

## **WHAT MICROSATELLITES CAN TELL US ABOUT DISEASE RESISTANCE IN FREE-LIVING SHEEP POPULATIONS: THE GENETICS OF RESISTANCE TO NEMATODES IN NATURALLY PARASITISED SOAY SHEEP FROM ST. KILDA, SCOTLAND**

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*Abstract:* Microsatellites can be applied to assess neutral genetic variation within or among individuals and populations, they provide markers useful for deriving pedigree relationships, and they can act as markers for regions of the genome containing QTL or candidate genes of importance. Here I will discuss how microsatellites have been applied in these three ways to study the genetic basis of resistance to gastrointestinal nematode parasites in an unmanaged population of feral Soay sheep on the island of Hirta in the St. Kilda archipelago, Scotland. Soay sheep are naturally parasitised by gastrointestinal nematodes of the genus *Teladorsagia*, the most important nematode in European domestic sheep. These worms cause damage to the gut and nutrient deficiency, and contribute to over-winter mortality during years of harsh weather and high population density. In Soay sheep parasitism can be regularly monitored by counting eggs in faeces (FEC) non-invasively. Three questions were addressed in this project using microsatellite DNA information: i) is there heritable variation for resistance, ii) is resistance compromised by inbreeding, and iii) what genes are associated with resistance? Since 1985, the paternity of 68% of 2,020 sampled lambs has been determined using a panel of 12-17 microsatellite DNA markers. This information was combined with 1,690 known mother-offspring relationships to produce a pedigree of the population. We estimated quantitative genetic parameters for FEC using REML. There was significant heritable variation for FEC ( $h^2 = 0.09$  in males, 0.19 in females). Maternal effects were higher in females (0.20 vs. 0.07) suggesting that exposure to parasites and infection may be partly mediated by the maternal environment (i.e. shared home range use). Average individual heterozygosity ( $H$ ) at the microsatellite loci used in the paternity analysis also provides a measure inversely correlated with inbreeding.  $H$  was negatively associated with FEC indicating that relatively inbred sheep are more susceptible to parasitism by nematodes. These individuals were also less likely to survive harsh winters due to their increased parasite burdens, suggesting that parasites mediate natural selection against inbreeding. Finally, we typed Soay sheep at a diallelic microsatellite locus located in the interferon gamma gene which is associated with resistance to nematode infection in domestic sheep. One allele conferred reduced FEC and increased levels of immunoglobulin A in young Soay sheep. In the Soay sheep project, microsatellites have proven to be powerful and flexible tool for unravelling the genetics of a complex and important phenotypic trait. In principle, these approaches can be applied to any other ungulate population where DNA samples can be obtained and individuals can be monitored if we utilise the domestic sheep and cattle genome maps as a source of informative markers.

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