

ASSESSMENT OF GERANIOL-INCORPORATED POLYMERS TO CONTROL *Aedes albopictus* (DIPTERA: CULICIDAE)

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Summary:

Effective control of mosquito borne diseases has proven extremely difficult with both vector and pathogen remaining entrenched and expanding in many disease endemic areas. When lacking an effective vaccine, vector control methods targeting both larval habitats and adult mosquito populations remain the primary strategy for reducing risk. *Aedes albopictus* from Thailand was used as a reference baseline for evaluation of natural insecticides incorporated in polymer disks and pellets and tested both in laboratory and field conditions. In laboratory and field tests, the highest larval mortality was obtained with disks or pellets containing IKHC (Insect Killer Highly Concentrate) from Fulltec AG Company. This product is reputed to contain geraniol as an active ingredient. With pellets, high mortality of *Ae. albopictus* larvae (92 %) was observed in presence of 1 g of pellets per 500 ml of water at day 1st, and the mortality was 100 % at day 1st for larvae in presence of 5 or 10 g of pellets. Fulltec AG Company has not accepted to give us the exact composition of their IKHC product. Therefore, we cannot recommend it, but the principle of using monoterpenes like geraniol, incorporated into polymer disks or pellets as natural larvicide needs more attention as it could be considered as a powerful alternative in mosquito vector control.

KEY WORDS: *Aedes albopictus*, mosquito vector, larvicide, monoterpene, natural product, vector control.

Résumé : ÉVALUATION DU CONTRÔLE D'*Aedes albopictus* (DIPTERA : CULICIDAE) À L'AIDE DE POLYMÈRES INCORPORÉS DE GÉRANIOL

Le contrôle effectif des maladies à transmission vectorielle est très difficile, les vecteurs et les pathogènes se maintenant souvent en position retranchée et se développant dans de nombreux foyers endémiques. En l'absence de vaccin efficace, les méthodes de lutte antivectorielle ciblant à la fois les habitats larvaires et les populations d'adultes restent la stratégie de choix pour réduire le risque. *Aedes albopictus* en Thaïlande a été choisi pour des tests d'évaluation d'insecticides naturels incorporés dans des disques ou des granulés de polymères, à la fois au laboratoire et sur le terrain. Dans tous les tests, la mortalité larvaire la plus élevée a été obtenue avec les disques et les granulés contenant de l'IKHC (Insect Killer Highly Concentrate) de la compagnie Fulltec AG. Ce produit est réputé contenir du géraniol comme matière active. Avec les granulés, une mortalité de 92 % a été observée en présence d'un gramme de granulés pour 500 ml d'eau dès le premier jour, et cette mortalité était de 100 % en présence de 5 et 10 g de granulés dès le premier jour. La compagnie Fulltec AG n'ayant pas accepté de nous donner la composition exacte de leur IKHC, nous ne pouvons recommander ce produit. Mais le principe d'utiliser des monoterpènes incorporés dans des disques ou des granulés de polymères, comme traitement larvicide, nécessite une grande attention, car cela pourrait devenir une méthode alternative efficace de contrôle des moustiques.

MOTS-CLÉS : *Aedes albopictus*, vecteur, larvicide, monoterpène, produit naturel, lutte antivectorielle.

Since the implementation of the European directive 98/8/EC, known as the "biocide directive", most of the old effective, inexpensive but polluting biocides used for vector control (Rozendaal, 1997) have been withdrawn from the European market. Now, assessment of unwanted side-effects is compulsory for any active biocide substance and, eventually, for any formulated biocide product that contains it, prior to acquiring marketing authorization. Considerations of cost, acceptability, safety and, more recently, respect for the environment, have led companies, research institutes and international agencies to offer

new compounds such as insecticides of biological origin, like *Bacillus thuringiensis* ser. *israelensis* (Bti), *Bacillus sphaericus*, Spinosad and growth regulators mimicking insect hormones (Fontenille *et al.*, 2009). Certain active pyrethroid substances show the advantage of being active at low doses and having low persistence (no residual effect), but have low selectivity. Some trials are also under way on natural substances such as essential oils or plant extracts, like geraniol (Khallaayoune *et al.*, 2009; George *et al.*, 2009) or other monoterpenes. Most compounds used for vector control are implemented by trained specialized teams, but after the epidemics of chikungunya in La Reunion Island (2005-2006) and dengue in Martinique and Guadeloupe, personal protection against vectors (PPAV) revealed to be also very important (PPAV Working Group, 2011). The main dengue and chikungunya vectors like *Aedes aegypti*, *Ae. albopictus* (Guzman *et al.*, 2010) and also nuisance caused by *Culex quinquefasciatus*, could be partly controlled by mechanical

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