Tree Genetics and Breeding - Exercise Tillppo Geuna Filippo Geuna Filippo Geuna TU 20-12-2022o Geu

The following cross population was analyzed with AFLP markers which produced a series of bands including those indicated by the segregating arrow. (i) Estimate the most plausible segregation model for the two markers (A) and (B), deducing the genotype of the parents of such progeny, and verify it with an X² test. (ii) If the two markers A and B were in linkage what would be their estimated distance and the phase of parents?



Tree Genetics and Breeding – Exercise 1 (solution) Excel calculations

Filippo Geuna F	Hypothesis 1:1	Genotype	o (observed)	e (expected)	d (observed-expected)	d^2	d^2/e)
-ilippo Geuna I		Band present (a-)	14	15	-1	1	0,07)
-ilippo Geuna I		Band absent ()	16	15	1	1	0,07	
ilippo Geuna I								
ilippo Geuna F								
ilippo Geuna F								
lippo Geuna P					df = 1	chi-square	0,13	
ippo Geuna P								
ippo Geuna P			Band ratio (a- vs)	Chi-square	P = 0,05	P = 0,01	P = 0,001	
ippo Geuna P			15 vs 15	0,00	Accept	Accept	Accept	
ippo Geuna P			16 vs 14	0,13	Accept	Accept	Accept	
ippo Geuna P			17 vs 13	0,53	Accept	Accept	Accept	
ippo Geuna P			18 vs 12	1,20	Accept	Accept	Accept	
ippo Geuna P			19 vs 11	2,13	Accept	Accept	Accept	
ippo Geuna P			20 vs 10	3,33	Accept	Accept	Accept	
ippo Geuna P			21 vs 9	4,80	Reject	Accept	Accept	
ippo Geuna P			22 vs 8	6,53	Reject	Accept	Accept	
ppo Geuna P								
ppo Geuna H								
ppo Geuna P	Hypothesis 3:1	Genotype	o (observed)	e (expected)	d (observed-expected)	d^2	d^2/e	
ppo Geuna P		Band present (a-)	19	22,5	-3,5	12,25	0,54	
ppo Geuna P		Band absent ()	11	7,5	3,5	12,25	1,63	
ppo Geuna P								
ppo Geuna P								
ppo Geuna P								
ppo Geuna P					df = 1	chi-square	2,18	
ippo Geuna P								
ippo Geuna P			Band ratio (a- vs)	Chi-square	P = 0.05	P = 0.01	P = 0.001	
ippo Geuna n			15 vs 15	10.00	Reject	Reject	Accept	
ippo Geuna I			16 vs 14	7.51	Reject	Reject	Accept	t
ippo Geuna R			17 vs 13	5,38	Reject	Accept	Accept	Ť,
ippo Geura I			18 vs 12	3,60	Accept	Accept	Accept	Ť,
ippo Geuna P			19 vs 11	2.18	Accept	Accept	Accept	Ť.
ippo Geuna i			20 vs 10	1.11	Accept	Accept	Accept	Ť,
lippo Geuna l			21 vs 9	0.40	Accept	Accept	Accept	Ť,
lippo Geuna I			22 vs 8	0.04	Accept	Accept	Accept	Ť,
ubbo Gentia i				0,01	, weeps	recept	recept	-11

ilippo Geuna Filippo Geuna Filippo Geu © 2012 Filippo Geuna - Università degli Studi di Milano una Filippo Geuna Filippo Geuna Filippo Geu

Prohal	ABELLA 2.5	Quadrata) Geuna Filippo
Proba	ninta di Chi-	Quadrato			PROBAB	ILITÀ					 Geuna Filippo Geuna Filippo
10	0.05	0.00	0.50	0.50				0.05	0.01	0.001) Geuna Filippo
af	0,95	0,90	0,70	0,50	0,30	0,20	0,10	0,05	0,01	0,001	—) Geuna Filippo
1	0,004	0,016	0,15	0,46	1,07	1,64	2,71	3,84	6,64	10,83) Geuna Filippo
2	0,10	0,21	0,71	1,39	2,41	3,22	4,61	5,99	9,21	13,82	
3	0,35	0,58	1,42	2,37	3,67	4,64	6,25	7,82	11,35	16,27) Geuna Filippo
4	0,71	1,06	2,20	3,36	4,88	5,99	7,78	9,49	13,28	18,47) Geuna Filippo
5	1,15	1,61	3,00	4,35	6,06	7,29	9,24	11,07	15,09	20,52) Geuna Filippo
6	1,64	2,20	3,83	5,35	7,23	8,56	10,65	12,59	16,81	22,46	 Geuna Filippo Geuna Filippo
7	2,17	2,83	4,67	6,35	8,38	9,80	12,02	14,07	18,48	24,32) Geuna Filippo
8	2,73	3,49	5,53	7,34	9,52	11,03	13,36	15,51	20,09	26,13	 Geuna Filippo Geuna Filippo
9	3,33	4,17	6,39	8,34	10,66	12,24	14,68	16,92	21,67	27,88) Geuna Filippo
10	3,94	4,87	7,27	9,34	11,78	13,44	15,99	18,31	23,21	29,59	 Geuna Filippo Geuna Filippo
11	4,58	5,58	8,15	10,34	12,90	14,63	17,28	19,68	24,73	31,26) Geuna Filippo
12	5,23	6,30	9,03	11,34	14,01	15,81	18,55	21,03	26,22	32,91	
13	5,89	7,04	9,93	12,34	15,12	16,99	19,81	22,36	27,69	34,53) Geuna Filippo
14	6,57	7,79	10,82	13,34	16,22	18,15	21,06	23,69	29,14	36,12	
15	7,26	8,55	11,72	14,34	17,32	19,31	22,31	25,00	30,58	37,70	
20	10,85	12,44	16,27	19,34	22,78	25,04	28,41	31,41	37,57	45,32	 Geuna Filippo Geuna Filippo
25	14,61	16,47	20,87	24,34	28,17	30,68	34,38	37,65	44,31	52,62) Geuna Filippo
30	18,49	20,60	25,51	29,34	33,53	36,25	40,26	43,77	50,89	59,70	 Geuna Filippo Geuna Filippo
50	34.76	37.69	44 31	49 34	54.72	58.16	63.17	67.51	76.15	86.66) Geuna Filippo

The V2 test (such shills, tehls)

Tree Genetics and Breeding - Exercise 2 Ippo Geuna Filippo Geuna Filippo Geuna Filippo Geuna Fi TU ...-12-2022 G

The following electropherograms represent two independent SSR loci (labeled in blue and red, respectively) of two individuals chosen for a cross. (A) What electrophoretic profiles and at what frequencies are expected in the progeny?; (B) What profiles and frequencies would be expected in the progeny if the two loci were linked at a distance of 10 cM?; (C) The genetic analyzer is broken and you are forced to separate the products on a polyacrylamide gel. What electrophoretic profiles do you expect?; (D) Calculate the genetic distance between the two individuals.



Filippo Geuna Filippo Geuna Filippo Geuna Filippo Geuna - Università di Milanoo Geuna Filippo Geuna Fi

Tree Genetics and Breeding – Exercise 2 (solution) una Filippo Geuna Fil**TU** Ge-12-2022

The following electropherograms represent two independent SSR loci (labeled in blue and red, respectively) of two individuals chosen for a cross. (A) What electrophoretic profiles and at what frequencies are expected in the progeny?; (B) What profiles and frequencies would be expected in the progeny if the two loci were linked at a distance of 10 cM?; (C) The genetic analyzer is broken and you are forced to separate the products on a polyacrylamide gel. What electrophoretic profiles do you expect? ppo Geni

		127 178	127 186	135 178	135 186	na na na		
p 0 12	25	127 180	127 186	135 180	135 186	Offspring2	125	135
p 18	30	125 178	125 180	125 178	125 180	na ---	<u> </u>	6
	25	127 184				na na na		
P 18	34	125 178				na Imppo ocaria Imppo na Imp po ocaria Imppo	N.	N
р р 1:	25	125 190		135 178		na Offspring3 na	127	135
p 18	30	127 178		135 180		na na na		
р Р 1 3	35	135 184				na na Filippo Geuna Filippo	Geura Filippo Ger	N L
p 18	34	127 178				na Offspring4		135
po Geu po Geu	na Fili na Fili				euna Filippo Geu euna Filippo Geu	na		

Tree Genetics and Breeding – Exercise 2 (solution)

TU ...-12-2022

The following electropherograms represent two independent SSR loci (labeled in blue and red, respectively) of two individuals chosen for a cross. (A) What electrophoretic profiles and at what frequencies are expected in the progeny?; (B) What profiles and frequencies would be expected in the progeny if the two loci were linked at a distance of 10 cM?; (C) The genetic analyzer is broken and you are forced to separate the products on a polyacrylamide gel. What electrophoretic profiles do you expect?



Tree Genetics and Breeding – Exercise 2 (solution) ina Filippo Geuna Fil**TU** Ge**-12-2022**

The following electropherograms represent two independent SSR loci (labeled in blue and red, respectively) of two individuals chosen for a cross. (A) What electrophoretic profiles and at what frequencies are expected in the progeny?; (B) What profiles and frequencies would be expected in the progeny if the two loci were linked at a distance of 10 cM?; (C) The genetic analyzer is broken and you are forced to separate the products on a polyacrylamide gel. What electrophoretic profiles do you expect?



MGV2 Examination – Exercise 2 Geuna Filippo Geuna Filippo Geuna Filippo Geuna Fili**Ti / 25-05-2021**3

The following table shows the phenotypes and numbers of progeny of a backcross between an individual heterozygous for three loci in linkage and a tester individual. (A) Establish which locus is in the middle and reconstruct the genotype of the triple heterozygote analysed. (B) Determine which of the two molecular markers (and which allele) could be used to make assisted breeding for the red flower trait.

	opo Geuna Filippo Geu	Locus P	lippo Geuna Filippo Geu			
Filippo Geuna Filip	LOCUS A	LOCUS D				
Filippi Quana Filip	250 bp	127 bp	ippo Geun Alla po Geu			
Filippo Geuna Fili	230 hn	123 hn	ppo Geun 🎾 po Geu			
Filippo Geuna Filip	Too ph	120 00	ippo Geun a Emp po Geu			
Filippo Geuna Fili	250 bp	127 hn	ippo Geuna Filippo Geu			
Filipp1 0 Uta Filip	220 hp	122 bp	ppo Geuna Count			
Filippo Geuna Filip	230 bp	123 DP	ippo Geuna 💋 lo Geu			
Filippo Geena Filip	250 bp	127 bp	ippo Geuni Con Lo Geu			
Filippo Geona Fili	230 bp	127 bp	ppo Geuna 💦 io Geu			
Filippo Geuna Fili	230 bp	123 bp 🚃	ppo Geun: 🗡 jo Geu			
Filippo Geuna Filip	opo Geuna Filippo Geu	na Filippo Geuna Fi	lippo Geuna Filippo Geu			
Filippo Ge5na Filip	250 bp	127 bp 📩	ppo Geun no Geu			
Filippo Geuna Filip Filippo Geuna Filip	230 bp	123 bp	ippo Geun		Filippo Geuna Filip	po Geuna Filippo Geuna
Filippo Geuna Fili	non Geuna Filippo Geu		ippo Geuna Filippo Geu		Filippo Geuna Filip	po Geuna Mippo Geuna
Filippo 21 a Fili	250 bp	127 bp	ppo Geun:		Filippo Geuna Filip	po Geuna Filippo Geuna
Filippo Geuna Fili	230 bp	123 bp	ppo Geun: 🌾 lo Geu			
Filippo Geuna Fili	2.50 bp	125 bp	ppo Geun: 📕 o Geu			
Filippo 31na Filip	250 hp	127 hn	ippo Geuna Cilippo Geu			
Filippo Geuna Filip	200 00	127 00	ppo Geun			
Filippo Geuna Fili	230 bp	123 bp	ppo Geuna Ellinno Geu			
Filipp1 0 4 a Fili	250 hr	1071	ippo Geun Ann Io Geu			
Filippo Geuna Fili	250 bp	127 bp	ppo Geun 🦙 po Geu			
Filippo Geuna Fili	230 bp	123 bp 📩	ppo Geun 📂 jo Geu			
Filippo Geuna Filip	abo oddiirr einaao odd	на тпірро осопа т	lippo Geuna Filippo Geu			
109	250 bp	127 bp 📩	ppo Geuna Chiego Geu			
Filippo Geuna Fili	230 bp	123 bp	ppo Geuna Dio Geu			
Filippo Geuna Filip	opo Geuna Filippo Geu	na Filippo Geuna Fi	lippo Geuna Filippo Geu	© 2012 Filippo	Geuna - Universit	a degli Studi di Milano

MGV2 Examination – Exercise 2 (solution) TH ...-06-2020

It is first necessary to determine the order of the genes using the class of double recombinants (the least numerous)

	ppo Geuna	Filippo Ge	euna Fi	lippo Ge	una P						Ge E	rocodu	ro for	dotorn	ninina	the ord	or of go	noc:
	ABC	Filippq	una Fi		una F						Ge	loceuu		uerenn	mining		si ol ye	1163.
	ppo Geuna	Filippo Ge	eufia Fi		una F						Ge -	The pa	rental	and d	ouble	recombi	inant	
	abc	Filippo Ge	50		una P						Gelc	lasses	are ide	entified	1.		mane	
	Abc		5 F		una F						Ge	It has t	o be d	etermi	ned w	hich co	nfigurat	ion
	aBC		5 C		una F						C o	f marke	ers (lin	ear or	der) al	lows the	Э	
	ppo Geuna	Filippo G	euna Fi		una F						Ge tr	ansforr	nation	of the	parer	tal chro	mosom	nes
	ABC	Filippo C	una Fi		una F						Ge ir	nto chro	mosoi	mes w	ith do	uble cro	ssing-o	ver.
	abC	Filippo G	31		una F						Geuna	a Filippo G	Seuna Fi	lippo Ge	euna Fili	ppo Geun	a Filippo	Geuna
	AbC	Filippe) 4 a Fi		una F													
	ppo Geuna	Filippo G	euña Fi		una F			Α	В	С			Α	b	С			
	ppo Geuna	Filippo Ge	euna Fi		una F	ilippo	Geur		Gdun	a Filipbo	Geuna	a Fi lippo G	0-1-	lippe G	in a line	ppo Geun		
	ppo Geuna ppo Geuna	Filippo Ge Filippo Ge	euna Fi euna Fi	lippo Ge lippo Ge	una F			a 🕽	k b	Хc	Geun	Filippo G	а	B	С	Is this	the cas	se?
Or	ice the or	der has	beer	า	ina F	ilippo	Geun	mbpe	Gdun	a Filipbo	Geuna	Filippo d	Ontra	ippb Ge	una in	ppo Geun	a Filippo	Geuna
est	ablished	, the pa	irwise	Э	ina F													
dis	tances m	nust be	estab	lished	B			App		C								
CIL	non Gourna	Filinge Gr	una Ei	linno Ga		lippo	Geuna	Filippo	Geun	a Filippo	Geuna							
%	ecombin	ation re	gion	1 = (SI	R reg	gion '	1 + D	R)/tc	otal p	rogeny	Geuna	= (104	1 + 109	9+5+	- 5) / 6	46 = 0 .	345 (34	.5 cM
0/.	ppo Geuna	Filippo Ge	runa Fi	2 - (9)	una f	ilippo	Geuna	P)/to	Geun	a Filippo	Geuna	-(21)	L 21 L	lippo Ge	1646	ppo Geun	a Filippo	Geuna
/0 1	COMDIN DDD Geuna	Filippo Gr	giori i		una	ilippo	Geuna	Filippo	Geur	logen	Geuna	i Filippo G	Seuna Fi	lippo Ge)/040	ppo d e u : ppo Geun	a Filippo	Geuna
												FilippB				Ao Geu	Filippo	
	ppo Geuna	Filippo Ge	euna Fi	lippo Ge	una F	lano						Filippo C	34.5	сМ	euna Fili	9.6 cl	Filippo	

Tree Genetics and Breeding - Exercise 3 Ilippo Geuna Filippo Geuna Filippo Geuna MA 20-11-2012

In the following backcross, identify the recombinants and calculate the phase and the map distance in cM between the SSR marker and the "red berry" trait assuming that the mother is heterozygous for the gene that determines the "red berry". Below are the two crossbreeding parents and 28 offspring. Draw the arrangement of the marker and the gene for berry color on the chromosome and discuss what you have done.

Filippo Geuna Filippo Madre	Padre	001	002	003	004	005	006	007	800	009	010	011	012	013
250 bp 📩		la Filippo		Filippo G		ppo Geuna pp o Geun a					po Geun	a Filippo		ilippo Geuna ilippo euna
230 bp	lippo Geur lippo Geur	na Filippo na Filippo	Geuna	Filippo G Filippo G	Seuna Fili Seuna Fili	ppo Geuna pp <u>o Geu</u> na	a Filippo Filippo	Geuna I Geuna I	Filippo Ge Filippo Ge	una Filip una Filip	ipo Geun	a Filippo a Filippo	Geuna F	-ilippo Geuna Filippo Geuna
Filippo Ge 014	015	016	017	018	019	020	021	022	023	024	025	026	027	028
Filippo Geuna Fi		na Filippo		Filippo G	euna Fili Seuna Fili	ppo Geuni ppo Geuni	a Filippo		Filippo Ge		po Geun	a Filippo		Filippo Geuna
230 bp 📩	lippo Geur lippo Geur	ia Filippo la Filippo	Geuna	Filippo G Filippo G	ieuna Fili ieuna Fili	ppo Geuna ppo Geuna	a Filippo a Filippo	Geuna f	Filippo Ge	una Filip una Filip	po Geun	a Filippo a Filippo	Geuna F	ilippo Geuna ilippo Geuna
Filippo Geuna Fi Filippo Geuna Fi	lippo Geur lippo Geur	na Filippo na Filippo	Geuna Geuna	Filippo G Filippo G	Seuna Fili Seuna Fili	ppo Geuna ppo Geuna	a Filippo a Filippo	Geuna I Geuna I	Filippo Ge Filippo Ge	una Filip una Filip	po Geun	a Filippo a Filippo	Geuna F Geuna F	ilippo Geuna ilippo Geuna
Filippo Ge	Padre	na Filippo na Filippo	002	003	euloo4ili	ppo 005 ppo Geom	006	Geura I	008	009	po Geun	a Milppo a Silippo	General General	ilippo Geuna ilippo Geuna
Filippo G	**	88	88	88	88	83	88	88	88	88	88	88	88	88 Seuna
Filippo Gerra Fi	lip % eur	a Filippo	P a	F 8 o C	iet % Fili	ppc Peuna	8		Filip % Ge Filippo Ge	8	o B eun	a 🎖 ppo a Filippo	Genna F	ilip Geuna
		a Filippo				ppo Geuna		Geuna l						
Filippo Geulia Fi	015	016	017	018	019	020	021	022	023	024	025	026	027	028
Filippo G	×	88	R	88	888	888	88	88	88	×	888	88	×	**
Filippo Geraa Fi	8	8000	ଞ	F 🛜 🛛	8	ppo	-	- 🛜	11 7 G	8	8		8	ili 🌮 Geuna
				C	2012 Filip	po Geuna	- Univer	rsità di M	Ailano					



Tree Genetics and Breeding - Exercise 4 lippo Geuna Filippo Geuna Filippo Geuna MA 20-11-2012

Exercise inspired by Fig. 20.19 (page 971) of the book "Genetics and Genomics (Barcaccia and Falcinelli)". In the following backcross, identify the recombinants and calculate the phase and the map distance in cM between the two RFLP markers with the mother heterozygous for both markers. Below are the two parents and 28 children. Draw the arrangement of the markers on the chromosome identifying the phase (cis or trans) and discuss what you have done.



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Tree Genetics and Breeding - Exercise 4 (solution) Genna Flippo Genna MA 20-11-2012

Exercise inspired by Fig. 20.19 (page 971) of the book "Genetics and Genomics (Barcaccia and Falcinelli)". In the following backcross, identify the recombinants and calculate the phase and the map distance in cM between the two RFLP markers with the mother heterozygous for both markers. Below are the two parents and 28 children. Draw the arrangement of the markers on the chromosome identifying the phase (cis or trans) and discuss what you have done.



Appello di MGV2 –	Esercizio 3				ME 29-04-2020
Calculate the genetic dista	ance between the	e six individuals /	A, B, C, D, E,	F characterized	by the AFLP type
narker shown below.					
ppo Geuna Filipp A Geuna B ilippo	o Cuna Fili D oo Geur	E Filippo 🕞 una Filipp			
Marker 1 Ilippo Geuna Filippo		a Filippo Geuna Filipp			
Marker 2	o Geuna Filippo Geun	a Filippo Geuna Filipp			
ppo deana Filippo deuna Filippo	o Geuna Filippo Geun	a Filippo Georga Filipp			
Marker 3	o Geuna Filippo Geun				
Marker 4	o Geuna Filiopo Geun				
Marker 5	o Geuria Filippo Geuri	a rilippo Gedita rilipp			
opo Geuna Filippo Geuna Filippo	o Geuna Filippo Geun	a Filippo Geuna Filipp			
Marker 6	o Geuna Filippo Geun	a mono provina Filing			
Marker 7 Filippo Geuna Filippo	o Geuna Filmen Geun	ppo Geuna Filipp			
Marker & Filippo Geuna Filippo	o Geuna Filinno Geun	a Filippo Geupa Filipp			
ppo Geuna Filippo Geuna Filippo	o Geuna Filippo Geun	a Filippo Geuna Filipp			
Marker 9 Marker 9					
Marker 10 Marker 10	o Geuna Filippo Geu	- Filippo Geuna Filipp			
	o Geuna Filippo Geun		o Geuna Filippo (
	o Geuna Hill © 2009 Fi	ilippo Geuna - Univer	sità degli Studi di	Milano uppo Geuna	

Appello di MGV2 – Esercizio 2

WE 11-05-2022

Calculate the genetic distance between the six individuals A, B, C, D, E, F characterized by the two SSR markers shown below in color. Also discuss the level of polymorphism of the two markers. na Filipp С Α В E 154 bp 150 bp 148 bp 146 bp 142 bp AGe Bilippo Geuna F D ΠE. 127 bp 125 bp 123 bp 121 bp 117 bp © 2009 Filippo Geuna - Università di Milano

Tree Genetics and Breeding – Esercizio 4 TU 08-06-2021 A TaqMan® assay on a cross population for a SNP locus produced the two-dimensional profile (Allelic Discrimination Plot) reported in box (a). (A) Determine the genotype of the two parents; (B) Estimate with an X² test whether the segregation observed in the progeny is statistically acceptable with respect to the proposed genotype; (C) What can be said about case (b)?

