

Chasing the Trojan Female: Common wasp mitochondrial DNA variants that are associated with low fitness

Jana Dobelmann ¹, Neil J. Gemmell ², Oliver Quinn ¹, Tom Wenseleers ³, Philip J. Lester ^{*1}

¹ School of Biological Sciences, Victoria University, Wellington

² Department of Anatomy, University of Otago, Dunedin

³ Department of Biology, KU Leuven, Laboratory of Socio-ecology and Social Evolution, Leuven, Belgium

A new and emerging pest control method is based on the use of existing mitochondrial DNA mutations, which impair or inhibit male fertility while having little effect on females. It effectively is a variant of the Sterile Insect Technique with the queens carrying these mutations called Trojan females. Mitochondrial genes are typically involved in the energy metabolism and are passed on by the female line only, which allows male harming mutations to accumulate in these genes. We examined fitness effects of mitochondrial DNA in populations of common wasps (*Vespula vulgaris*) in their home range of Belgium and in the invaded range of New Zealand. Within colonies, there was a significantly positive relationship between worker number and new queen productivity, though the slope of that relationship was significantly lower in the New Zealand population. We suspect that this lower queen productivity in New Zealand is due to higher wasp densities with increased levels of competition here. In New Zealand there were three common haplotypes (mitochondrial genotypes) that frequently had high queen productivities. Genetic diversity was higher in Belgium with no dominant haplotypes. Within both countries there were colonies with no or only few queens being produced. In New Zealand, rare haplotypes were associated with this low queen productivity, as would be expected if a lineage had a reproductive defect. These low-productivity lineages may represent pest control candidates, with only slightly deleterious effects on female but severe effects on male reproduction. Further research on male effects in these lineages will show if we have caught the Trojan female.

