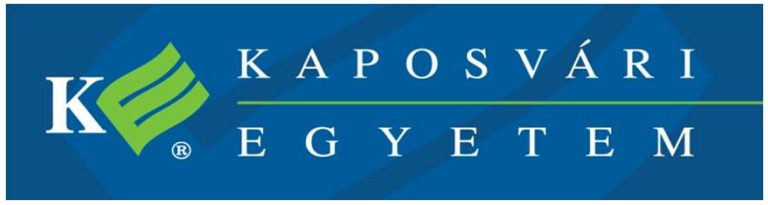
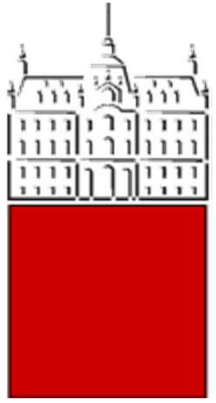
Additive and dominance genetic effects for litter size components in Pannon White rabbits

Nagy, **Gorjanc**, Čurik, Farkas, Szendrő





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Introduction

- Genetic variation
  - additive
  - non-additive
    - dominance
    - epistasis
- Inbriding depression

Estimation of additive and dominance for litter size components in rabbits

Material

- Synthetic Pannon White population (Hungary)
- Data from 1992 to 2009
  - pedigree 4,804
  - phenotype
    - dams 3,883
    - litter size records 18,398

Number of rabbits born alive (NBA) and
Number of rabbits born dead (NBD)

Methods

- Linear model accounting for:
  - parity (factor)
  - season as year-month (factor)

  - inbreeding (regression)
    - dam & litter
  - complete generation equivalents (regression)
    - dam & litter

  - permanent (factor)
  - additive (factor)
  - dominance (factor)

Methods

Non-additive „world“ is more complex than additive!

- **Approximate model** (deBoer & Hoeschele, 1993) inbreeding affects only
  - mean (via regression on inbreeding) and
  - additive genetic variance (via **A**)
- Hoeschele & VanRaden (1991) method of constructing $\mathbf{D}^{-1}$
- REML estimates using VCE-6 (Groeneveld et al., 2008)

Models

Model	Inbreeding	P	A	D
A			X	
Ai	X		X	
AP		X	X	
APi	X	X	X	
APD		X	X	X
APDi	X	X	X	X
AD			X	X
ADi	X		X	X

Descriptive statistics

Variable	Mean	SD	Min	Max
NBA[1]	8.1	3.3	0	19
NBD[1]	0.6	1.6	0	16
F litter[1]	2.5	3.1	0	30.6
CG litter[1]	5.9	3.3	1	14.3
F dam[2]	1.9	2.6	0	29.1
CG dam[2]	5.0	3.4	0	13.9

[1]N=18,398; [2]N=3,883

Results – inbreeding depression (per 10% F)

	NBA		NBD	
Model	F dam	F litter	F dam	F litter
Ai	-0.18	-0.41	0.16	0.06
APi	-0.15	-0.41	0.17	0.06
APDi	-0.14	-0.41	0.18	0.06
ADi	-0.14	-0.41	0.18	0.06

- Negative effect for NBA and positive for NBD
- Litter inbreeding stronger in NBA
  opposite for NBD (early vs. late gestation)

Results – variance components NBA

Model	P	p2	A	h2	D	d2	r2
A			1.33	12			12
Ai			1.33	12			12
AP	0.66	6	0.62	6			12
APi	0.66	6	0.62	6			12
APD	0.55	5	0.60	6	0.54	5	16
APDi	0.55	5	0.60	6	0.52	5	15
AD			0.98	9	1.30	12	21
ADi			0.98	9	1.29	12	21

Results – variance components

Model	P	p2	A	h2	D	d2	r2
Ai	**NBA**		1.33	12			12
APi	0.66	6	0.62	6			12
APDi	0.55	5	0.60	6	0.52	5	15
ADi			0.98	9	1.29	12	21
Ai	**NBD**		0.08	3			3
APi	0.04	2	0.05	2			4
APDi	0.01	0.5	0.05	2	0.13	5	7.5
ADi			0.05	2	0.14	6	8

Breeding value correlations

NBA	APi	APDi	ADi
Ai	0.975	0.974	0.993
APi		**0.999**	0.987
APDi			0.989

NBD	APi	APDi	ADi
Ai	0.995	0.991	0.992
APi		**0.998**	0.998
APDi			1.000

Breeding value inflation

NBA	APi	APDi	ADi
Ai	1.6	1.6	1.2
APi		**1.0**	0.7
APDi			1.4

NBD	APi	APDi	ADi
Ai	1.3	1.4	1.4
APi		**1.1**	1.1
APDi			1.0

Conclusions

- Expected direction of inbreeding depression
  - litter effect stronger for NBA and opposite for NBD (early vs. late gestation)
- Sizeable dominance variation for litter size components
- Repeatability animal model nicely „accounts“ for dominance component

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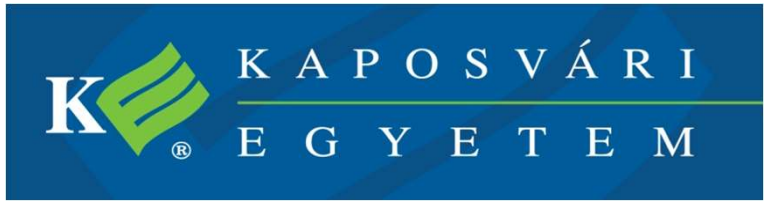

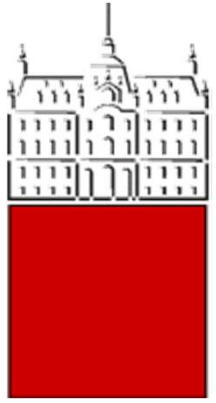

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