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四大作物の違い				
	Wheat	Maize	Rice	Potato
Ploidy	6x	2x	2x	4x
Inheritance	Disomic	Disomic	Disomic	Tetrasomic
Heterosis	No	Yes	No	Yes
Mating system	Inbreeder	Outbreeder	Inbreeder	Outbreeder
Propagation	Seed	Seed	Seed	Tuber

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Numbers and percentages of wild and cultivated potato species at various ploidy levels

Ploidy level	Numbers	Percentage
2x	129	73
3x	7	4
4x	27	15
5x	3	2
6x	10	6

Hawkes (1990) The potato: evolution, biodiversity and genetic resources. Belhaven Press

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倍数体における遺伝

Disomic polyploid

(二染色体の倍数体)



Disomic inheritance

(二染色体の遺伝)

<i>S. acaule</i>	$2n=4x=48$
<i>S. stoloniferum</i>	$2n=4x=48$
<i>S. fendleri</i>	$2n=4x=48$
<i>S. agrimonifolium</i>	$2n=4x=48$
<i>S. oxycarpum</i>	$2n=4x=48$
<i>S. tuquerrense</i>	$2n=4x=48$
<i>S. demissum</i>	$2n=6x=72$



Complete bivalent formation

Diploidization
(二倍体化)

Tetrasomic polyploid

(四染色体の倍数体)



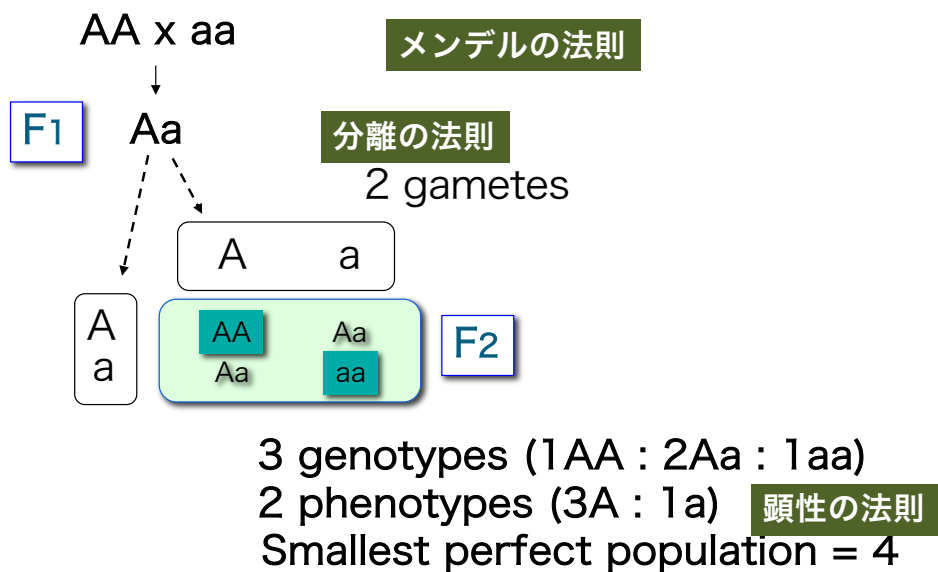
Tetrasomic inheritance

(四染色体の遺伝)

S. tuberosum $2n=4x=48$

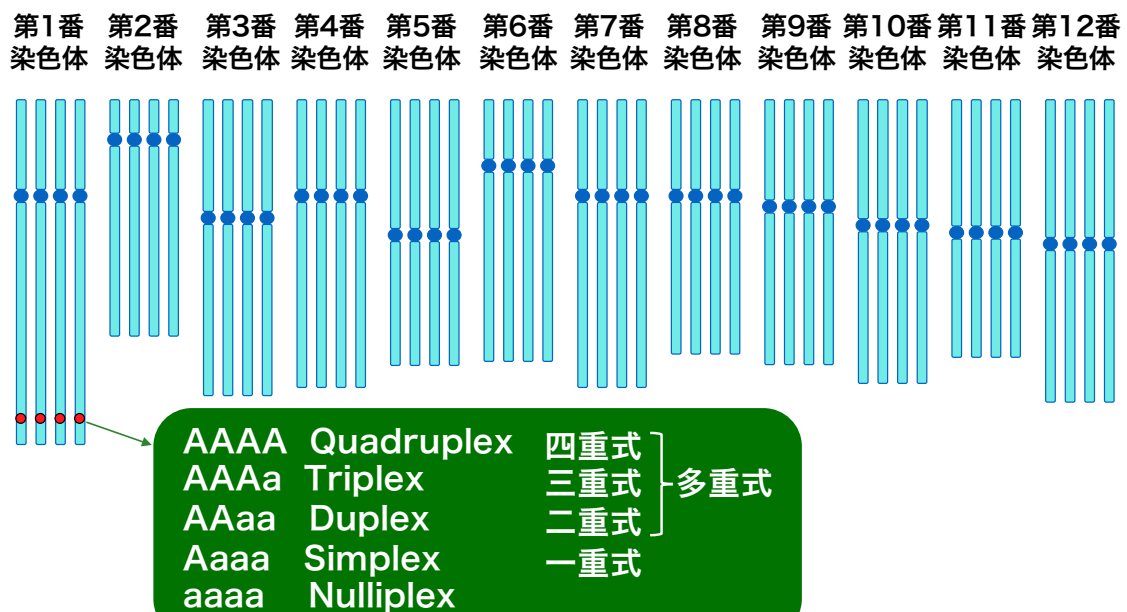
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Genetic segregation in disomic inheritance with one allelic pair

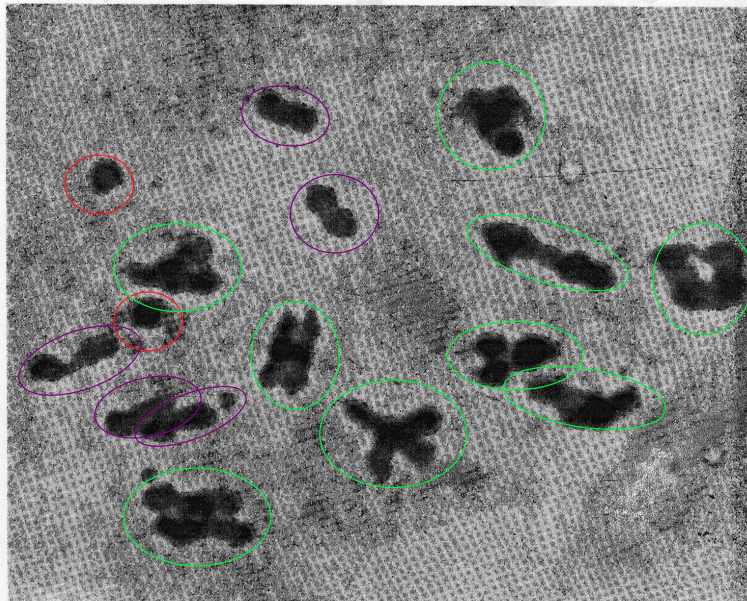


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バレイショは同質四倍体 ($2n=4x=48$)



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CHIPPEWA VARIETY AT METAPHASE I

Figure 6

Nine quadrivalents can be seen at metaphase I in the Chippewa variety. Two bivalents are super-imposed over each other, which gives the appearance of a quadrivalent. $2I + 5II + 9IV$.

2 univalents
(1価染色体)

5 bivalents
(2価染色体)

9 quadrivalents
(4価染色体)

4本の相同染色体間で四価染色体を形成する場合がある

Swaminathan (1954)
J Hered 45:265-272

Meiosis of the common potato

$2n=4x=48, 2I+5II+9IV$

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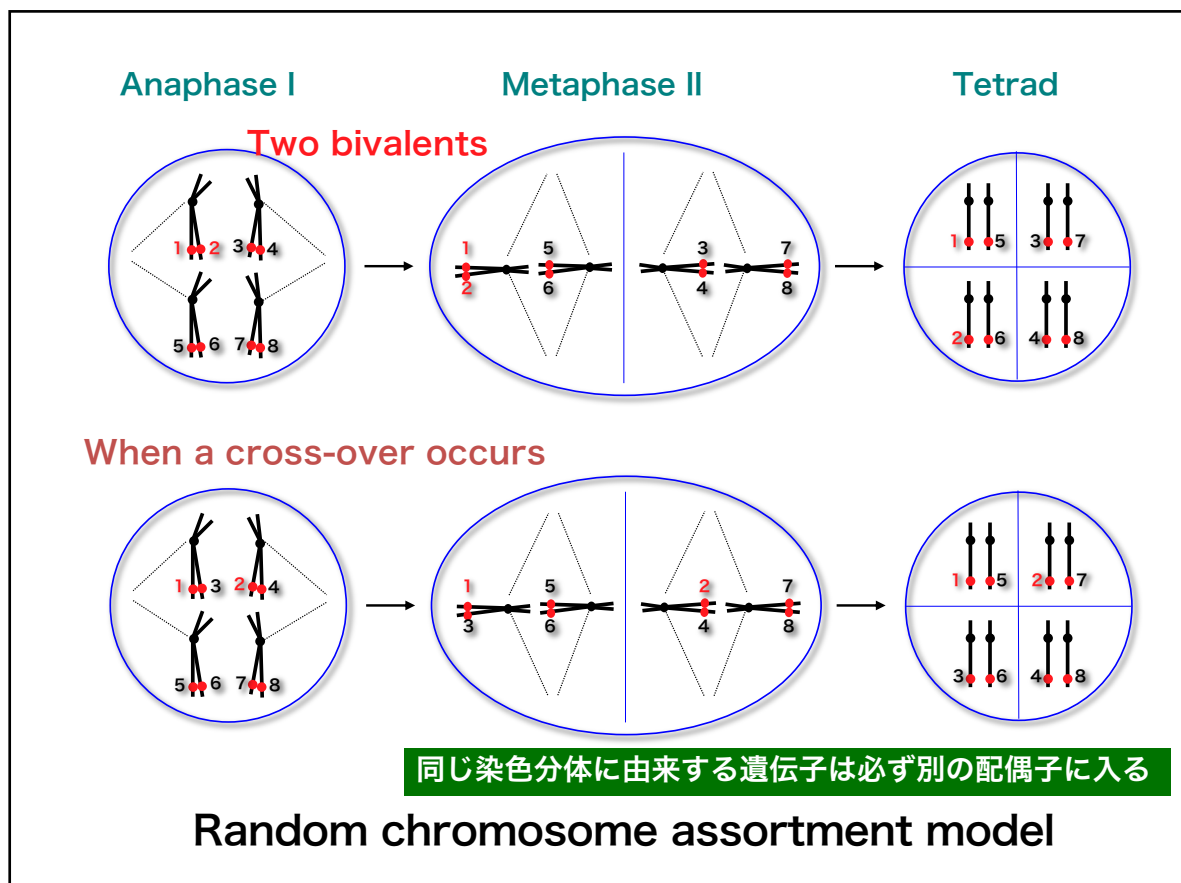
普通バレイショ品種の染色体対合頻度

Clone	I	II	III	IV	Ref.
Duke of York	2.2	18.6	0.2	2.0	1)
Norin No. 1	1.6	18.3	0.8	1.9	2)
Dejima	3.2	18.2	2.0	0.7	3)
Pepo	0.9	18.4	0.5	2.2	2)
Deodara	1.6	17.3	1.2	2.1	4)
36/209	1.1	20.3	0.5	1.3	4)
Gladstone	5.7	17.9	0.7	1.1	4)
Cl.650	4.0	18.1	0.4	1.7	5)
Cl.B 72	3.5	17.9	0.6	1.7	5)
Fichtelgold	1.8	18.9	0.9	1.4	6)

2~4の多価染色体

1) Swaminathan (1954), 2) Irikura (1976), 3) Yamada et al. (1998),
4) Lamm (1945), 5) Bains (1951), 6) Wangenheim (1954)

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Chromatid combination in gametes

Chromatids	1	2	3	4	5	6	7	8
1			1.3	1.4	1.5	1.6	1.7	1.8
2			2.3	2.4	2.5	2.6	2.7	2.8
3					3.5	3.6	3.7	3.8
4					4.5	4.6	4.7	4.8
5							5.7	5.8
6							6.7	6.8
7								
8								

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Gametic output for a simplex individual (Aaaa)

Chromatids	A A	a a	a a	a a
A		Aa Aa	Aa Aa	Aa Aa
A		Aa Aa	Aa Aa	Aa Aa
a			aa aa	aa aa
a			aa aa	aa aa
a				aa aa
a				aa aa
a				
a				

$Aa : aa = 1 : 1$

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Gametic output for a duplex individual (AAaa)

Chromatids	A A	A A	a a	a a
A		AA AA	Aa Aa	Aa Aa
A		AA AA	Aa Aa	Aa Aa
A			Aa Aa	Aa Aa
A			Aa Aa	Aa Aa
a				aa aa
a				aa aa
a				
a				

$AA : Aa : aa = 1 : 4 : 1$

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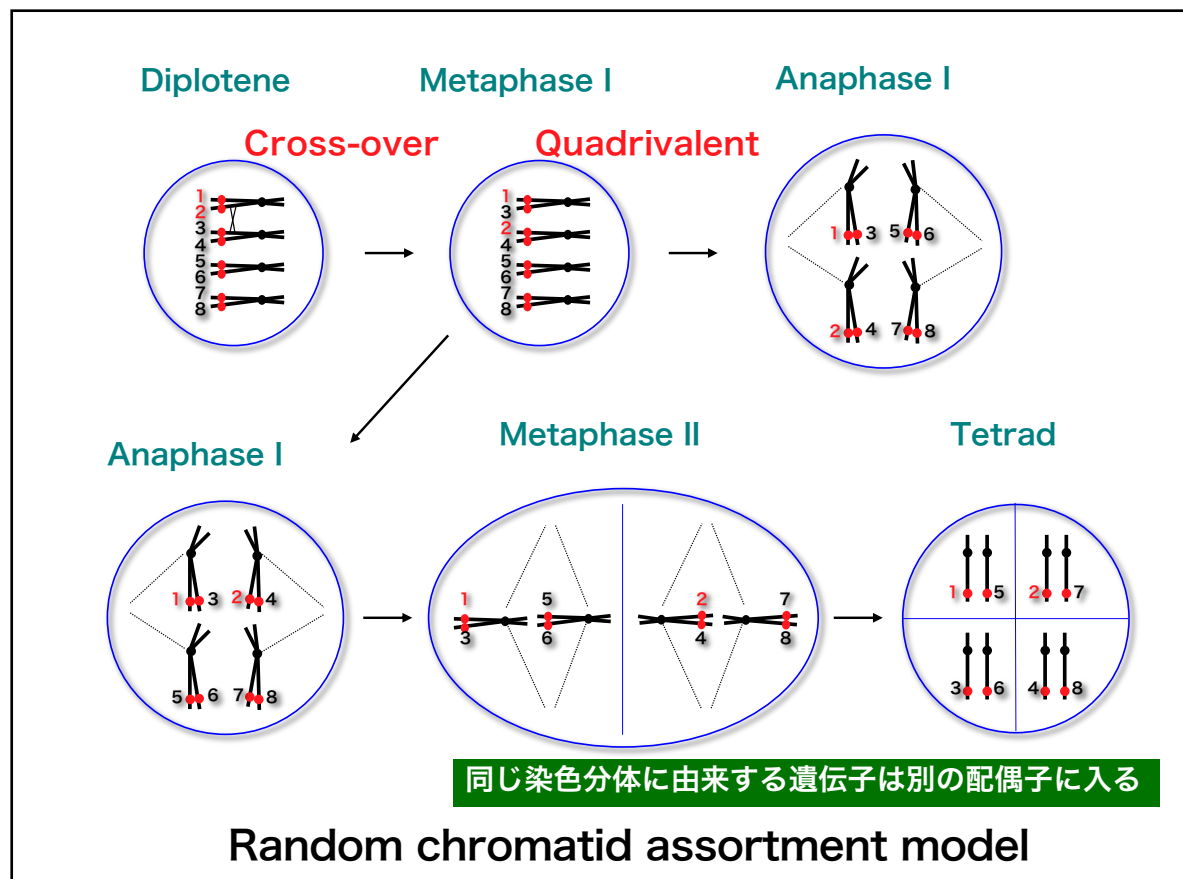
Duplex x simplex

Gametes		Simplex (Aaaa)	
		1Aa	1aa
Duplex (AAaa)	1AA	1AAAa	1AAaa
	4Aa	4AAaa	4Aaaa
	1aa	1Aaaa	1aaaa

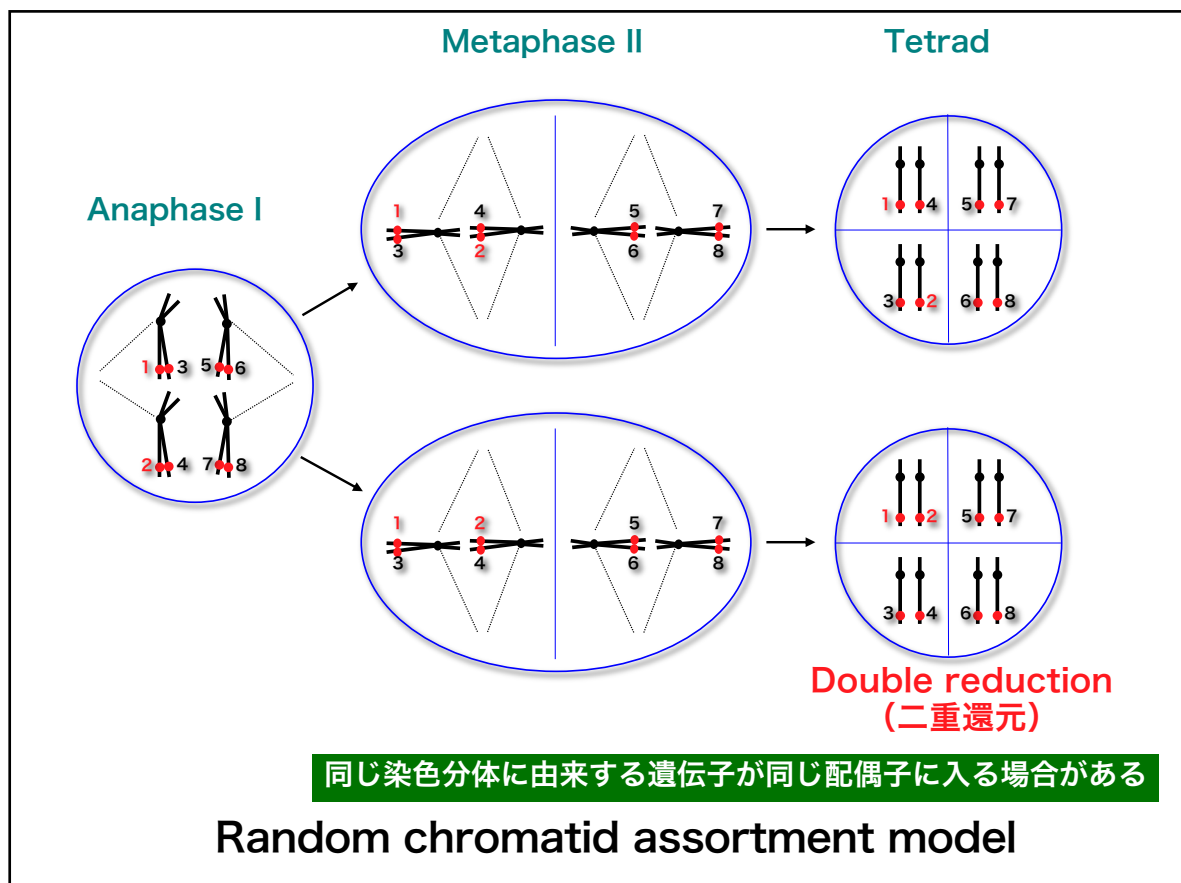
Genotypes 1AAAa : 5AAaa : 5Aaaa : 1aaaa

Phenotypes 11A : 1a

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Chromatid combination in gametes

Chromatids	1	2	3	4	5	6	7	8
1		1.2	1.3	1.4	1.5	1.6	1.7	1.8
2			2.3	2.4	2.5	2.6	2.7	2.8
3				3.4	3.5	3.6	3.7	3.8
4					4.5	4.6	4.7	4.8
5						5.6	5.7	5.8
6							6.7	6.8
7								7.8
8								

Double reduction (二重還元) の結果

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Gametic output for a simplex individual (Aaaa)

Chromatids	A A	a a	a a	a a
A	AA	Aa	Aa	Aa
A		Aa	Aa	Aa
a		aa	aa	aa
a			aa	aa
a			aa	aa
a				aa
a				aa
a				

AA : Aa : aa = 1 : 12 : 15

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Gametic output for a duplex individual (AAaa)

Chromatids	A A	A A	a a	a a
A	AA	AA	Aa	Aa
A		AA	Aa	Aa
A		AA	Aa	Aa
A			Aa	Aa
a			aa	aa
a				aa
a				aa
a				

AA : Aa : aa = 3 : 8 : 3

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Duplex x simplex

Gametes		Simplex (Aaaa)		
		1AA	12Aa	15aa
Duplex (AAaa)	3AA	3AAAA	36AAAa	45AAaa
	8Aa	8AAAa	96AAaa	120Aaaa
	3aa	3AAaa	36Aaaa	45aaaa

Genotypes 3AAAA : 44AAAa : 144AAaa :
156Aaaa : 45aaaa

Phenotypes 347A : 45a (7.7A : 1a)

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Phenotypic ratios assuming full dominance

Mating type		Random chromosome assortment A : a	Random chromatid assortment A : a
AAAA x ----		1 : 0	1 : 0
AAAa x AAAa		1 : 0	783 : 1
AAAa x AAaa		1 : 0	130 : 1
AAAa x Aaaa		1 : 0	51.3 : 1
AAAa x aaaa		1 : 0	27 : 1
AAaa x AAaa		35 : 1	20.8 : 1
AAaa x Aaaa		11 : 1	7.7 : 1
AAaa x aaaa		5 : 1	3.7 : 1
Aaaa x Aaaa		3 : 1	2.5 : 1
Aaaa x aaaa		1 : 1	0.87 : 1
aaaa x aaaa		0 : 1	0 : 1

実際的分離比はこの間になる

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Phenotypic ratios assuming full dominance in a mono-allelic locus

Diploid
Disomic polyploid

Always form a bivalent



3A : 1a

Tetrasomic tetraploid

When form two bivalents



Random chromosome assortment model

When cross-over and form a quadrivalent



Random chromatid assortment model

Ratios are two extremes

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シストセンチュウ抵抗性品種の育成

品種	系譜	育成年
トヨアカリ	ツニカ x WB61037-4	1986
キタアカリ	男爵薯 x ツニカ	1987
エゾアカリ	ツニカ x Priekulsky Ranny	1987
とうや	R392-50 x WB77025-2	1992
ムサマル	ツニカ x 根育20号	1992
ベニアカリ	北海61号 x R392-50	1994
さやか	Pentland Dell x R392-50	1995
アーリースターチ	島系523号 x R392-50	1996
花標津	W553-4 x R392-50	1997

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R392集団で出現する遺伝子型頻度

R392系統群 ← Hudson x Wauseon
HHhh Hhhh

モデル	HHHH	HHHh	HHhh	Hhhh	hhhh
Random chromosome assortment	0	1	5	5	1
Random chromatid assortment	3	44	144	156	45

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R392系統の後代検定（森・梅村 1992）

交配組合せ	R	S	R (%)	期待頻度 (%)		推定遺伝子型
				I	II	
トヨシロ x R392-6	55	95	36.7	50.0	46.4	hhhh x Hhhh
トヨシロ x R392-13	80	119	40.2	50.0	46.4	hhhh x Hhhh
トヨシロ x R392-36	92	107	46.2	50.0	46.4	hhhh x Hhhh
トヨシロ x R392-3	180	53	77.3	83.3	78.6	hhhh x HHhh
トヨシロ x R392-11	175	25	87.5	83.3	78.6	hhhh x HHhh
トヨシロ x R392-12	177	23	88.5	83.3	78.6	hhhh x HHhh
トヨシロ x R392-26	149	51	74.5	83.3	78.6	hhhh x HHhh
トヨシロ x R392-27	170	28	85.9	83.3	78.6	hhhh x HHhh
トヨシロ x R392-53	183	17	91.5	83.3	78.6	hhhh x HHhh
トヨシロ x R392-25	189	11	94.5	100.0	96.4	hhhh x HHHh
トヨシロ x R392-50	191	9	95.5	100.0	96.4	hhhh x HHHh
R392-27 x R392-50	206	5	97.6	100.0	99.2	HHhh x HHHh

(I) Random chromosome assortment model or (II) Random chromatid assortment model

2つのモデルに対して χ^2 検定を行う必要がある

森・梅村（1992）In: 線虫研究の歩み（日本線虫研究会）p. 272-276

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