Efficacy and Duration of Picaridin and Oil of Lemon Eucalyptus Compared to DEET Against the Southern House Mosquito, *Culex quinquefasciatus*

John P. Smith, Jimmy D. Walsh & Eric H. Cope

ABSTRACT

Two commercial formulations of picaridin (Cutter Advance® (7% picaridin) and Cutter Advance Sport® (15% picaridin)) and one formulation of oil of lemon eucalyptus (Repel Lemon Eucalyptus® 40%) were evaluated in vivo against *Culex quinquefasciatus*, using a modification of the K&D module technique developed by Klun & Debboun (2000). Comparisons were made with two standard DEET repellents (Off! Insect Repellent® (14%) and Off! Skintastic® (7%)) and a non-treated control. Complete protection (i.e., 100% repellency) was provided by both the 15% picaridin and 14% DEET for 6 hrs post-treatment. Repellency was also similar between the 7% formulations of picaridin and DEET, although complete protection extended for only 2 hrs post-treatment. The botanical repellent, Repel Lemon Eucalyptus 40% provided complete protection for 4 hrs post-treatment.

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) recently added two new ingredients, picaridin and oil of lemon eucalyptus (p-methane 3,8 diol), to the agency list of recommended repellents. This was based on efficacy data published in the literature for a limited number of mosquito species. This study was performed to evaluate three new, commercial products containing these ingredients against *Culex quinquefasciatus*, the southern house mosquito, a major vector species in the southern U.S. Neither these products, nor this species have been tested to date.

OBJECTIVES

1. Evaluate the repellency and duration of commercial formulations of picaridin and oil of lemon eucalyptus against *Culex quinquefasciatus*.
2. Compare repellency with standard commercial formulations containing DEET (N,N-diethyl-meta-toluamide).

MATERIALS & METHODS

1. 10 starved female *Culex quinquefasciatus* were aspirated into each of 6 chambers within K&D repellent test modules (Fig. 1).
2. Clear packing tape was applied to the base of the modules and cut open to expose the sliding doors. The tape was removed and replaced after the module was alcohol swabbed between assays to reduce contamination.
3. Six randomly assigned treatments were applied at 28.6 µl to 12 cm² rectangles drawn on the skin surface of the upper legs with a ball-point pen and template matching the door openings.
4. Treatments were separated by one chamber to reduce repellent interaction so that three treatments were tested per leg. The three remaining treatments were tested by rotating the chamber 180° to the opposite leg, thus utilizing all six chambers.
5. Two-minute biting counts were performed for each of the six treatments consisting of five test repellents (Fig. 2) and a non-treated control.

RESULTS & DISCUSSION

Fig. 3 presents the biting counts by treatment for each of the post-treatment time intervals. As expected, biting counts in the non-treated control (blue bars) were consistently higher than the repellent treatments. Biting pressure occurred throughout the day, increasing later in the day. Biting counts for the repellents did not occur until the 4 hr time interval and then only in the lower concentration DEET and picaridin formulations. Biting counts also occurred at the 6 hr interval for the oil of lemon eucalyptus. There were no bites in the higher concentration DEET or picaridin formulations.

CONCLUSIONS

Picaridin performed as well as DEET against *Culex quinquefasciatus*. Repel Lemon Eucalyptus 40% appears to be a good repellent for persons interested in a plant-based alternative. It outperformed both the lower DEET and picaridin formulations.

LITERATURE CITED