MOSQUITO SYMBIONTS AS TOOL FOR CONTRASTING ZIKA INFECTION

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Symbiotic Control: use of symbiotic microbes to interfere with vector competence.

- The expression of effector genes rendering a mosquito vector incapable to transmit pathogens using bacteria as vehicle (Paratransgenesis).

- The interference with microbial symbionts conferring specific adaptations to insect pests (likely related to their capacity to vector diseases).

- Novel biocontrol approaches (Wolbachia-like) using maternally inherited symbiont transinfected into mosquitoes in order to interfere with pathogen transmission.
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Symbiotic Control: 
*Asaia* as a good candidate.

- Proper localization: in the midgut and salivary glands thus overlapping Plasmodium localization, and in the gonads.
- It’s cultivable and transformable with exogenous DNA.
- Modified strains of *Asaia* are able to efficiently colonize midgut, salivary glands and gonads
- Transmission occurs through horizontal (co-feeding, mating) and vertical routes (maternal transmission). In particular vertical routes offer the chance to introduce engineered bacteria into mosquito populations in the field!
Paratransgenesis through vectors: a semi-\textit{natural} strategy.

Mancini et al., 2016. Parasite & Vectors

\textbf{Fighting malaria with engineered symbiotic bacteria from vector mosquitoes.}


\textbf{Conclusions:} Our results demonstrate the considerable ability of modified \textit{Asaia} to colonise different populations of malaria vectors, including species where its association is not primary, in large environments. The data support the potential to employ transgenic \textit{Asaia} as a tool for malaria control, disclosing promising perspective for its field application with suitable effector molecules.
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May *Asaia* provide useful adaptations to its host?

- Delayed **larval** development in *Anopheles* mosquitoes deprived of *Asaia* bacterial symbionts (Chouaia et al, 2012).

- **Asaia** accelerates **larval** development of *Anopheles gambiae* (Mitraka et al, 2013).
May *Asaia* provide useful adaptations to its adult host?

*An. stephensi* were thoracically injected with an anti-*Asaia* mAbs.

Logrank test: P value < 0.05

Logrank test: P value < 0.0001
May *Asaia* provide useful adaptations to its **adult** host?

- **mAb Anti-Asaia** treatment followed by microarray analysis, reveals a sex biased gene modulation.
What in *Ae. aegypti*? (preliminary results)

**Logrank test:**

- **Males:**
  - *P* value Males < 0.0001

- **Females:**
  - *P* value Females (0.9049)
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Does *Asaia* directly interfere with *Zika* development?

**Chromobacterium Csp_P** Reduces Malaria and Dengue Infection in Vector Mosquitoes and Has Entomopathogenic and *In Vitro* Anti-pathogen Activities

Jose Luis Ramirez, Sarah M. Short, Ana C. Bahia, Raul G. Saraiva, Yuemei Dong, Seokyoung Kang, Abhai Tripathi, Godfree Mlambo, George Dimopoulos

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- Shaking conditions
- HPLC
- LC-MS and NMR analyses
Metagenomic analysis in three different organs of several mosquito species/strains

Asaia distribution among different mosquito species/strains is not homogeneous.
Many more symbionts maybe employed to develop innovative MBD control approaches
Take home message

✔️ *Asaia* provides good evidences for its employment in paratransgenic applications that are on the road from lab to field.

✔️ Its involvement in other types of symbiotic control applications are still questionable and further experiments are ongoing. Those against Zika virus may open some new avenue in the contrast of this viral infection.

✔️ The high complexity of the microbiota in different organs of several lab strains of different mosquito species, suggests that a relevant number of bacterial symbionts maybe employed to develop innovative MBD control approaches, Zika infection included.
Credits

Collaborations:

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