

# Evaluation of the biological and residual efficacy of microencapsulated propoxur paint, with Inesfly technology, on *Rhipicephalus sanguineus* ticks in semi-controlled tests and a field trial

Álvarez Hernández G.,<sup>1</sup> Méndez Galván JF.,<sup>2</sup> López Soto LF.,<sup>1</sup> Villegas Trejo AC.,<sup>3</sup> Gil Torro I.,<sup>4</sup> Pruñonosa Santana JA<sup>3</sup>

<sup>1</sup> Departamento de Medicina y Ciencias de la Salud, Universidad de Sonora, Sonora, México. [galvarezh63@gmail.com](mailto:galvarezh63@gmail.com)

<sup>2</sup> Hospital Infantil de México "Federico Gómez". Dr. Márquez 162, Col. Doctores, Delegación Cuauhtémoc. C. P. 06720, Ciudad de México, México.

<sup>3</sup> Consultoría para la Evaluación e Investigación en Salud Pública (CEISP), Primera privada las Flores 5, Colonia Acapantzingo, CP 62493, Cuernavaca, Morelos. México.

<sup>4</sup> Inesfly Corporation S.L., Paiporta, España

## INTRODUCTION

The reemergence of spotted fever caused by *Rickettsia rickettsii* associated with the tick *Rhipicephalus sanguineus* represents a threat to public health in several localities in the state of Sonora, Mexico, where more than 100 cases occur annually, with specific lethality rates of 30% to 70%.

Its control rely on several strategies according to the stage of development of the vector, many of which are high cost and of limited residuality.

In 2017 we initiated laboratory tests to evaluate the residual efficacy of an insecticide paint with microencapsulated propoxur with positive results in the control of *Rhipicephalus sanguineus*, that led to a community intervention trial in Miguel Alemán located in the Municipality of Hermosillo, Mexico.

## MATERIALS AND METHODS

-INESFLY CARBAPAIN 10 (Inesfly Corporation S.L., Paiporta, Spain) containing 1% propoxur and propoxur WP at 70% were used for surface treatments.

-Cement and clay substrates were prepared, sealed and sprayed with the wettable powder formulation or painted with the propoxur paint at a dose of 1.4 g ai/m<sup>2</sup> and 1g/m<sup>2</sup> propoxur respectively.

-Ticks were collected from infested dogs in 222 houses in Hermosillo. A total number of 6,816 *R. sanguineus* were used in the 9 bioassays series for one year.

-Groups of 30 individuals were exposed to the treated substrates in three replicates for 24 hours. Unpainted substrates were used as control groups.

-Field assay consisted in a comparison study in four different blocks: complete painting of walls, painting one meter from floor level, indoor residual spraying with propoxur and control. Entomological surveys of ticks inside and outside the houses were carried out in for a one-year period.

## CONCLUSIONS

-The microencapsulated propoxur paint showed consistent tick mortality for one year at the laboratory level, compared to the wettable propoxur powder which has been reported to have 4 months residual effect.

-The propoxur paint achieved an important reduction in tick density at time of highest population density (August-November) in the study area.

-The long-lasting efficacy provided by the propoxur paint in the laboratory and field studies offers a promising alternative against disease vectors of considerable longevity such as *Rhipicephalus sanguineus* ( $\geq 1$  year).

## RESULTS

### LABORATORY TRIALS

A one-year average mortality of 98.5% (CI :95%  $\pm$  1.1469) of the 9 evaluations (adult tick exposure) was recorded for the propoxur paint (Fig. 1).

The spray formulation showed nearly complete mortality up to four months after application. A decrease in efficacy was observed from 72.6% to 13.6% at month 5 and 12 respectively. The average mortality was 74.3% (CI: 95%  $\pm$  1.2805) (Fig. 1).

### FIELD TRIAL

Entomological surveys conducted at month 6 after the intervention (highest seasonal density of *R. Sanguineus*) showed infestation levels of 2 and 3 ticks per positive house for the total wall painting and 1m respectively, while for the control and residual spray groups, there were 24 and 18 ticks per positive house (Fig. 2).

The residual spraying did not have a noticeable impact on the average number of ticks per positive house.

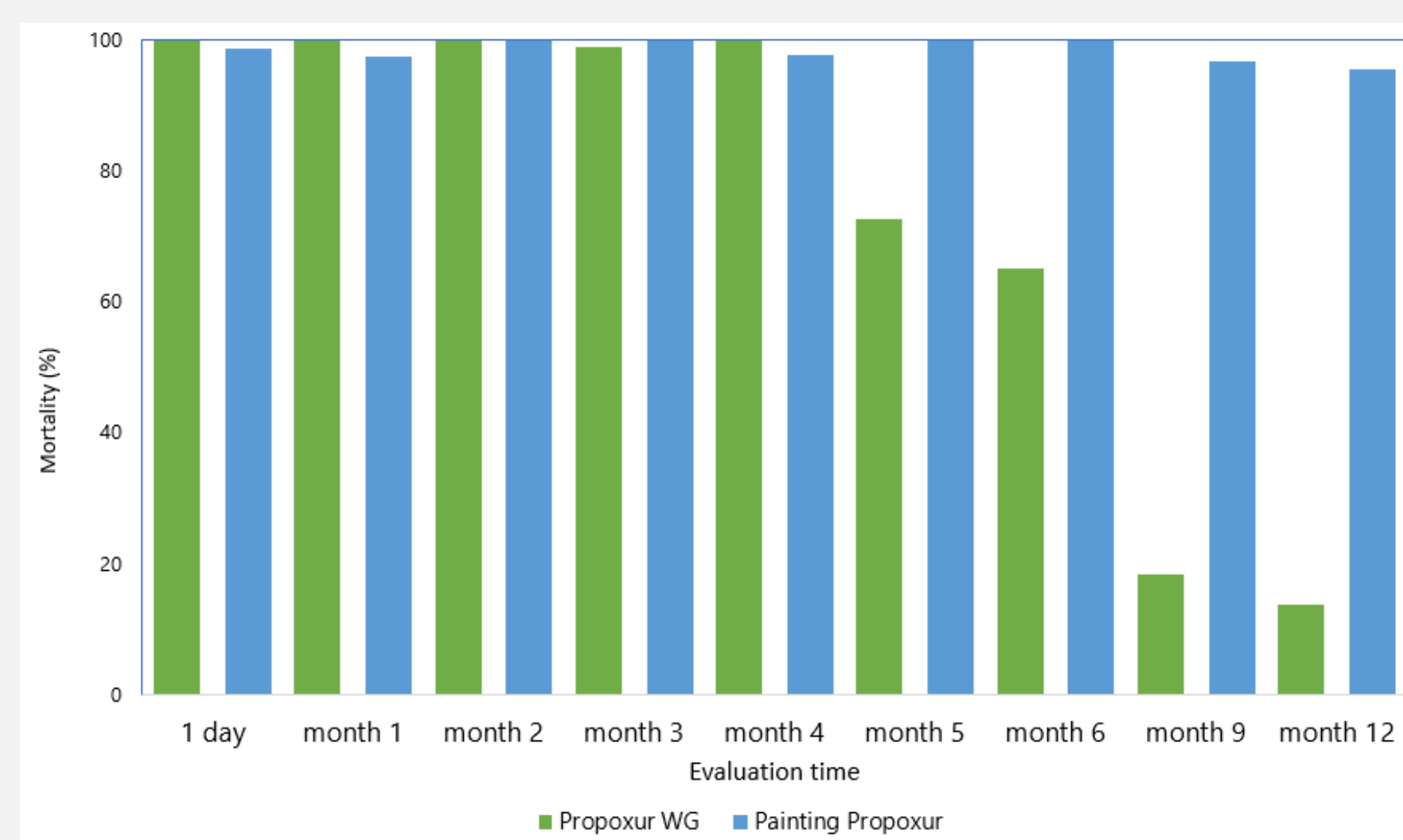


Fig. 1 Mortality (%) of *Rhipicephalus sanguineus* ticks exposed to Propoxur wettable powder and paint with microencapsulated propoxur, under laboratory conditions. Hermosillo, Sonora, Mexico. 2017-2018

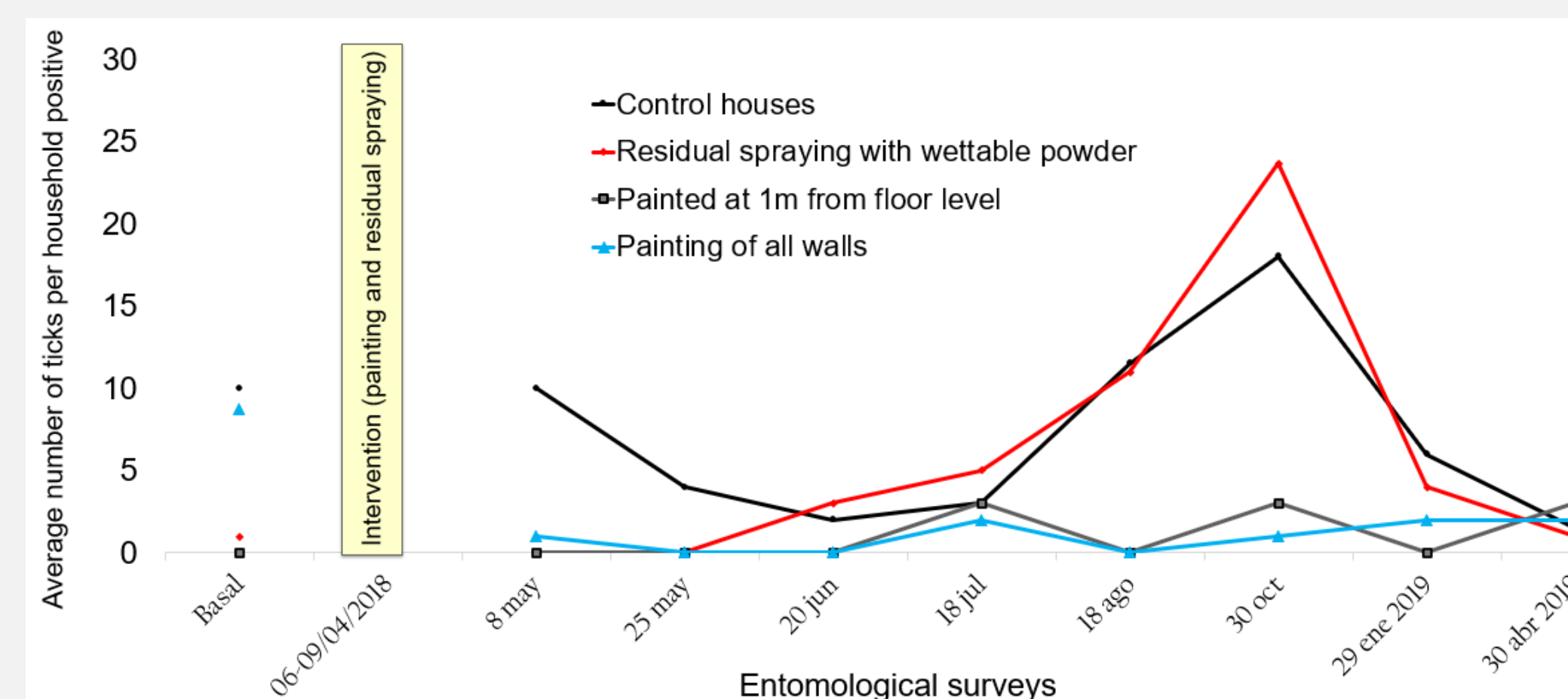


Fig. 2. Average number of *Rhipicephalus sanguineus* ticks per positive house under 3 treatment schemes and a group of control houses in Poblado Miguel Aleman,. Hermosillo, Sonora, Mexico. 2018-2019



Fig. 3 Exposure of *Rhipicephalus sanguineus* to propoxur paint and control substrate



Fig. 4 Treatments: a) total painting of walls, b) painting up to 1m to floor level and c) residual spraying.

## ACKNOWLEDGMENTS

To Ricardo Arce and Jorge Castañeda for their consistent participation in the development of the field and laboratory work and their friendship.

## REFERENCES (Review and link with the text)

- Schioler K. 2016. Insecticidal Paints: A Realistic Approach to Vector Control?. PLOS Neglected Tropical Diseases. DOI:10.1371/journal.pntd.0004518.
- WHO, 2006. Guidelines for testing mosquito adulticides for indoor residual spraying and treatment of mosquito nets.