Hybridization in North Island Tree Weta

Natasha Mckean

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Abstract

Hybridization has important implications for species concepts, understanding the speciation process, as well as the issue of sister species coexistence and conservation. Tree weta (genus *Hemideina*) are an interesting natural system for studying hybridization, as some species have multiple chromosome races that can interbreed, and all are broadly parapatric with at least one other species in the wild, so there are many opportunities for natural hybridization to occur. It is not known in many cases whether species pairs are hybridizing in the wild, or whether introgression occurs. This study focused on the interactions between *H. thoracica* and its two neighbouring species; *H. crassidens* and *H. trewicki.*

Surveys of one area of sympatry between *H. thoracica* and *H. crassidens,* and one between *H. thoracica* and *H. trewicki*, were conducted to see if the parent species and putative hybrids could be easily distinguished, and to find out the relative ratios of the parents and putative hybrid individuals. Weta from the parent populations were studied in areas where they are sympatric as well as allopatric to look for evidence of possible divergence and/or introgression in sympatry. These studies showed that where these species pairs are sympatric, parent forms were predominant, with few morphological intermediates, despite parent species existing in similar proportions. *Hemideina thoracica* and *H. trewicki* differed in sympatry regarding both size and possibly life history, with *H. thoracica* females being larger and both sexes maturing later than *H. trewicki. Hemideina thoracica* and *H. crassidens* showed possible evidence of introgression, but no evidence of divergence in sympatry.

Karyotypes, a mitochondrial locus, and eight nuclear loci were examined for evidence of introgression between the species pairs in sympatry. All putative hybrids (morphological intermediates) from both species pairs were found to be genetic hybrids, with strong evidence of being F_1 hybrids. No evidence was found for introgression of karyotypes or of mitochondrial haplotypes in either case. No evidence of introgression was found at nuclear loci for *H. thoracica* and *H. trewicki.* However, *H. thoracica* and *H. crassidens* showed some overlap at nuclear markers in sympatry, suggesting a low level of introgression. There was also a sex-bias in the production of F_1 hybrids, with most having a *H. crassidens* mother.

Hemideina thoracica appears to interact differently with its two neighbouring species; *H. crassidens* and *H. trewicki. Hemideina thoracica* and *H. trewicki* appear to be reproductively isolated, and are possibly exploiting different niches. *Hemideina thoracica* and *H. crassidens* by contrast, showed no evidence of divergence and are presumably dealing with strong interspecific competition, as well as introgression where they meet. These two species are unusual in maintaining a bimodal hybrid zone in the apparent absence of assortative mating. They also contrast with Haldane's rule, as F_1 males have some level of fertility, while females are likely infertile. A sex-bias in the production of F_1 hybrids may be due to 'sexual exclusion', and so could possibly provide an explanation of how *H. thoracica* has managed to displace *H. crassidens* from much of its former range.

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