Towards area-wide control of buffalo flies

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Buffalo flies (BF) (*Haematobia irritans exigua*) were introduced to Australia in 1838 and have become major cattle pests in Australia's northern cattle industries. They have been steadily expanding their range southward and their spread is likely to be further facilitated by climate change. Control programmes consisting of compulsory chemical treatments and regulated cattle movements have proven unsuccessful in preventing the spread of buffalo flies and without area-wide intervention they are likely to become major cattle pests in Australia's southern beef and dairy industries.

Directly targeting BF populations using the intracellular, insect-infecting bacterium *Wolbachia* represents an attractive alternative. *Wolbachia* have a range of effects of potential use in area-wide approaches for the control of insect pests and insect-vectored diseases, including cytoplasmic incompatibility that causes embryonic mortality when uninfected females mate with infected males, transmission blocking of insect-vectored pathogens, and a range of fitness effects that can reduce fly populations. This paper describes fitness effects when BF are transinfected with *Wolbachia*.

Three strains of *Wolbachia* (*w*AlbB, *w*Mel and *w*MelPop) were isolated from mosquito cells and used to infect *Haematobia* cells from a recently established cell line. The *Wolbachia* strains were each reared through more than 80 passages in the *Haematobia* cells to adapt them to the BF context and then microinjected into pupae from a laboratory colony of BF. Pupae were reared through to adult flies and the effects of *Wolbachia* infection on longevity of BF, egg production and eclosion of flies from pupae were assessed in laboratory studies. Results are shown in Figure 1. Analysis was by Mantel-Cox logrank test (Figure 1a) and one way ANOVA with Tukey's multiple comparison test (Figures 1b, 1c).

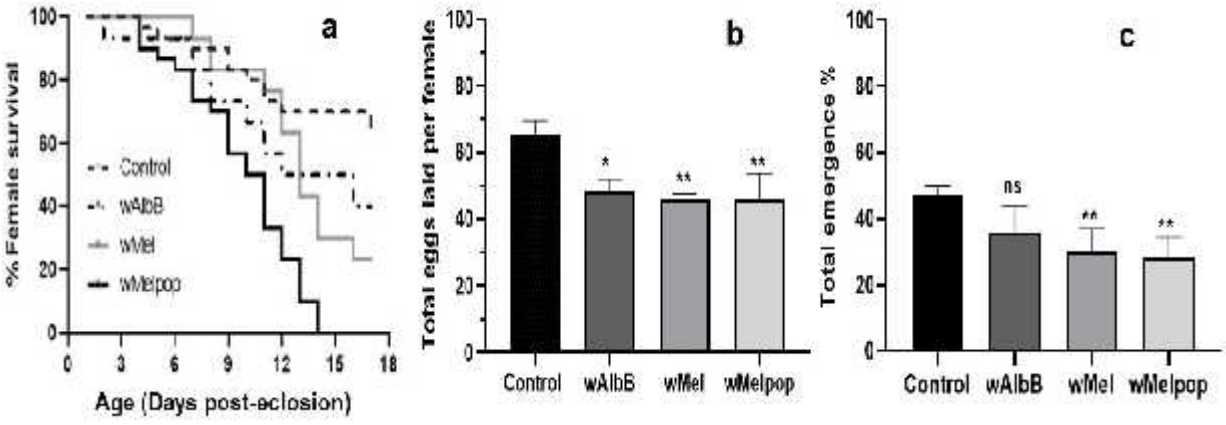

Figure 1. Reduction in (a) longevity, (b) egg production and (c) number of adults eclosing from pupae in buffalo flies infected with *w*Alb, *w*Mel and *w*MelPop *Wolbachia.* Controls were sham-injected pupae. Comparison between controls and *Wolbachia*-infected strains shown by horizontal bars, (*P<0.05; **P<0.01).

Infection with *Wolbachia* significantly reduced the longevity of BF (*w*MelPop and *w*Mel; p<0.0001), the number of eggs laid (*w*MelPop, *w*Mel, wAlb; P<0.05) and percent of pupae hatching to adult flies (*w*MelPop, *w*Mel, wAlb; P<0.05). This could markedly affect the viability BF populations, particularly in locations near the edge of the BF range. In addition, the effects of cytoplasmic incompatibility when uninfected female flies mate with infected males could further reduce BF reproduction and could also potentially be used in 'sterile-male type' approaches for local eradication (McGraw and O'Neill 2013). These results provide further indication of the potential for use of *Wolbachia*-based strategies to prevent range expansion of BF and to reduce BF impacts in current endemic areas.

Reference

McGraw EA and O'Neill SL (2013) *Nature Reviews Microbiology* **11**, 181-193.

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