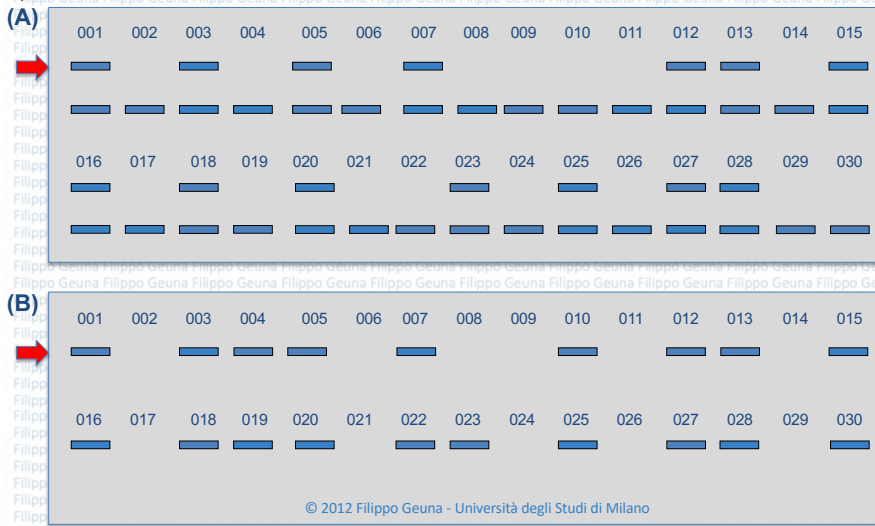


Tree Genetics and Breeding – Exercise 1 TU 20-12-2022

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?



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

Hypothesis 1:1	Genotype	o (observed)	e (expected)	d (observed-expected)	d ²	d ² /e
	Band present (a-)	14	15	-1	1	0,07
	Band absent (-)	16	15	1	1	0,07
				df = 1	chi-square	0,13
	Band ratio (a- vs -)	Chi-square	P = 0,05	P = 0,01	P = 0,001	
	15 vs 15	0,00	Accept	Accept	Accept	
	16 vs 14	0,13	Accept	Accept	Accept	
	17 vs 13	0,53	Accept	Accept	Accept	
	18 vs 12	1,20	Accept	Accept	Accept	
	19 vs 11	2,13	Accept	Accept	Accept	
	20 vs 10	3,33	Accept	Accept	Accept	
	21 vs 9	4,80	Reject	Accept	Accept	
	22 vs 8	6,53	Reject	Accept	Accept	
			df = 1	chi-square	2,18	
	Band ratio (a- vs -)	Chi-square	P = 0,05	P = 0,01	P = 0,001	
	15 vs 15	10,00	Reject	Reject	Accept	
	16 vs 14	7,51	Reject	Reject	Accept	
	17 vs 13	5,38	Reject	Accept	Accept	
	18 vs 12	3,60	Accept	Accept	Accept	
	19 vs 11	2,18	Accept	Accept	Accept	
	20 vs 10	1,11	Accept	Accept	Accept	
	21 vs 9	0,40	Accept	Accept	Accept	
	22 vs 8	0,04	Accept	Accept	Accept	

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The X² test (probability table)

(from Russell, chapter 2 page 36)

TABELLA 2.5

Probabilità di Chi-Quadrato

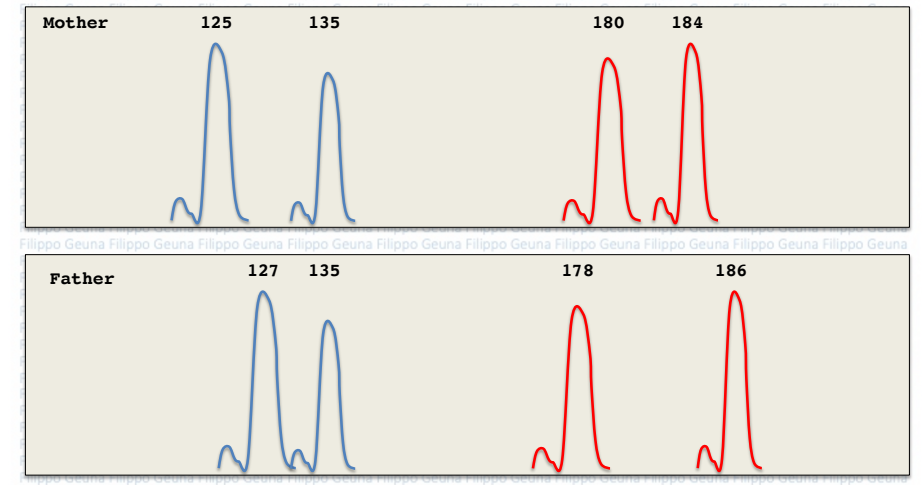
df	PROBABILITÀ									
	0,95	0,90	0,70	0,50	0,30	0,20	0,10	0,05	0,01	0,001
1	0,004	0,016	0,15	0,46	1,07	1,64	2,71	3,84	6,64	10,83
2	0,10	0,21	0,71	1,39	2,41	3,22	4,61	5,99	9,21	13,82
3	0,35	0,58	1,42	2,37	3,67	4,64	6,25	7,82	11,35	16,27
4	0,71	1,06	2,20	3,36	4,88	5,99	7,78	9,49	13,28	18,47
5	1,15	1,61	3,00	4,35	6,06	7,29	9,24	11,07	15,09	20,52
6	1,64	2,20	3,83	5,35	7,23	8,56	10,65	12,59	16,81	22,46
7	2,17	2,83	4,67	6,35	8,38	9,80	12,02	14,07	18,48	24,32
8	2,73	3,49	5,53	7,34	9,52	11,03	13,36	15,51	20,09	26,13
9	3,33	4,17	6,39	8,34	10,66	12,24	14,68	16,92	21,67	27,88
10	3,94	4,87	7,27	9,34	11,78	13,44	15,99	18,31	23,21	29,59
11	4,58	5,58	8,15	10,34	12,90	14,63	17,28	19,68	24,73	31,26
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
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
25	14,61	16,47	20,87	24,34	28,17	30,68	34,38	37,65	44,31	52,62
30	18,49	20,60	25,51	29,34	33,53	36,25	40,26	43,77	50,89	59,70
50	34,76	37,69	44,31	49,34	54,72	58,16	63,17	67,51	76,15	86,66

Accettare al livello di 0,05 | Rifiutare

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Tree Genetics and Breeding – Exercise 2 TU ...-12-2022

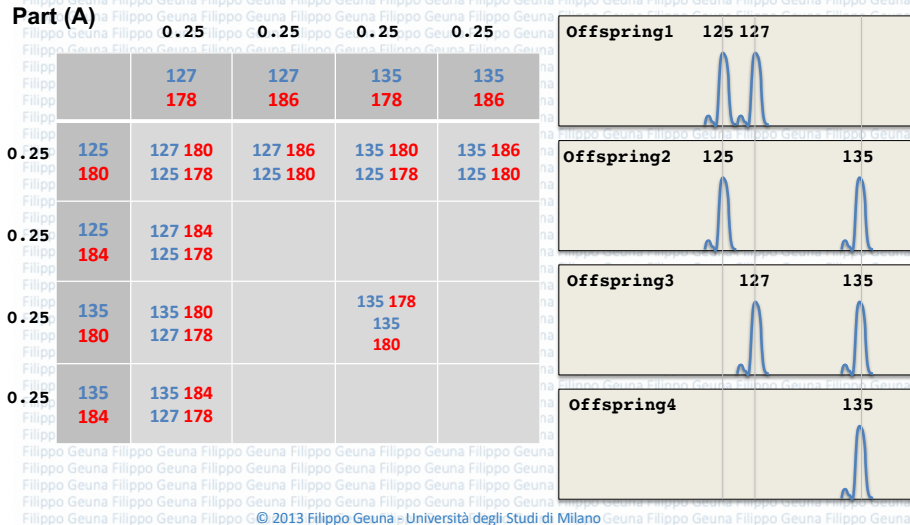
The following electropherograms represent two independent SSR loci (labeled in blue and red, respectively) of two individuals chosen for a cross. (A) What electrophoretic profiles and at what frequencies are expected in the progeny?; (B) What profiles and frequencies would be expected in the progeny 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?; (D) Calculate the genetic distance between the two individuals.



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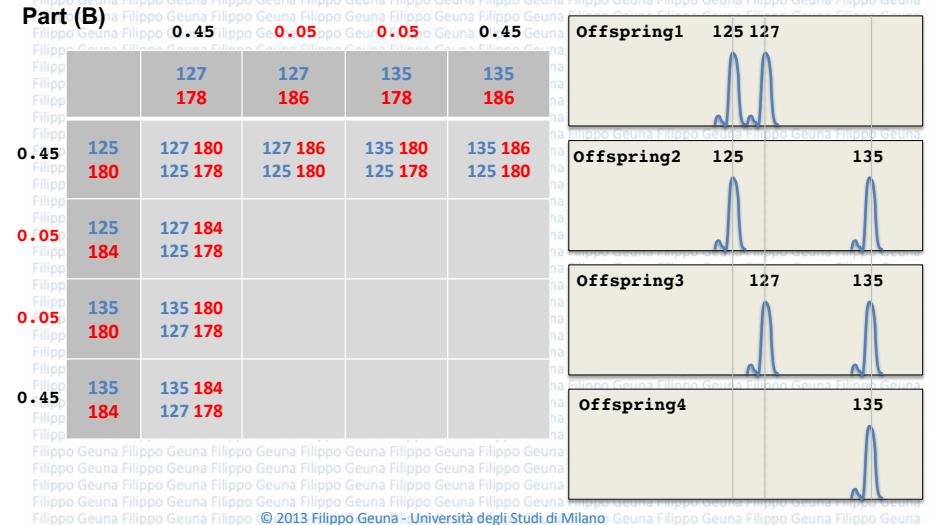
Tree Genetics and Breeding – Exercise 2 (solution) TU ...-12-2022

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?



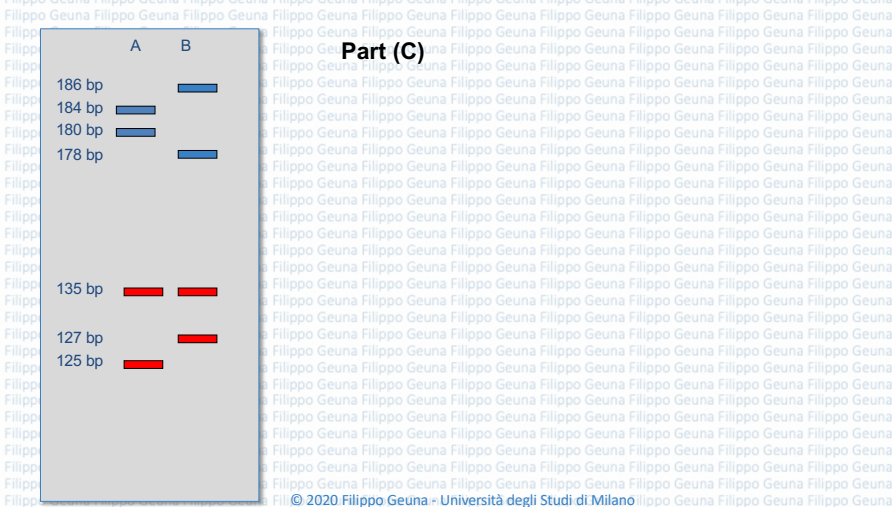
Tree Genetics and Breeding – Exercise 2 (solution) TU ...-12-2022

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?



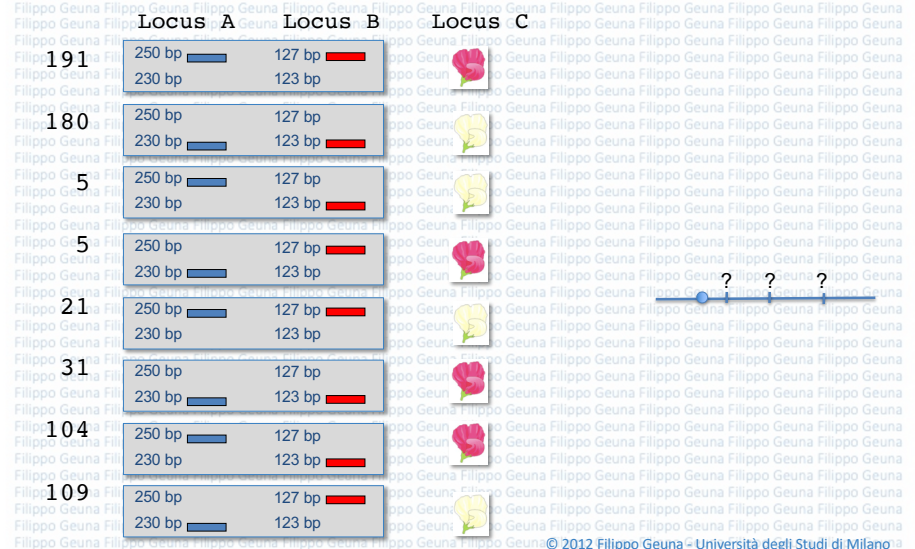
Tree Genetics and Breeding – Exercise 2 (solution) TU ...-12-2022

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?



MGV2 Examination – Exercise 2 TU 25-05-2021

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.



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

ABC	191
abc	180
Abc	5
aBc	5
ABc	21
abC	31
AbC	104
aBc	109

Procedure for determining the order of genes:

- The parental and **double recombinant** classes are identified.
- It has to be determined which configuration of markers (linear order) allows the transformation of the parental chromosomes into chromosomes with double crossing-over.



Once the order has been established, the pairwise distances must be established

% recombination region 1 = (SR region 1 + DR) / total progeny = (104 + 109 + 5 + 5) / 646 = 0.345 (34.5 cM)

% recombination region 2 = (SR region 2 + DR) / total progeny = (21 + 31 + 5 + 5) / 646 = 0.096 (9.6 cM)



Solution of part (B) of the exercise using correlation analysis through contingency tables

	250	230		127	123
	161,5	161,5		161,5	161,5
	161,5	161,5		161,5	161,5

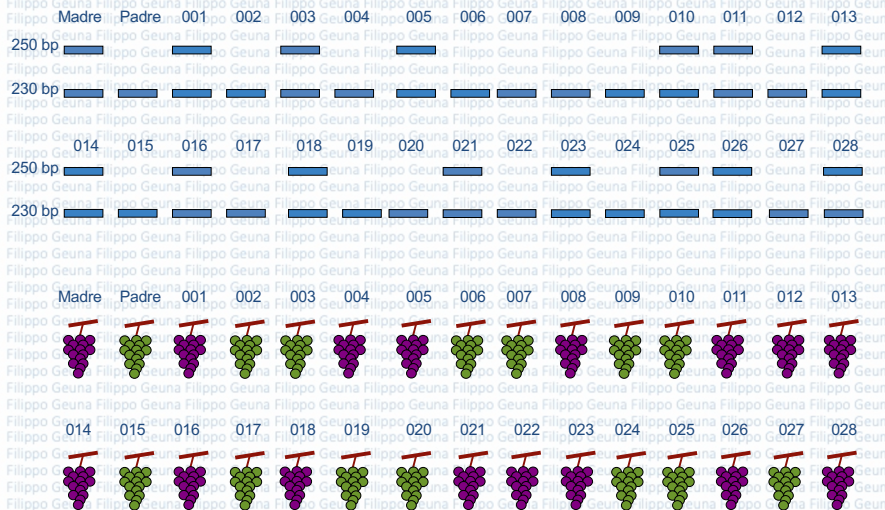
Expected numbers in case of independence

	250	230		127	123
	295	36		196	135
	26	289		130	185

Observed numbers for each combination of trait/marker locus

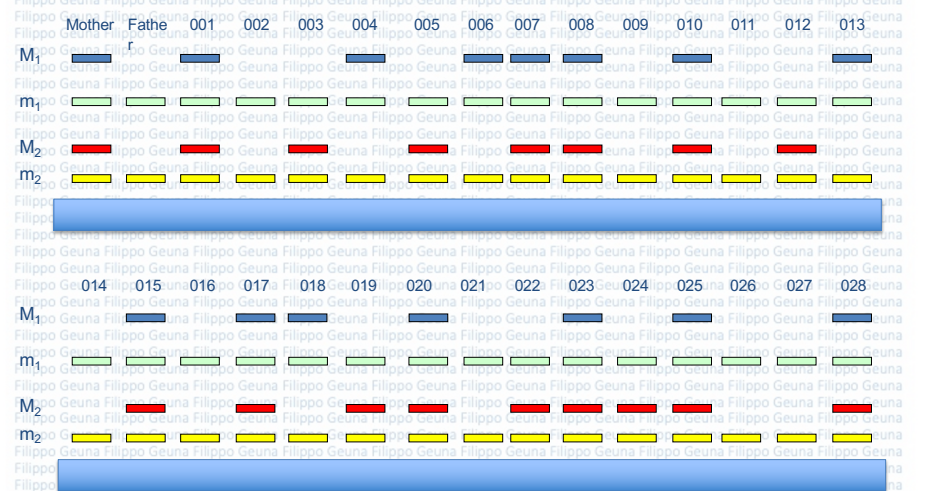
Tree Genetics and Breeding – Exercise 3

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.



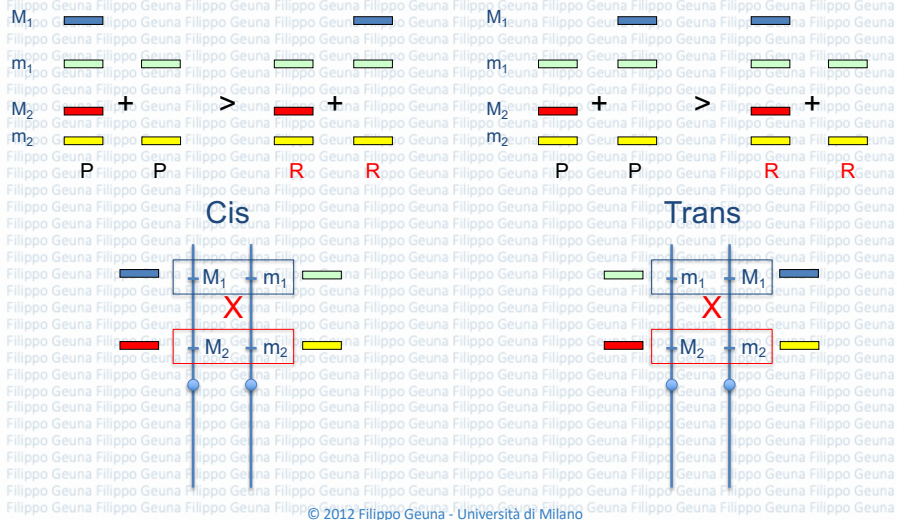
Tree Genetics and Breeding – Exercise 4

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.



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

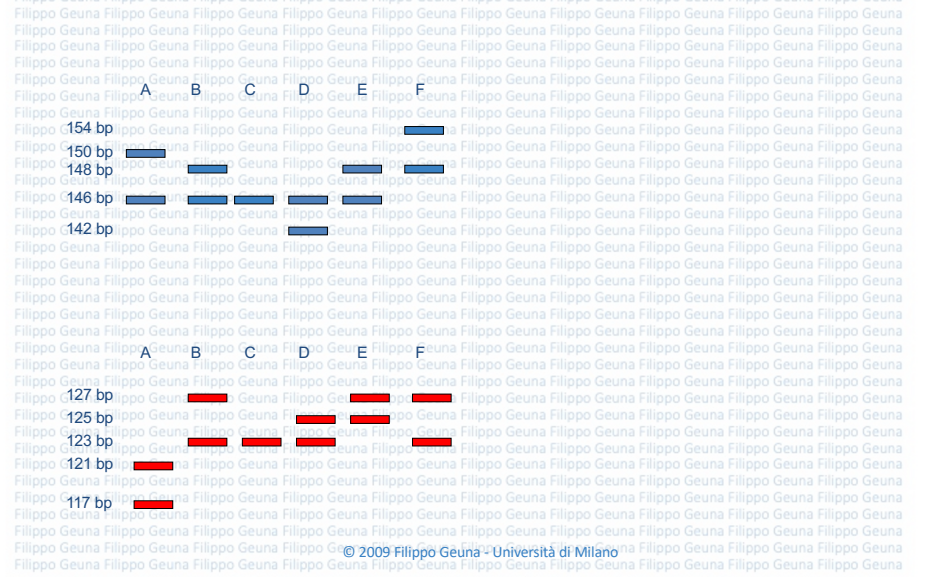
Exercise inspired by Fig. 20.19 (page 971) of the book "Genetics and Genomics (Barcaccia and Falcinelli)". In the following backcross, identify the recombinants and calculate the phase and the map distance in cM between the two RFLP markers with the mother heterozygous for both markers. Below are the 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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Appello di MGV2 – Esercizio 2 WE 11-05-2022

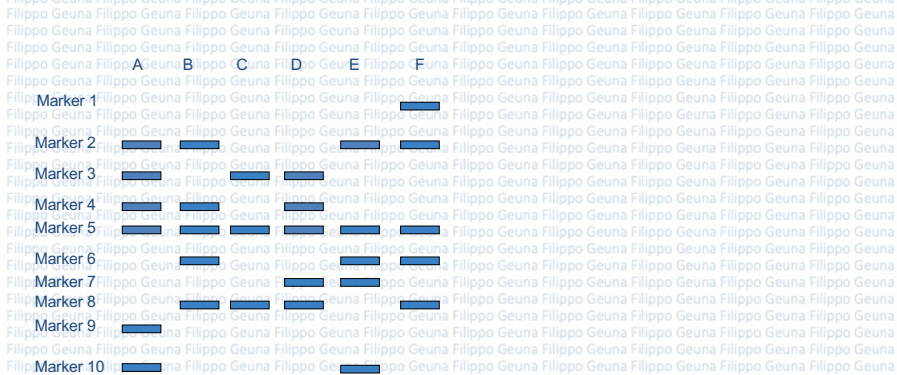
Calculate the genetic distance between the six individuals A, B, C, D, E, F characterized by the two SSR markers shown below in color. Also discuss the level of polymorphism of the two markers.



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Appello di MGV2 – Esercizio 3 ME 29-04-2020

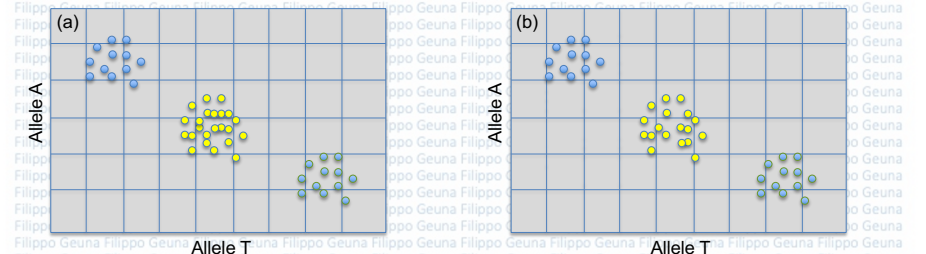
Calculate the genetic distance between the six individuals A, B, C, D, E, F characterized by the AFLP type marker shown below.



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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)?



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