

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

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Motivation and Aim: The modern market demands the animal breeds or breed types characterized by good viability, high growth rate and ability to effectively use feed. One of the way to improve the existing breeds is obtaining of breed hybrids. Hybrids are expected to have the increasing of the economically important traits because of mixing the genetic contributions of its parents. However, earlier for hybrids of romanovskaya sheep and argali (*Ovis ammon*) negative heterosis was shown for meat productivity traits and viability. In this work, we aimed to find genetic loci associated with negative heterosis in these hybrids.

Methods and Algorithms: 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. We used Cox regression for viability GWAS analysis and linear model for GWAS analysis of meat productivity traits. For each of the trait we used additive and three non-additive models (dominant, recessive, overdominant). As covariates, we used sex, number of fetuses, last time interval with available phenotype information, two first genetical principal components of kinship matrix and PRS (Polygenic risk score) for SNPs shown as associated with mortality.

Results: As a result, we discovered 3 loci associated with viability (rs422463993, rs415115903, rs417748866) and 19 loci associated with two indexes (compactness and shortlegged). For each locus, we manually checked the boxplots to infer the model of heritability. For four loci, we have demonstrated the effect of negative heterosis. Two of four loci (rs419262145 and rs399332377) explained 4.2 and 7.8 % variance of negative heterosis respectively.

Conclusion: The results can be useful for further association studies and preliminary estimation of genetic variability for economically important traits in different sheep breeds.

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