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Coat color genetics in farm animals Examples

Modul no.2: Animal Genetics

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Erasmus+ project 2021-1-SK01-KA220-HED-000032068

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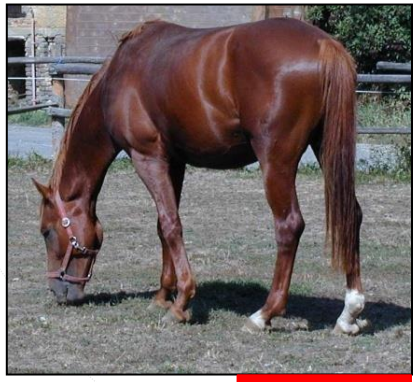
Horse coat color genetics – basic colors

EXTENSION locus (MC1R gene)	*AGOUTI* locus (ASIP gene)	Coat colour
ee	***..***	**chestnut**
E. ***(EE*** nebo ***Ee)***	***aa***	**black**
E. ***(EE*** nebo ***Ee)***	***A.*** ***(AA*** nebo ***Aa)***	**bay**



chestnut

black

bay

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Example 1:

Make a Punnett square for mating of two bay parents, both heterozygous at AGOUTI and EXTENSION loci.

Calculate phenotypic segregation ratio in their offsping.

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Phenotype: bay x bay

Genotype: ***AaEe*** x ***AaEe***

Gametes: ***AE, Ae, aE, ae*** ***AE, Ae, aE, ae***

Offspring:

	AE	***Ae***	***aE***	***ae***
AE	bay	bay	bay	bay
Ae	bay	chestnut	bay	chestnut
aE	bay	bay	black	black
ae	bay	chestnut	black	chestnut

Phenotypic segregation ratio: 9 : 3 : 4

Recessive epistasis of ***ee*** over ***A* locus alleles.**

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AaEe x AaEe

- Probability of **chestnut** foal?

Common genotype **ee ..**

Ee x Ee = 0.25 EE + 0.5 Ee + **0.25 ee** **(25 %)**

- Probability of **black** foal?

Common genotype **E. aa** = 0.75 x 0.25 = 0.1875 **(18.75 %)**

- Probability of **bay** foal?

Common genotype **E. A. =** 0.75 x 0.75 = 0.5625 **(56.25 %)**

Validation: 25 % + 18.75 % + 56.25 % = 100 %

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GREY

Old Kladruber Horse

Lipizzan horse

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Photos: www.nhkladruby.cz

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Genetic determination

GREY locus (G)

Gene STX 17 *(Pielberg et al., 2008)*

- ***G*** allele is completely dominant over ***g*** *allele*

  BUT greying in ***Gg*** individuals is slower and sometimes incomplete
- ***G*** allele „mask“ all other color phenotypes (carriers of ***G*** allele will turn grey regardless of their basic color)

DOMINANT EPISTASIS of G allele over all other loci involved in coat color determination.

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AaEeGg x AaEeGg

Gametes: *AEG, AEg, AeG, Aeg, aEG, aEg, aeG, aeg*

	AEG	*AEg*	*AeG*	*Aeg*	*aEG*	*aEg*	*aeG*	*aeg*
AEG	grey	grey	grey	grey	grey	grey	grey	grey
AEg	grey	bay	grey	bay	grey	bay	grey	bay
AeG	grey	grey	grey	grey	grey	grey	grey	grey
Aeg	grey	bay	grey	chestnut	grey	bay	grey	chestnut
aEG	grey	grey	grey	grey	grey	grey	grey	grey
aEg	grey	bay	grey	bay	grey	black	grey	black
aeG	grey	grey	grey	grey	grey	grey	grey	grey
aeg	grey	bay	grey	chestnut	grey	black	grey	chestnut

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Example 2:

Calculate probability of grey offspring.

Gg x Gg → 0.25 GG + 0.5 Gg + 0.25 gg

↓

0.75 (75 %) G.
Greying will occur

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Example 3:

What genotype at the G locus must a stallion have to obtain as many greys as possible after mating to Old Kladruber black mares?

♀ ♂

gg x gg ⟶ 100 % gg

gg x Gg ⟶ 50 % Gg + 50 % gg

gg x GG ⟶ 100 % Gg

If we use a stallion that has a **homozygous dominant genotype at the G locus**, all of his foals will be grey.

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Partners:

Mendel University in Brno

Siedlce University of Natural Sciences and Humanities

Czech University of Life Sciences Prague

Thank you for your attention!

This presentation has been supported by the Erasmus+ KA2 Cooperation Partnerships grant no. ***2021-1-SK01-KA220-HED-000032068 "Innovation of the structure and content of study programs in the field of animal genetic and food resources management with the use of digitalisation - Inovácia obsahu a štruktúry študijných programov v oblasti manažmentu živočíšnych genetických a potravinových zdrojov s využitím digitalizácie"****. The European Commission support for the production of this presentation does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.*

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