A new tool in biological control: parasitoid acclimation

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Problem: Acclimation

Acclimation of natural enemies is a serious problem, when bio-control agent are introduced into different climatic zones, for which they are not adapted.

Solution: using microorganisms

Microorganisms typically experience a wide range of tolerance to climate condition (i.e. *E. coli*). The phylogenetic relatedness of secondary symbiotic bacteria (**SSB**) of aphids to *E. coli* may explain their contribution to thermal tolerance in aphids as well.

Regiella insecticola (PAUS), *Hamiltonella defensa* (PABS), and *Serratia symbiotica* (PASS) are known to confer (at least partially) thermal tolerance to individuals harboring them.

We hypothesized that the use of parasitoids as biocontrol agents can be optimized when acclimated to specific environmental conditions by infecting them with these specific bacteria.

Experimental set-up

The parasitoid *Aphelinius abdominalis,* a host feeding species, being active at a range from 15-38°C and with a thermal threshold at 8°C was reared on *Sitobion avenae* clones, differing in SSBs: (5) infested with PABS, (7) infested with PAUS, and (6) without SSBs; in addition we use one *Acyrthosiphon pisum* clone infested with PASS (M). The parasitoids were reared on these clones for three generations at 20°C; thereafter they were transferred to different temperatures regimes. SSB infections were tested with RT-PCR; hatching rates were used to assess the effect of temperature regimes on parasitoid fitness.

Results

Are SSBs transferred to aphid parasitoids during host feeding or larval development?

YES! Both parasitoid host feeding and development in SSB infected clones resulted in transmission.

Do SSB infected parasitoids benefit from infections at different temperature regimes?

YES! SSB infected parasitoids are more tolerant to different climatic conditions (**A**). For example, individuals infected with PABS, PAUS or PASS are more tolerant to varying thermal conditions, while individuals without SSBs specifically suffer at low temperatures.

Do parasitoids are tolerant because infected themselves or because the host aphids are infected ?

Parasitoid individuals acquire tolerance because they become infected with SSBs and not because aphids clones confer tolerance. For example, when initially reared on clone 6, devoid of SSBs, and thereafter reared on clone 5 and 7, infected with PABS or PAUS, next generation parasitoid individuals become tolerant to cold conditions (6°C)(**B**). However, not all combinations are in favor of tolerance acquisition. For example, parasitoid specimens, harboring PAUS (aphid clone 7), suffer when reared on aphid clone 5 harboring PABS!

A

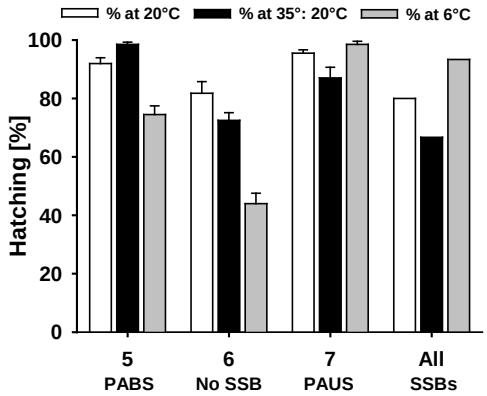

Figure (**A**): Hatching rate of parasitoids reared on aphid clones differing in secondary symbionts at different temperature regimes

B

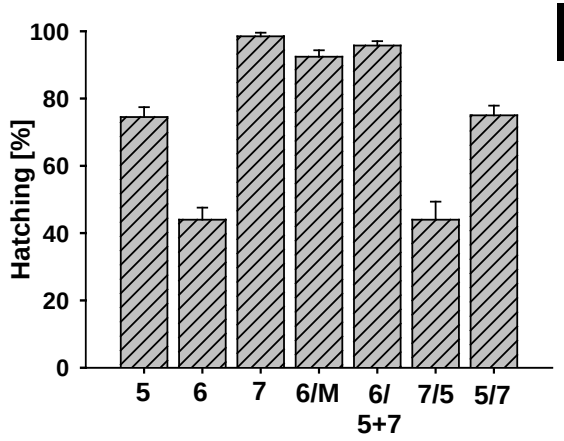

Figure (**B**): Hatching rate of parasitoids reared on different aphid clones at 20°C, then transferred to 6°C temperature regimes. Next generations reared at 35°:20°C regimes, after acquiring (or not) SSBs from original aphid clones and being transferred to aphid clones differing in their SSBs

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