MICROBIAL STRATEGIES FOR CONTROLLING VECTOR DISEASE INSECTS: INSIGHTS FROM CEPAVE, ARGENTINA

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Introduction

Vector-borne diseases remain a major challenge in the Americas. During outbreaks, health authorities often rely on chemical control. However, the emergence of pyrethroid-resistant *Aedes aegypti* populations (Figure 1) in Argentina underscores the urgent need for locally adapted strategies against synanthropic insects. CEPAVE is a leading institution in South America in the study of natural enemies and biological control of insect vectors. New findings on endosymbiotic bacteria and an innovative strategy for controlling *Aedes aegypti* will be presented. The integration of biological approaches into vector control programs provides an effective strategy for overcoming challenges associated with insecticide resistance and vector-borne diseases.

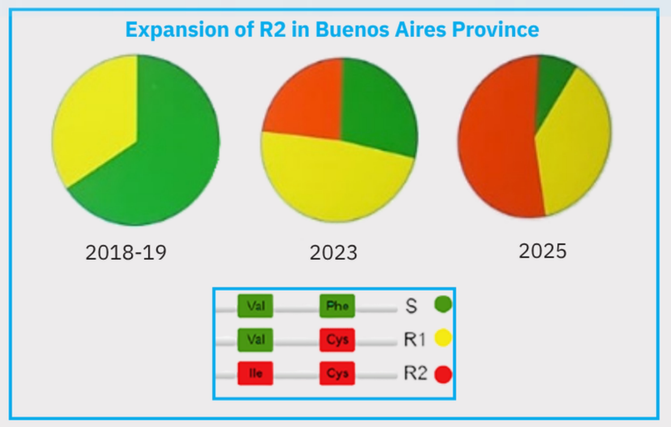


Fig.1. Evolution of Insecticide Resistance (Kdrs) in the Province of Buenos Aires. Doctoral Thesis – Barrera Llanes (2025). S= Susceptible; R1 y R2= Resistence

Materials and Methods

Field surveys were conducted throughout the country, in natural areas, to search for entomopathogenic microorganisms with potential use in control strategies. Reared *Aedes aegypti* larvae from CEPAVE insectary were used as bait in traps to isolated oomycetes from natural bodies of water. Larvae were examined for oomycete infection, and pathogenic strains were isolated and preserved in the CEPAVE Entomopathogenic Fungi Collection (CONICET–UNLP). Nets and CDC traps were used to collect adult mosquitoes for the detection of *Wolbachia* infection. PCR procedures were performed targeting a region of the coxA gene.

Results

Field survey

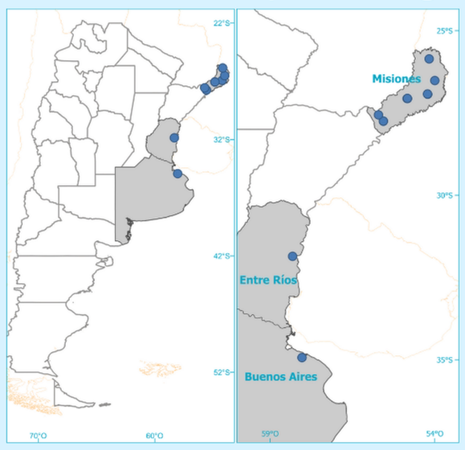
Nine virulent strains of *Leptolegnia chapmanii* (Oomycetes, Leptolegniacea) were isolated from various natural aquatic habitats in the provinces of Entre Rios and Misiones, using the *Ae. aegypti* larvae as bait. These strains were deposited in the CEPAVE Entomopathogenic Fungi Collection for further investigations. Additionally, 280 mosquito adults specimens representing 20 species from the provinces of Buenos Aires, Corrientes, Misiones, and Tucumán were examined for *Wolbachia*. Infections was detected in five species belonging to the genera *Aedes*, *Culex*, *Mansonia*, and *Toxorhynchytes*

Bioinsecticide trap

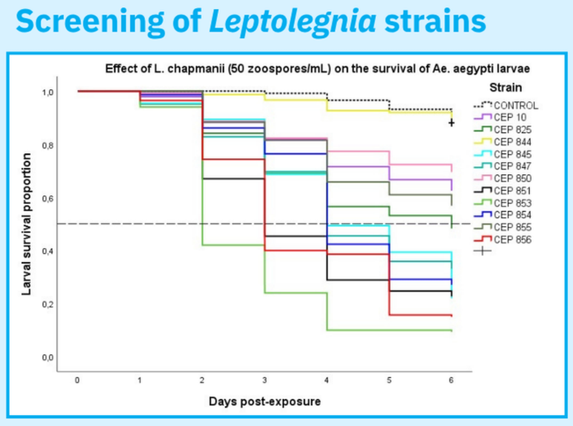
Two complementary strategies were evaluated for developing a bioinsecticide trap: the use of entomopathogenic fungi to induce adult mosquito mortality and oomycetes as larvicides. *Metarhizium* sp. CEP085 was selected for the adult-targeted trap design based on previously published reports from our research group. This strain exhibited high virulence against *Aedes aegypti* adults under laboratory conditions, causing over 80% mortality within one week. Additionally, the strain demonstrated strong viability, sporulation capacity, and long-term in vitro preservation. Preliminary virulence assays with the Argentine *Leptolegnia chapmanii* strains revealed differences in larval survival over time. Strains CEP851, CEP853, and CEP856 were selected for further assessment as larvicides in the bioinsecticide trap due to their high virulence.

LARVAE

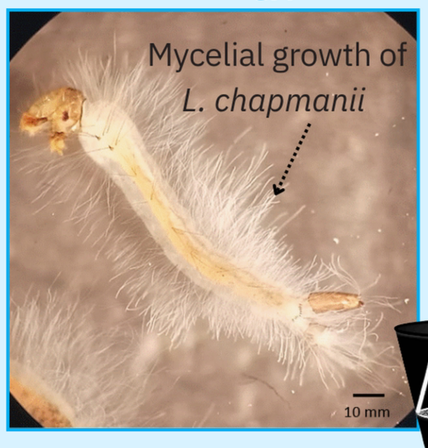
Current locations of *L. chapmanii* in Argentina

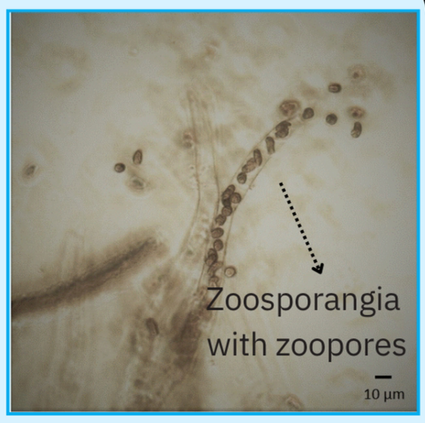


Screening of *Leptolegnia* strains

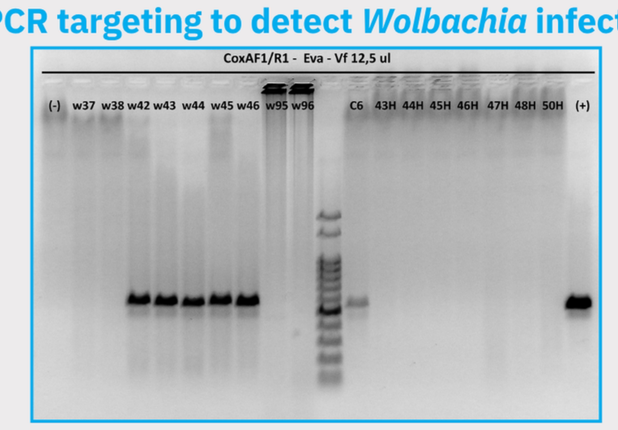


Infected *Aedes aegypti* larvae





PCR targeting to detect *Wolbachia* infection



ADULTS

Infected Mosquito

***Metarhizium* culture**

Future perspectives

The incorporation of locally adapted biological control strategies offers a promising alternative to reduce insecticide dependence. Their integration into vector control programs may contribute to the long-term management of *Aedes aegypti* and other vector species.

References

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