5th European Seminar on Agrobiodiversity 22-25 of September 2011,
Dimitrovgrad, Serbia
Combined Annual Meeting of SAVE and of DAGENE

Ecotypes - breed variants adapted to different environments, in example of Tsigai haemoglobin genotypes

András Gáspárdy

Szent István University, Faculty of Veterinary Science, H-1078 Budapest,
István u. 2., Hungary

5th European Seminar on Agrobiodiversity will be “Preservation or adaptation? – Conservation in the face of a changing environment”.

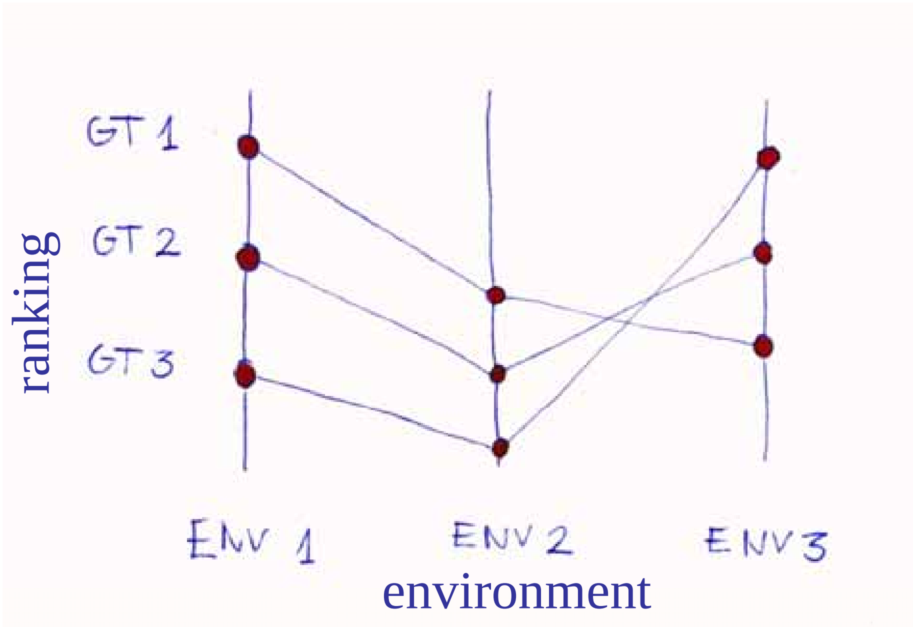
Ecotypes - breed variants adapted to different environments, in example of Tsigai haemoglobin genotypes

5th European Seminar on Agrobiodiversity will be "Preservation or adaptation? – Conservation in the face of a changing environment".

Ecotypes - breed variants adapted to different environments, in example of Tsigai haemoglobin genotypes

Breeding value estimation

- A **genotype-environment** interaction is evaluated when the ranking order of genotypes are proven by different environments.



5th European Seminar on Agrobiodiversity will be "Preservation or adaptation? – Conservation in the face of a changing environment".

Ecotypes - breed variants adapted to different environments, in example of Tsigai haemoglobin genotypes

5th European Seminar on Agrobiodiversity will be "Preservation or adaptation? – Conservation in the face of a changing environment".

Ecotypes - breed variants adapted to different environments, in example of Tsigai haemoglobin genotypes

Assumptions
– genetic equilibrium

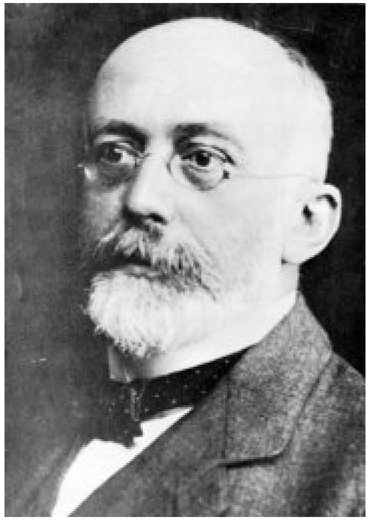
- The gene(allele)- and genotype frequencies remain **in all the next generations the same**, when any disturbing impacts* act and we suppose that the genotypes have the same vitality, fertility and mating chance.

*mutation, immigration – selection, emigration

„Weinberg-Hardy-Tsetverikov rule”

Sergey Sergeyevits Tsetverikov (1880-1959)

Godfrey Harold Hardy
(1877-1947)



Wilhelm Weinberg
(1862-1937)

5th European Seminar on Agrobiodiversity will be "Preservation or adaptation? – Conservation in the face of a changing environment".

Ecotypes - breed variants adapted to different environments, in example of Tsigai haemoglobin genotypes

I. Kind of selection

Natural selection

The natural selection allows only those individuals to reproduce that posses traits adaptive to the environments in which they live (*partial* or *total* selection).

Artificial selection

The artificial selection is operative when humans determine which individuals will be allowed to leave offspring.

Natural selection (partial)

Different advantages of hemoglobin-variants (AA, AB, BB) in sheep.

BB-variant has less fixing-ability on oxygen what will be manifested in lower fertility rate.

Hemoglobin	**AA**	**AB**	**BB**
Fertility rate in lowland:	200	260	115
Fertility rate in mountains:	190	210	60
Survival rate:	190/200 0,95	210/260 0,82	60/115 0,52
Fitness, w:	**1,00**	0,86	0,55
Coefficient of selection (s = 1- w)	**0,00**	0,14	0,45

Evans J.V., Harris H., Warren F.L. (1957): Haemoglobin types in British breeds of sheep. Biochem J., 65:42.p.

Allelic frequencies of Haemoglobin by Tsigai sheep variants

Haemoglobin	Jákotpuszta (2003) (n=82)	Bátmonostor (1964) and Csátalja (1976) (n=448)	Szalkszentmárton (1990) and Apajpuszta (1998) (n=290)	Cegléd (1990) (n=227)
Hb^A	**0,1611**	**0,0706**	**0,0616**	**0,0163**
Hb^B	0,8389	0,9295	0,9385	0,9837
Eco-type	mountain	l o w l a n d		dairy

Haemoglobin genotypes

- importance in the taxonomy,

- consequences are not unambiguous,

- the respiratory functions of Hb variants do not differ,

- fertility of Hb variants was not confirmed by all the authors,

- Hb genotype is one of the relevant functional markers
  to monitor animal well-being

- animals with BB genotype are more resilient to parasites
  and climatic stress.

J. Anim. Breed. Genet. 118 (2001), 327–340
© 2001 Blackwell Wissenschafts-Verlag, Berlin
ISSN 0931–2668

Ms. eingegangen: 23.03.2000

[1]*Institut für Tierzucht und Haustiergenetik der Justus-Liebig-Universität Giessen und* [2]*Amt für Landwirtschaft und Ernährung, Pfaffenhofen an der Ilm, Deutschland*

Biochemische Polymorphismen und Haupt-mtDNA-Haplotypen bei Bergschafrassen und Waldschafen als Beitrag zur Abstammung der Hausschafe

By R. Wassmuth[1], S. Hiendleder[1], Ch. Mendel[2] und G. Erhardt[1]

Tabelle 1. Haupt-mtDNA-Haplotypfrequenzen sowie Allelfrequenzen im Hämoglobin (HBB), dem Vitamin-D-bindenden Protein (GC), der Carboanhydrase (CA2) und im Albumin (ALB) mit Vergleichswerten[a,b] (Major mtDNA-haplotype-frequencies and allele-frequencies of haemoglobin (HBB), vitamin D-binding protein (GC), carbonic anhydrase (CA2), and albumin (ALB) in comparison to literature data[a,b])

Rasse	n	mt DNA^A	mt DNA^B	HBB^A	HBB^B	GC^S	GC^F	GC^V	CA^F	CA^S	ALB^F	ALB^S	ALB^W
Steinschaf I	7	–	1.0	0.500	0.500	1.0	–	–	–	1.0	–	1.0	–
Steinschaf II	5	–	1.0	0.400	0.600	1.0	–	–	0.300	0.7	–	1.0	–
Brillenschaf	7	–	1.0	0.429	0.571	1.0	–	–	–	1.0	–	1.0	–
Weißes Bergschaf	11	–	1.0	0.546	0.435	1.0	–	–	–	1.0	–	1.0	–
Braunes Bergschaf	7	–	1.0	0.857	0.143	1.0	–	–	–	1.0	–	1.0	–
Waldschaf	7	0.571	0.429	0.571	0.429	0.929	0.071	–	–	1.0	–	1.0	–
Waldschaf I[a]	49	–	–	0.500	0.500	0.673	0.038	0.289	–	–	–	0.981	0.019
Waldschaf II[a]	26	–	–	0.582	0.418	0.725	0.153	0.122	–	–	0.010	0.949	0.041
Bergamasker	1	–	1.0	–	1.000	1.0	–	–	–	1.0	–	1.0	–
Bergamasker[b]	199	–	–	0.191	0.809	–	–	–	0.076	0.924	–	1.0	–

[a]Fésüs et al. 1992; [b]Zanotti Casati et al. (1990)

Table 1
Allele frequencies at the post-albumin, transferrin and haemoglobin loci of six Moroccan local sheep breeds

System	Allele	Timahdite	Béni Guil	Sardi	Boujaâd	D'man	Béni Ahsen
GC	F	0.085	0.097	0.087	0.039	0.092	0.061
	S	0.900	0.885	0.882	0.951	0.837	0.897
	V	0.015	0.018	0.031	0.010	0.071	0.042
TF	A	0.127	0.155	0.231	0.179	0.108	0.166
	G	0.045	0.050	0.042	0.061	0.019	0.028
	B*	–	–	0.016	–	–	–
	B	0.315	0.200	0.167	0.223	0.243	0.203
	C	0.127	0.260	0.207	0.257	0.190	0.402
	D	0.372	0.308	0.262	0.250	0.371	0.175
	M	–	–	0.005	–	0.013	–
	E	0.014	0.027	0.066	0.030	0.056	0.024
	P	–	–	0.002	–	–	0.002
HBB	A	0.008	0.063	0.009	0.025	0.063	0.025
	B	0.957	0.915	0.932	0.926	0.824	0.926
	H	0.035	0.022	0.059	0.049	0.113	0.049

Haemoglobin genotypes

- consequences are not unambiguous,

- the respiratory functions of Hb variants do not differ,

- fertility of Hb variants was not confirmed by all the authors,

- Hb genotype is one of the relevant *functional markers* to monitor animal well-being

- animals with BB genotype are more resilient to parasites and climatic stress.

Relationships among functional markers, management, and husbandry in sheep: a Mediterranean case study

F. Petazzi • G. Rubino • I. Alloggio • A. Caroli •
E. Pieragostini

2009

Vet Res Commun

Table 4 Correlation coefficients (R) between the considered variables (see the meaning of the code in Table 1) and 3 first principal components (PRIN) obtained from the Princomp analysis

Variable	PRIN	R	P
Alb/g	1	0.902	0.000
Glob/g	1	0.887	0.000
SAP	1	−0.846	0.001
Hct	2	0.799	0.003
HEALTH	2	0.799	0.003
HBBA	3	−0.776	0.005
HBBB	2	0.773	0.005
AREA	2	0.771	0.005
HBBI	2	−0.761	0.007
Hb	2	0.745	0.009
SIZE	3	0.736	0.010
TP	1	0.720	0.012
Chlo	1	0.669	0.024
Alb%	3	−0.668	0.025
Glob%	3	0.665	0.026
Alb%	1	0.660	0.027
Glob%	1	−0.660	0.027
Glob/g	3	0.654	0.029
Ca	1	0.634	0.036

Only the significant correlations are included, the coefficients being reported in ascending probability value for the null hypothesis (R=0)

5th European Seminar on Agrobiodiversity will be "Preservation or adaptation? – Conservation in the face of a changing environment".

Ecotypes - breed variants adapted to different environments, in example of Tsigai haemoglobin genotypes