Repellency of Aromatic Eastern Red Cedar to Urban Pests

by

Arthur G. Appel, Ph. D.
Department of Entomology
Auburn University, Alabama 36849-4201
(205) 826-4850

ABSTRACT-The repellency of aromatic eastern red cedar wood was evaluated against German, *Blattella germanica*, and brownbanded, *Supella longipalpa*, cockroaches and the firebrat, *Thermobia domestica*. Although not toxic, the cedar wood was significantly ($\alpha \leq 0.05$) repellent to each of the species tested. The greater the surface area of cedar paneling, the greater the degree of repellency.

Cedar and cedar wood products have long been considered useful for the protection of clothing, especially woolens, against a number urban pests. Several studies have indicated that cedar oil vapors retard the development and kill clothes moths and carpet beetles (Huddle and Mills, 1952; Laudani and Clark, 1954). Due to the increased use of synthetic fibers, the incidence of fabric pests and their damage has been on the decline. The repellent nature of cedar products has not, however, been investigated against other important household pests such as cockroaches and silverfish.

The purpose of this study was to investigate the repellent effects of cedar on the two most important indoor cockroach pests (Mampe, 1972; Ebling, 1975), the German, *Blattella qermanica*, and the brownbanded, *Supella lonqipalpa*, and against a major silverfish pest, the firebrat, *Thermobia domestica*. Both cockroach species are found worldwide primarily in apartments, low income housing, restaurants, and hospitals. The effect of cedar vapor concentration was also investigated by use of various surface areas of cedar paneling.

Materials and Methods

Insects and Apparatus

Cockroaches and firebrats were obtained from Auburn University cultures that had been maintained at 25 ± 2° C, 50 ± 10% relative humidity, exposed to an irregular photoperiod and supplied food and water *ad lib*. Adult male cockroaches and adult firebrats were used for the experiments.

Repellency was measured with a standard "Ebeling Choice Box" as described by Ebling et al. (1966). Briefly, the choice box is a 35 cm square wooden box, 10 cm tall, with a tempered Masonite floor. The box is divided into two equal compartments by a central wall that has a 13 mm diameter hole near the top center that allows the insects to move between the compartments. Both compartments are covered with sheets of transparent plexiglass to allow the insects to be observed. One compartment is covered with an opaque sheet to maintain darkness. Treatments are applied to this dark compartment and insects are released into the light compartment where there is food and water. Since the test insects are negatively phototaxic, they tend to move into the dark compartment during the photophase. Treatments are applied to the dark compartment and the repellency of the treatments measured as the number of insects remaining in the light.

Samples of newly made aromatic eastern red cedar paneling (7 mm thick) were obtained from Giles & Kendall, Inc. To test the effects of the cedar, the dark compartments of choice boxes were treated with one of the following: the floor was covered with a cedar panel (459 cm^2), three sides of the compartment were covered (410.4 cm^2), the floor, sides and top were covered (1,328.4 cm^2), and a control with no paneling. Test insects were acclimated in the light side of the boxes for 12 h before being allowed to enter the dark side. The number of live and dead insects in each compartment was recorded at daily for 14 days at approximately 11am.

Toxicity Testing

Continuous exposure tests were performed to evaluate the toxicity of cedar paneling to cockroaches and firebrats. Ten groups of six individuals of each species were confined to cedar panels with an inverted 9-cm diameter glass petri dish cover that had been coated on the inside sides with petroleum jelly to keep the insects in constant contact with the panel. Mortality was recorded daily for 7 days. Control insects were confined in glass petri dishes without access to cedar, mortality was similarly recorded daily.

Analysis

Data were converted to percentages and analyzed by nonlinear regression (see Mack and Backman 1986) using the SAS NLIN procedure (SAS Institute 1982). Performance indice, that combine repellency with toxicity were calculated as follows:

Performance Index = 1 - [Number Alive + Number Alive in Light][Number Dead + lnitial Number]$^{-1}$ * 100

A significance level of $\alpha = 0.05$ is used throughout.

Results and Discussion

Cedar panels were not toxic, but were significantly repellent to *B. germanica*, *S. longipalpa*, and *T. domestica*. Both the rate and the maximum level of repellency were directly related to the quantity of cedar put in the dark compartment of the choice box. There was no (0%) mortality of any of the three species tested during the 7-day continuous exposure period. In fact, 5% mortality was found in the *B. germanica* controls with no exposure to cedar. For all cedar treatments, the asymptotic 95% confidence levels of the maximum number of *B. qermanica*, *S.lonqipalpa*, and *T. domestica* in the light, untreated, compartment did not overlap those of the untreated controls. These statistical results indicate that all cedar treatments caused a significant ($\alpha \geq 0.05$) repellent reaction by cockroaches and firebrats. Although with the rectangular hyperbola model significant regressions could not always be obtained with all treatments, significant differences were always obtained among control, members of the group: chips, floor, and sides, and box treatments.

Performance indices clearly reflected the repellent, but nonlethal nature of cedar. Maximum asymptotic indices for control, untreated, boxes ranged from -10 to 7, agreeing with previous results on cockroaches (Rust and Reierson 1978). These data, however, have little value when comparing nonlethal treatments or compounds.

Based on the results of these experiments, cedar paneling is clearly repellent to German and brownbanded cockroaches and to firebrats. Each of these pests are found in the home as well as commercial establishments such as restaurants where they may cause damage to foodstuffs, transmit disease organisms, and themselves become allergens. The use of repellent safe materials, like cedar, in "built-in" pest control could not only prevent the establishment of pest populations, but aid in their control. Further investigations on the nature of the repellent in cedar, the range of species that can be repelled, the effects of aging on the repellency of cedar, and methods of analysis are strongly encouraged.

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