The phenotypic manifestation of *Wolbachia* genetic diversity in host fitness

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One of the most widespread prokaryotic symbionts of invertebrates is the intracellular bacteria *Wolbachia* that can be found in about 50% of insect species including *Drosophila*. *Wolbachia* can affect the *Drosophila* host in different ways including male killing, cytoplasmic incompatibility, protection from RNA-viruses, nutrition provisioning, fecundity increasing and suppression of mutations.

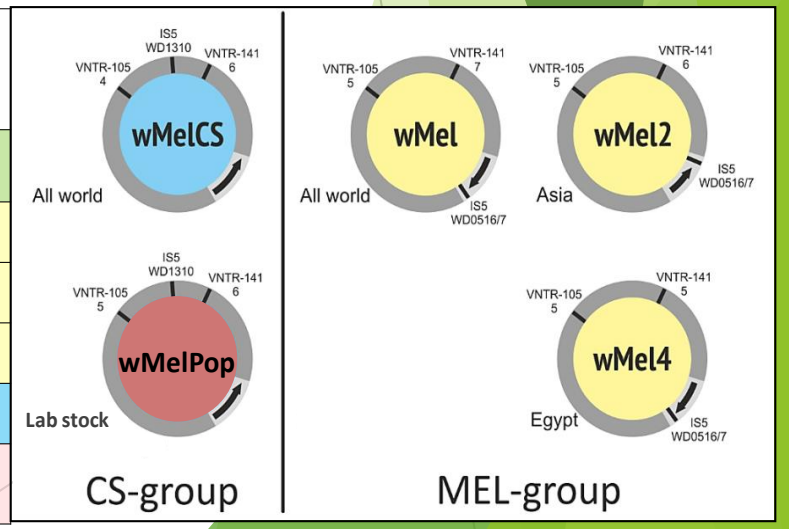
The idea of the study was:

- to investigate the effect of *Wolbachia* on the host stress resistance and fecundity;
- to find out if this effect depends on the genotype of the bacteria.

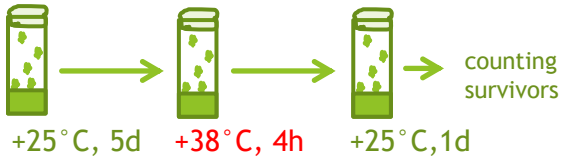
The model:

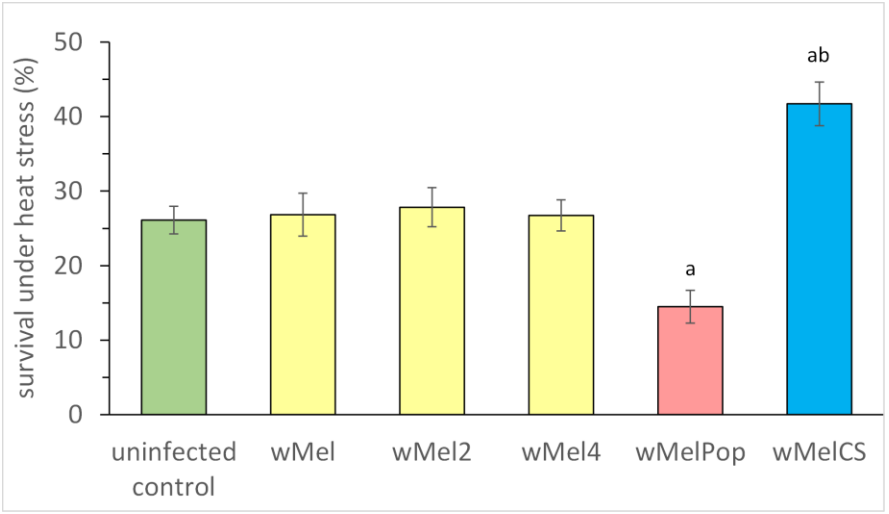
five conplastic *Drosophila* lineages carrying the nuclear background of interbreeded wild type Bi90 line and cytoplasmic backgrounds with different genotype variants of *Wolbachia* produced by 20 backcrosses of Bi90 tetracycline treated males with appropriate source of *Wolbachia*.

***Drosophila* strain**	***Wolbachia* infection**	**donor of cytoplasm**	**origin of donor strain**
$Bi90^{T}$	non-infected	Bi90, tetracycline treated	Kyrgystan, 2004
$Bi90^{Mel}$	wMel	Bi90	Kyrgystan, 2004
$Bi90^{Mel2}$	wMel2	42	Yuzhno-Sakhalinsk, 2015
$Bi90^{Mel4}$	wMel4	w304	Sinai Peninsula, Egypt, 2010
$Bi90^{CS}$	wMelCS	w153	Uzbekistan, 1989
$Bi90^{Pop}$	wMelPop	Iso wMelPop	Courtesy of Dr. Luis Teixeira



The effect of various *Wolbachia* infections on *D. melanogaster* heat stress resistance and fecundity

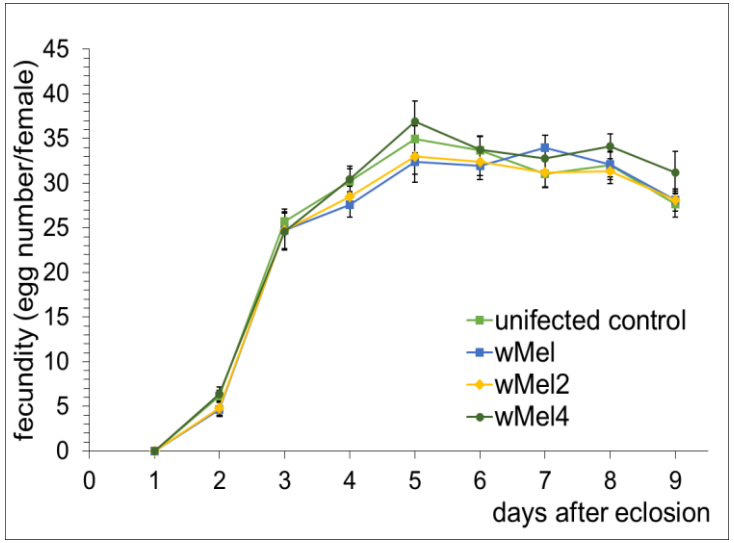


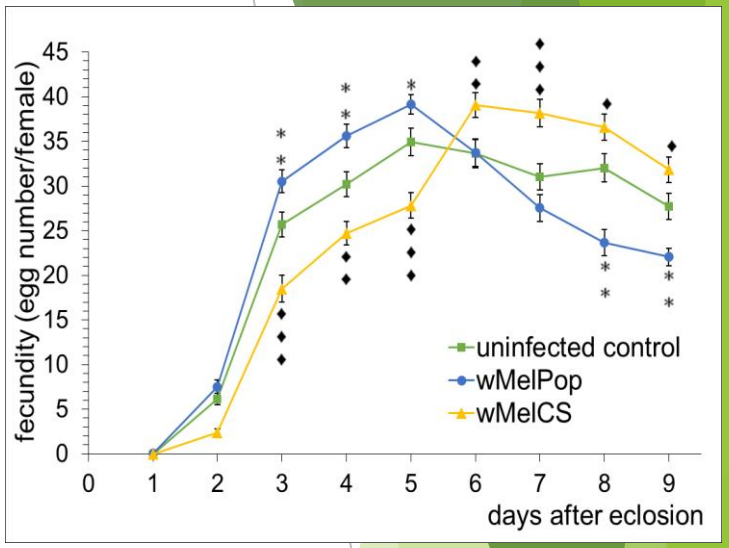


a – p<0.01 *vs* uninfected and wMel, wMel2, wMel4 infected groups

b – p<0.0001 *vs* wMelPop infected group

- wMel, wMel2 and wMel4 genotypes of *Wolbachia* do not affect the survival under heat stress;
- wMelCS genotype of *Wolbachia* increases stress resistance;
- the pathogenic wMelPop strain decreases stress resistance.





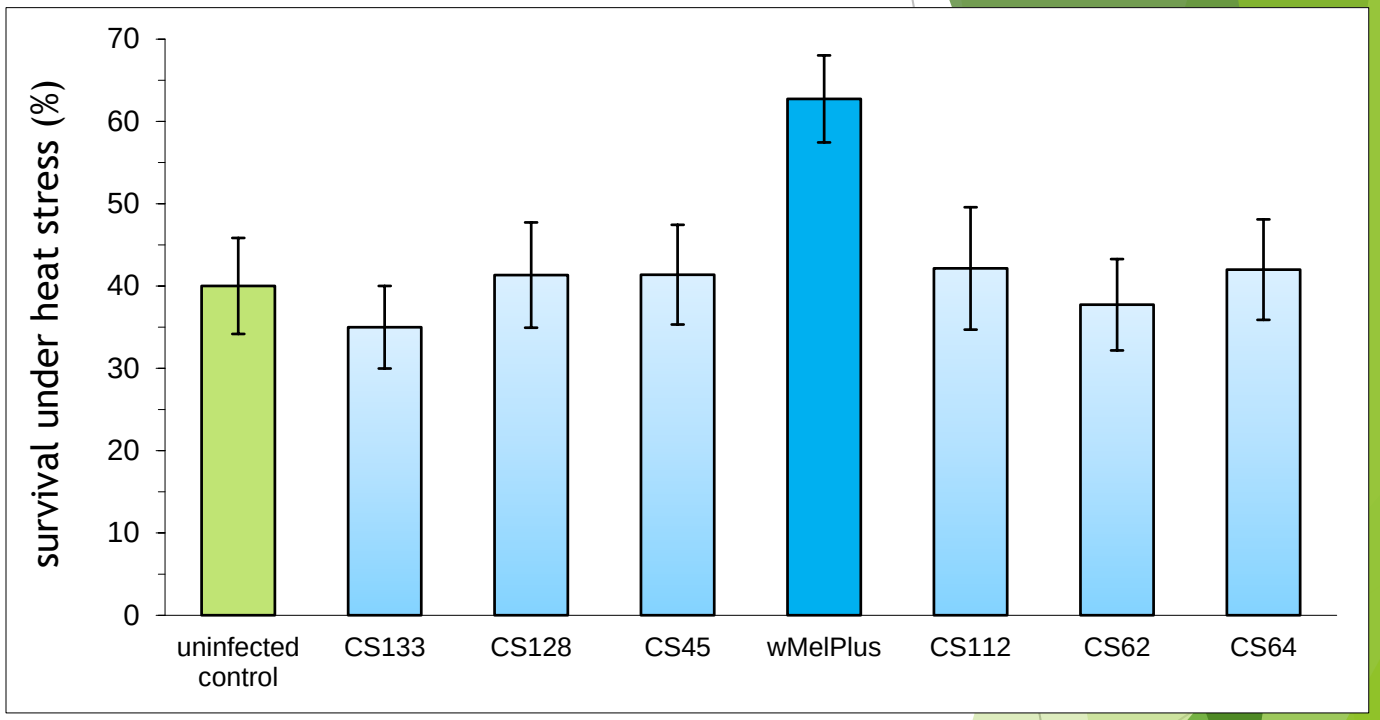
- wMel, wMel2 wMel4 *Wolbachia* do not affect *Drosophila* fecundity;
- wMelCS decreases the fecundity in the beginning of the oviposition increasing it later;
- the pathogenic wMelpop increases the fecundity in the beginning of the oviposition decreasing it later.

Thus, wMelCS genotype looks like “antipode” to wMelPop strain. We wondered if these characteristics were typical to wMelCS genotype on the whole, or we had run into a unique strain similar to wMelPop only “with a plus sign”.

The heat stress resistance in *D. melanogaster* carrying wMelCS *Wolbachia* strains of different origin

To clarify this question we created six more conplastic *Drosophila* lineages with *Bi90* nuclear background and cytoplasm with *Wolbachia* of wMelCS genotypes of different origins.

Drosophila strain	donor of cytoplasm	origin of laboratory donor strain
$Bi90^{CS112}$	3-112	Bloomington, USA, 2010
$Bi90^{CS128}$	1-128	Australia, 1986
$Bi90^{CS45}$	45	Sankt-Peterburg, Russia, 1995
$Bi90^{CS133}$	1-133	England, 1981
$Bi90^{CS62}$	3-62	Novosibirsk, Russia, 1990
$Bi90^{CS64}$	3-64	Spain, 1988



Thus, we showed that the wMelCS strain studied previously is truly unique: no other strain of wMelCS genotype under study showed any effect on survival under heat stress. So we named this unique *Wolbachia* wMelCS strain **wMelPlus**.

Conclusions

In the majority of cases the *Wolbachia* endosymbiont does not affect the fitness of host insect in general. However, a bacteria variant that sharply increases or decreases host fitness can appear as a result of mutation.

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