

# Loci associated with negative heterosis for viability and meat productivity in interspecies sheep hybrids

Zlobin A.S.<sup>1\*</sup>, Volkova N.A.<sup>2</sup>, Zinovieva N.A.<sup>2</sup>, Iolchiev B.S.<sup>2</sup>, Bagirov V.A.<sup>2</sup>, Borodin P.M.<sup>3</sup>, Aksenovich T.I.<sup>3</sup>, Tsepilov Y.A.<sup>1</sup>

<sup>1</sup> Kurchatov Genomic Center of the Institute of Cytology and Genetics, SB RAS, Novosibirsk, Russia

<sup>2</sup> L.K. Ernst Federal Science Center for Animal Husbandry, Dubrovitsy, Moscow Region, Russia

<sup>3</sup> Institute of Cytology and Genetics, SB RAS, Novosibirsk, Russia

\* zlobin@bionet.nsc.ru

**Aim:** This project is focused on detection of novel loci associated with meat productivity and carcass traits in sheep using multivariate approaches.

**Materials:** In total we have studied 87 backcross of romanovskaya x argali. Viability information was available for four time-points after animal birth (6 days, 42 days, 3 months, 6 month). We used four indexes related to meat productivity (compactness, shortlegged, length and cumulative) measured at 42 days after animal birth.

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**Methods:** We used Cox regression for genome wide association study of viability. We used likelihood ratio test (LRT) for estimating of association p-value using the following procedure. As null model (N0) we used the Cox model “Survivability ~ sex+number of fetus+Principal component 1+ Principal component 2”. As an alternative model (N1), we added SNP genotype as factor. The association statistic was calculated as  $-2(\text{LogLik}(N0-N1))$ . It was distributed as chi-squared with one degree of freedom in case the SNP had only two genotypic classes or with two degrees of freedom in case the SNP had all three genotypic classes. As a threshold we used  $0.05/N_{\text{indep snps}}$  where  $N_{\text{indep snps}} = 46,471$  snps remaining after a pruning procedure. We used linear regression for genome wide association study of four indexes. Prior to the analysis, we used GRAMMAR-Gamma method to correct the phenotypes for a relatedness structure. As covariates, we used sex, number of fetuses, last time interval with available phenotype information, two first genetical principal components and SNPs, associated with viability. Resulted residuals were used in GWAS analysis using LRT as described above

We found one locus significantly associated with viability. Inflation factor was 1.071

SNP	CHR	POS	P	A1/A2	AF	P.11	P.12	P.22	AF Romanovskaya)	AF Argali	Nearest gene
rs417431015	6	55587508	2.33e-07	G/A	0.368	28	54	5	0.5	0.6	ARAP2

AF – Frequency of A2 allele

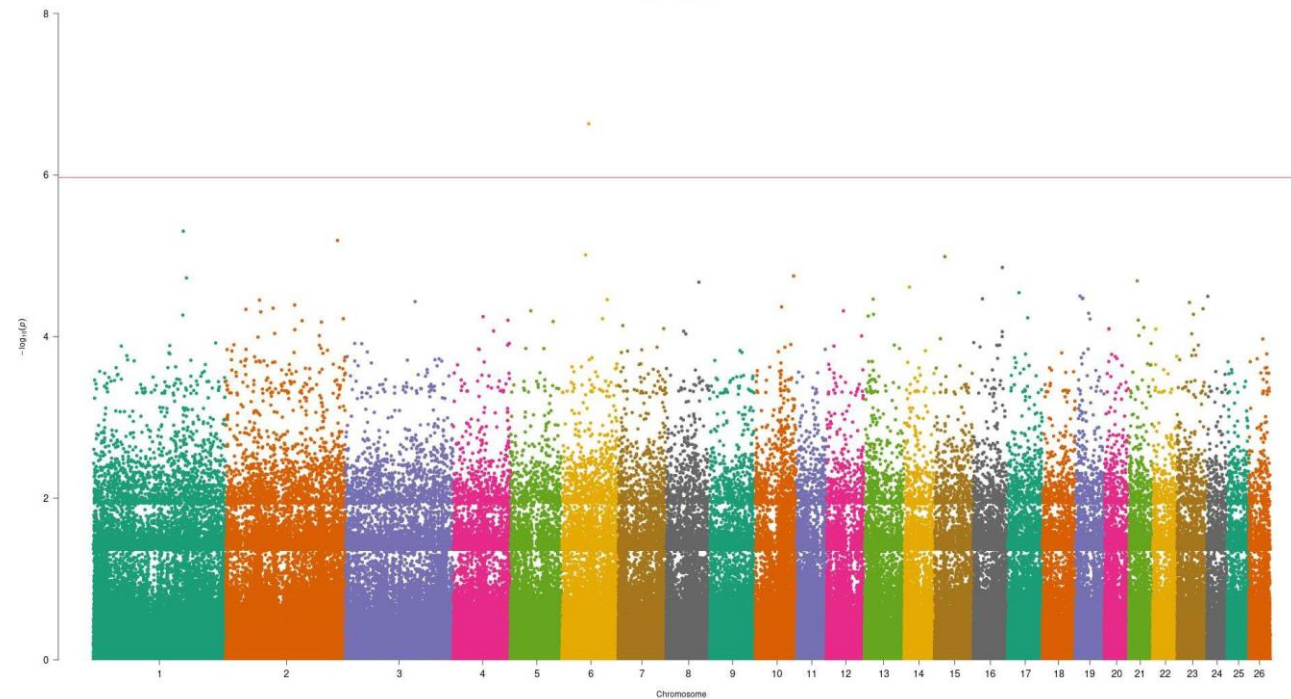
P.11 – Number of animals with two A1 alleles

P.12 – Number of animals with A1 and A2 alleles

P.22 – Number of animals with two A2 alleles

AF Romanovskaya – Frequency of A2 counted on 18 Romanovskaya sheep

AF Argali – Frequency of A2 count on 10 Argali (*Ovis ammon*)



We found two loci associated with compactness index.

SNP	CHR	POS	P	A1/A2	AF	P.11	P.12	P.22	AF Romanovskaya	AF Argali	Nearest gene
rs413302370	15	50414913	2.65e-07	A/G	0.407	39	24	23	0.667	1	<i>PDE2A</i> <i>ARAP1</i>
rs402808951	22	4457667	3.18e-08	A/G	0.282	55	15	17	0.278	1	<i>PCDH15</i>

AF – Frequency of A2 allele

P.11 – Number of animals with two A1 alleles

P.12 – Number of animals with A1 and A2 alleles

P.22 – Number of animals with two A2 alleles

AF Romanovskaya – Frequency of A2 counted on 18 Romanovskaya sheep

AF Argali – Frequency of A2 count on 10 Argali (*Ovis ammon*)

