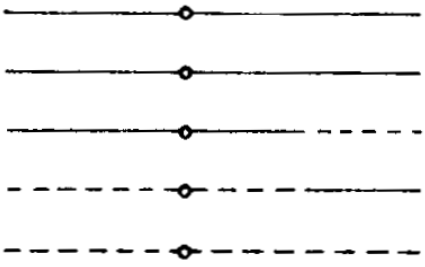
2° Trisomics

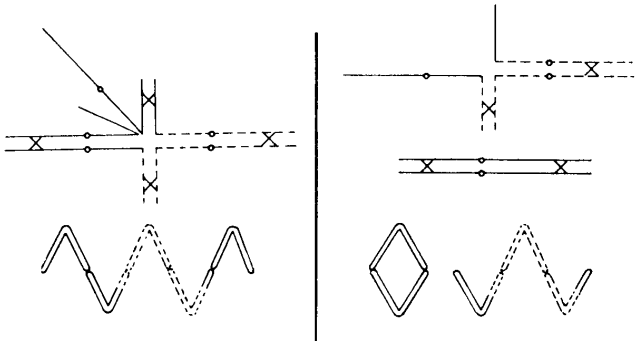
Belling and Blakeslee, 1922, 1924



Meiotic configurations of 2° trisomics, Sybenga, 1972, after Belling & Blakeslee, 1924. Numbers are the frequencies of the various configurations (N = 118).

3° Trisomics





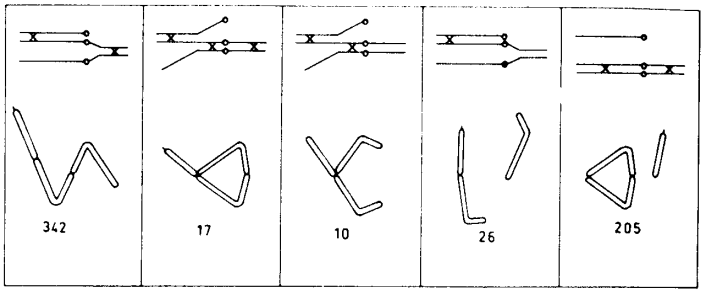
2 of the 9 possible pairing configurations. Sybenga 1972.

Tetrasomics

2x + 1 #11 2x + 2 #11

Double trisomics

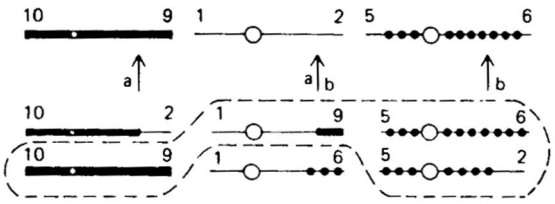
Telotrisomics



Meiotic configurations of rye telotrisomics. The numbers are the configurations observed in 600 cells. Sybenga, 1972.

Compensating trisomics

Burnham 1962



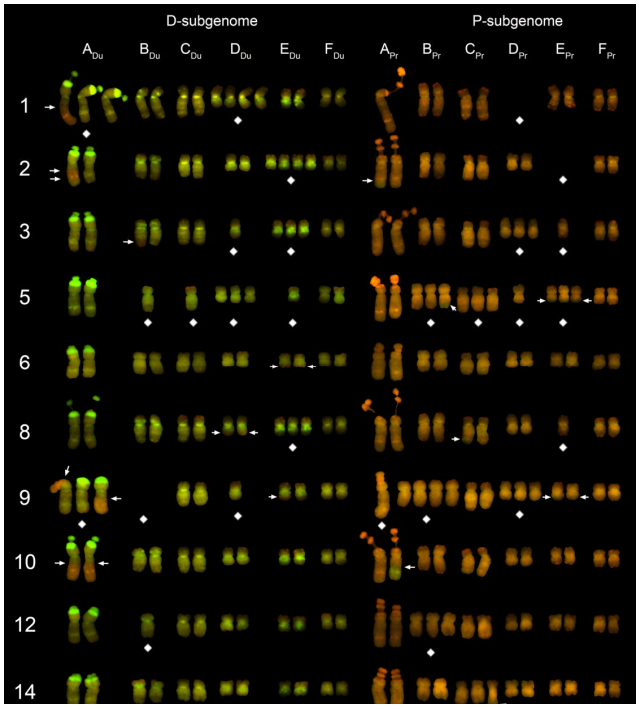


Figure 1. Compensated aneuploids in Trapogon miscellus, an allo4x from T. dubius (green) & T. pratensis (orange). Chester et al, 2012

Monosomic

Nullisomic

Double monosomic

Transmission

Blakeslee & Avery, 1938

Trisomic	Total	2n	2n + 1	% 2n + 1	2°	Unrel-ated 2°	Unrel-ated 1°	4x	1x
1.2	2049	1780	213	10.40	6	0	27	23	0
3.4	2089	1634	452	21.64	0	0	1	1	1
5.6	2367	1591	725	30.63	2	2	24	18	0
7.8	2080	1865	208	10.00	0	0	6	1	0
9.10	2160	1454	686	31.76	1	0	13	3	0
11.12	2228	1716	491	22.04	2	1	14	1	1
13.14	2033	1451	538	26.46	0	1	29	7	1
15.16	2278	1788	458	20.11	1	0	21	2	0
17.18	2140	1565	558	26.07	1	0	11	2	2
19.20	4758	4498	141	2.96	7	4	100	33	1
21.22	2340	1626	686	29.32	0	0	4	11	0
23.24	2044	1371	665	32.53	0	0	1	6	0
Average all 12 trisomics:				22.08					

Uses

Assigning genes to chromosomes

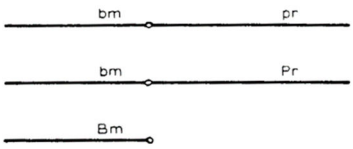
McClintock and Hill, 1931

	colored	colorless	ratio	Comments
Rr ⊗	608	204	3:1	
Rr × *rr*	1161	1196	1:1	
rr × *Rr*	132	135	1:1	
RRr ⊗	396	41	10:1	Approaches 8:1 (autotriploid ratio)
RRr × *rr*	819	213	4:1	

Maize trisomic for chromosome 10

Mapping with telotrisomics

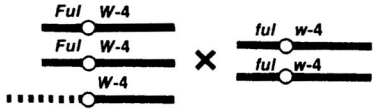
Rhoades, 1936



Segregation	2n (normal)	2n + telo short, broad leaf	Total	Ratio
Pr : *pr*	63 : 64	31 : 35	94 : 99	1 : 1
Bm : *bm*	1: 171	85 : 0	86 : 171	1 : 2

Assign genes to chromosomes with tertiary trisomics

Khush & Rick, 1967



	2n progeny			2n + 1 progeny		
	Dominant	Recessive	Ratio	Dominant	Recessive	Ratio
fulgens[1]	107	33	3:1	73	26	3:1
wiry-4	107	33	3:1	99	0	∞:0

[1] fulgens = yellow leaves

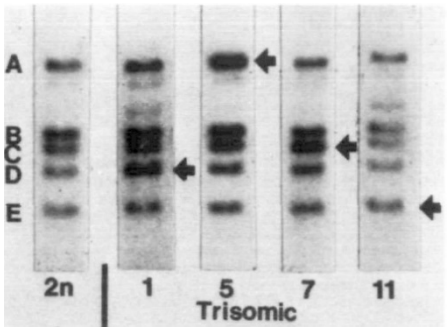
Place traits in the absence of genetic markers

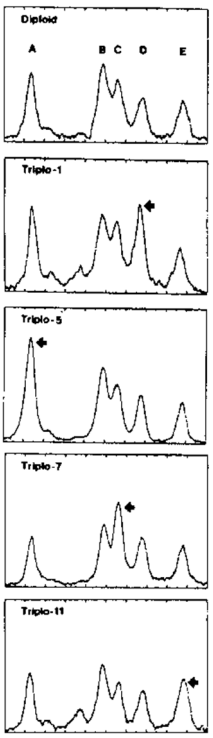
Carlson, 1972

Enzyme:	Trisomic:																	
	1.2	3.4	3.3	5.6	5.5	6.6	7.8	9.10	9.9	10.10	11.12	13.14	15.16	17.18	17.17	19.20	21.22	23.24
Alcohol dh																157		
Lactate dh				138	102	177												
Malate dh								139	87	171								
Isocitrate dh		147	190															
6-Phospho-gluconate dh				144	81	185												
Glucose-6-phosphate dh															141	94		
Glyceral-dehyde 3-phosphate dh															135	169		
Glutamate dh																	162	
Hexokinase		140	88															

Place markers on linkage groups

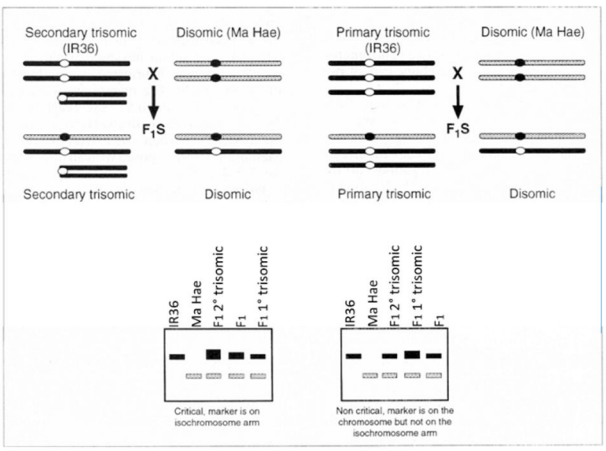
Young, Miller & Tanksley, 1987

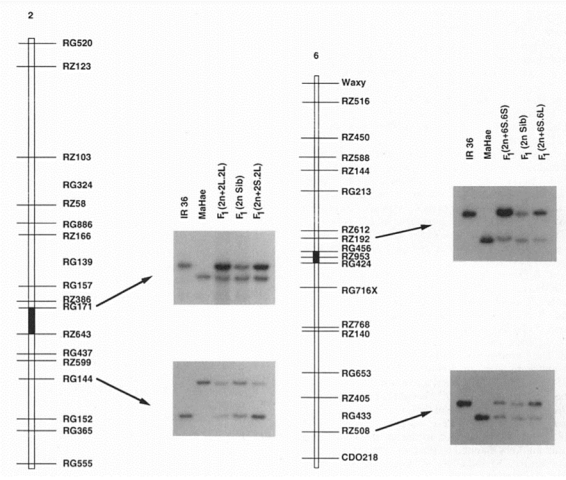




Localize centromeres

Singh et al., 1996





Plant breeding/male sterility

Frost & Lesley, 1954

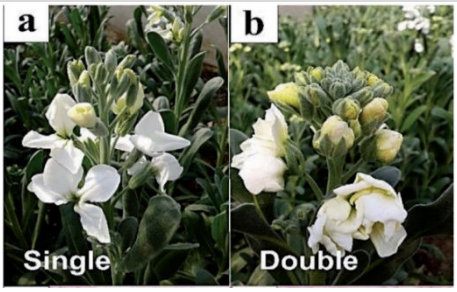
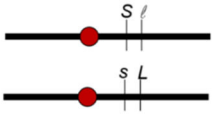
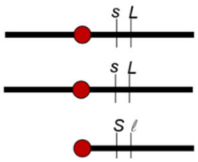


Figure 2. Single & double flowers of Hoary stock, Matthiola incana. Irani & Arab, 2017



Male → Female ↓	Sℓ (pollen lethal)	sL	
Sℓ		SsLℓ	Normal single
sL		ssLL	Normal double

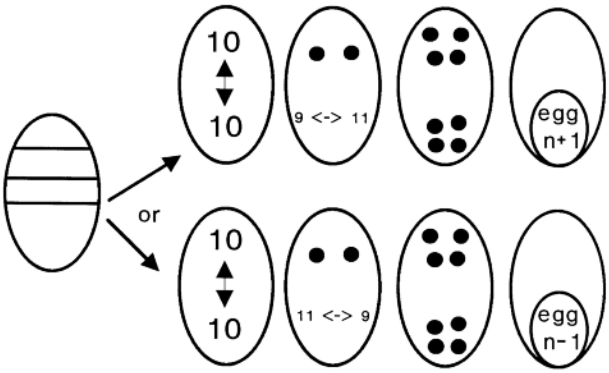


F/M → ↓	SsLℓ (poor pollen transmission)	sL	
SsLℓ		SssLLℓ	Slender single
sL		ssLL	Normal double

Monosomics in a diploid

The *r-x1* deficiency in maize, induced with X-rays by Satyanara & Kermicle, and described by **Plewa & Weber, 1973;**

Lin & Coe, 1986



Plewa & Weber, 1973