

DEET ALTERNATIVE REPELLENT STUDIES

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ABSTRACT

An experimental botanical outperformed Off! Skintastic, providing 100% repellency out to 4 hrs and better than 90% repellency out to 6 hrs. Other commercial botanicals did not perform as well. Off! Mosquito Coils provided remarkable control of *Culex quinquefasciatus* and *Aedes albopictus* in outdoor screened enclosures. Sandalwood Mosquito Sticks were ineffective.

INTRODUCTION

The spread of West Nile virus in the U.S. has rekindled interest in repellents. DEET-containing personal repellents are undoubtedly the most recommended products in the U.S.; however, many people prefer not using them because of skin sensitivities, odor and/or perceived toxic effects. A number of manufacturers have developed a wide range of botanical alternatives to meet this demand. There is very little efficacy data on botanicals because they are exempt from EPA registration requirements. Several states are now requiring efficacy proof before the product can be sold. Consumers want to know how well and how long these products perform.

Area repellents are frequently overlooked in the arsenal of personal protection measures. There are several such products on the market and very little comparative data on effectiveness.

PURPOSE

Provide efficacy data on personal and area repellents.

MATERIALS & METHODS

Personal Repellent Test Protocol:

Study 1:

1. BIB design following ASTM standards
2. 100 5-day old female *Culex quinquefasciatus* stocked in 3 cages. Dead mosquitoes replaced after each day of testing.
3. Five treatments (Fig. 1) – BugBan (15% citronella oil), ShooBug (2.5% cinnamon oil & 2.5% 2-phenethyl propionate), Royal Neem (wide variety of plant oils), Off! Skintastic (6.65% DEET) & Non-treated Control
4. Four evaluators
5. 1 ml repellent applied over 450 cm² of forearm. Hands covered with latex glove.
6. Three evaluators tested two repellents at a time – one on each forearm.
7. All repellents tested twice by three evaluators at each time interval over 4 days
8. Cage position randomized and evaluator location rotated daily. One minute biting counts taken at 0, 1, 2, 4, 6 hrs post-treatment.
9. Control counts conducted immediately prior and after each day of testing. Non-treated evaluator performed control counts at 2 & 4 hr post-treatment time intervals in all cages with both forearms.
10. Percent repellency calculated by subtracting mean biting count in treatment from control divided by control multiplied by 100.

Personal Repellent Test Protocol (con't):

Study 2:

1. Same as above except for the following:
2. Three evaluators
3. Three treatments – Experimental Botanical, Off! Skintastic & Non-treated Control
4. Each repellent tested eight times by two evaluators at each time interval over two 4-day periods.
5. Non-treated evaluator performed control counts at all post-treatment time intervals.

Area Repellent Test Protocol:

1. Test performed in two 8'Hx25'Wx25'D outdoor screened enclosures (Fig. 3a) stocked with 5000, 5-7 day-old colony-reared *Aedes albopictus* and *Culex quinquefasciatus*. One species per enclosure.
2. Four treatments-- Blank Sticks, Sandalwood Repellent Sticks, Off! Mosquito Coil (0.15% allethrin) and Control.
3. Control biting counts performed prior to each treatment application.
4. Test products applied according to labeled directions and positioned in center and halfway between the center and corners (i.e., five/enclosure).
5. Products ignited for 10 minutes prior to conducting first biting counts.
6. Three evaluators– all dressed in dark-blue, full-length work clothes, head nets and lamps. One chaired in center, others in opposing corners. Positions rotated at 15, 30 and 45 minute post-treatment.
7. Five-minute biting counts taken from the fingertip to the elbow on one forearm (Fig. 3b).
8. Entire experiment replicated three times over three separate weeks.



Fig. 1. Commercial repellents tested.

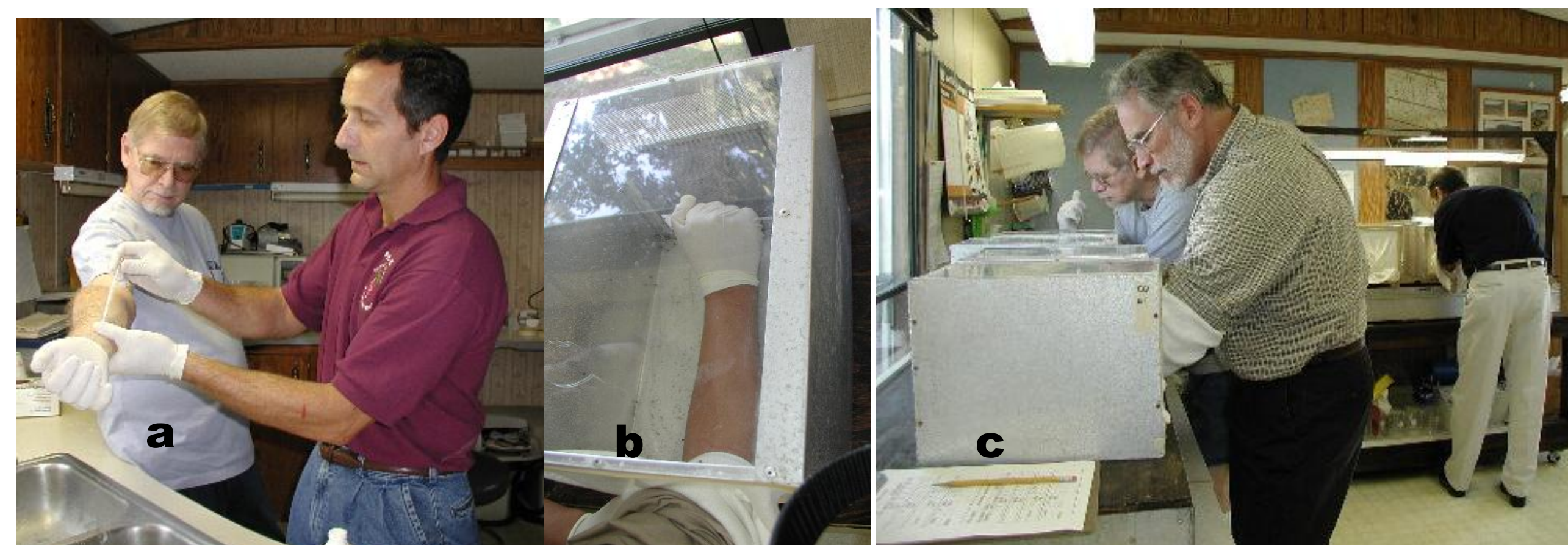


Fig. 2. (a) Repellent application; (b) arm exposure in cage; (c) evaluation underway

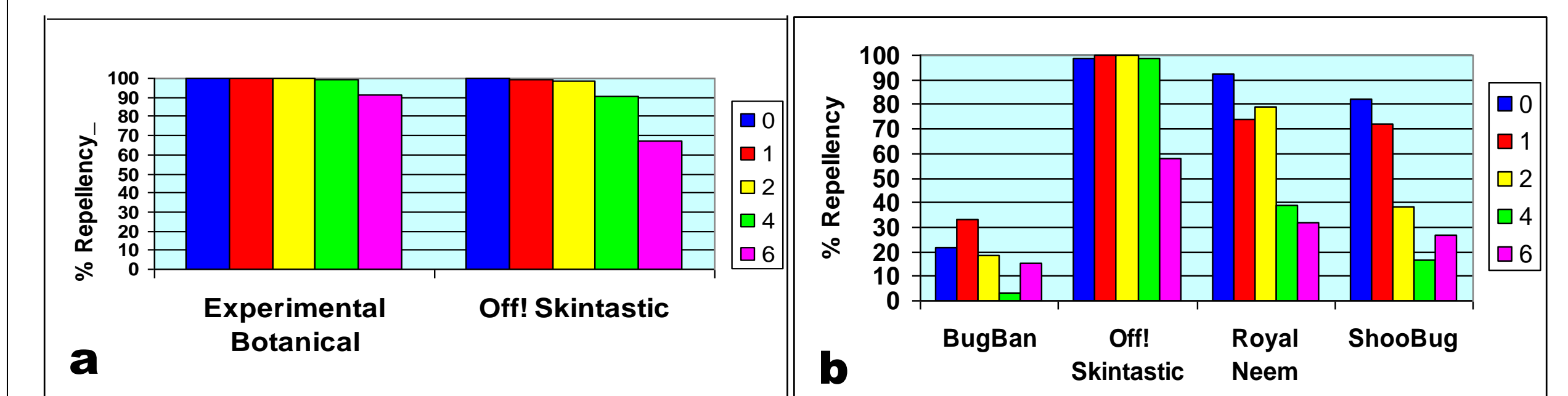


Fig. 3. (a) Area repellent testing enclosure; (b) taking 5-min. biting counts

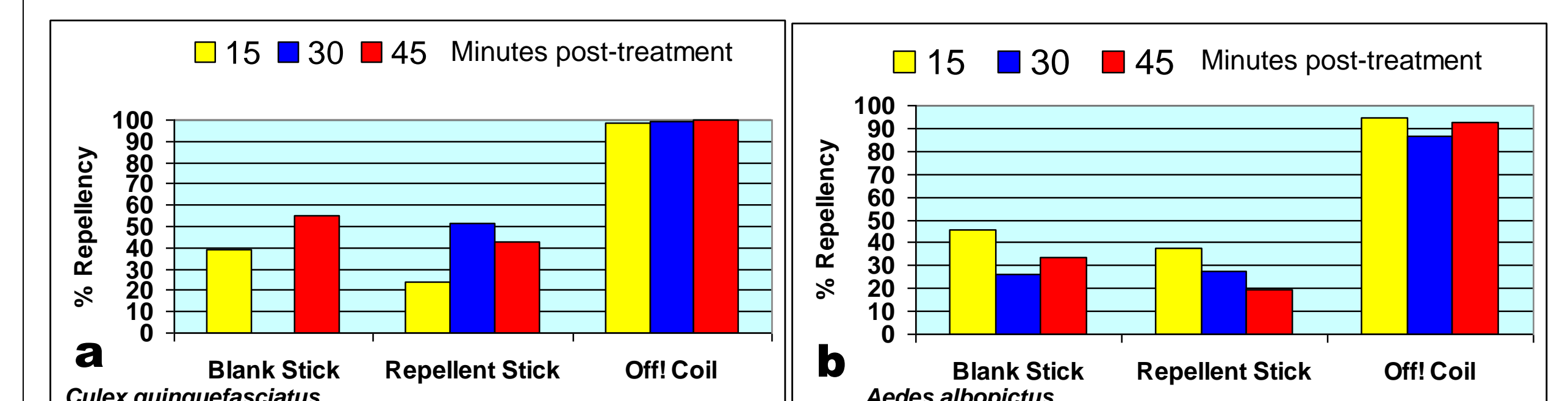
RESULTS

The experimental botanical outperformed Off! Skintastic against *Culex quinquefasciatus*. It provided repellency at or near 100% for 4 hours and >90% protection at 6 hours post-treatment (Fig. 4a). None of the other botanicals provided repellency comparable to Off! Skintastic (Fig. 4b). BugBan provided very poor repellency (<33%). Royal Neem and ShooBug provided initial repellency at just over 90% and 80%, respectively, but diminished rapidly after 2 hrs.

Off! Coils approached 100% repellency against *Culex quinquefasciatus* (Fig. 5a) and between 84-94% for *Aedes albopictus* (Fig. 5b). Sandalwood Mosquito Sticks ranged between 24-52% for *Cx. quinquefasciatus* (Fig. 5a) and 19-38% for *Ae. albopictus* (Fig. 5b). In most instances, the Sandalwood Mosquito Sticks did not reduce mosquito bites any better than similar sticks containing no repellent.



Figs. 4a & b. Comparative repellency of four botanicals compared to a DEET standard.



Figs. 5a & b. Comparative repellency of botanical area repellent with allethrin standard.

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