Innovations BioTechnologiques pour l’Élimination des Maladies à Transmission Vectorielle (CEA-ITECH-MTV)

UNB/IRSS

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Development Challenges and Impact of the Center of Excellence
Broad research topics

- Vector Bionomics and disease transmission
- Insecticide resistance studies and resistance management
- Genetic engineering
New Approaches exploiting inherent biological traits

Shift focus and exploit unexplored phenotypes

MALARIA transmission

Water management
Environmental modification
Chemical

Spraying Repellents Bednets
Mosquito ecology and behavioural studies

- The mechanisms of reproductive isolation between the molecular forms of An. gambiae
- The key parameters (physiological, ecological...) that enhance the mating competitiveness of males
- Can swarms of An. gambiae be targeted to control mosquito growth rate?
Questions

• Where and when swarms of *An. gambiae* can be found and how do they assort themselves in space?

• Do swarms of *An. gambiae* exhibit the same behaviour across Africa and can anyone detect them?

• Can we develop an efficient and scalable intervention method to specifically target mosquito swarms and could the villagers be trained to use it?
Swarms collection

Locations characterized and GPS

Males collected, identified, Ethanol and genotyped
Map distribution of *An. gambiae* swarms in Vallee du Kou
\[ \mu = 5.32 \]
\[ \sigma = 7.40 \]
Kernel Density Estimate of point pattern
Cluster analysis to split data set in groups
ANOVA to look at differences between key variables across groups
Potential Application
Genetic engineering

- Biocontrol agents (Fungi)
- Paratransgenesis
- Wolbachia based-approach
- Genetically modified mosquitoes and Gene drive
Fungi are natural enemies of insects

Entomopathogenic Fungi

- Major regulator of insect populations
- Kill mosquitoes as well
**Metarhizium genetic engineering**

**Gene synthesis**

**Bioassays**

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**pPcTox**

- **7895 bp**
- **pUC19 origin**
- **Amp**
- **Mcl1 promoter**
- **Mcl1 SP**
- **NotI (2780)**
- **BamHI (4669)**
- **Bar**

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**Bioassays**

- **Day after infection**
  - **WT(C1)**
  - **WT(C2)**
  - **WT(C3)**
  - **AaiT-549(C1)**
  - **AaiT-549(C2)**
  - **AaiT-549(C3)**
  - **Control**
Impact
Customized training to fit the need of the NMCP
Transgenic *Metarhizium* rapidly kills mosquitoes in a malaria-endemic region of Burkina Faso

**OPEN**

Improved efficacy of an arthropod toxin expressing fungus against insecticide-resistant malaria-vector mosquitoes
Partners of the ACE
"EDUCATION is the most powerful weapon which you can use to change the world."

Nelson Mandela