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RAPID COMMUNICATION

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Effect of softwood thin veneers in tatami on the activity of the house dust mite *Dermatophagoides pteronyssinus*

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Introduction

Many allergic diseases, such as asthma and atopic dermatitis, are caused by house dust mites and their excrement, and they are becoming serious health problems. Voorhorst et al. recognized in 1964 that house dust mites are the causative agents for many allergic diseases.[1]

It has been reported that essential oils extracted from woody plants suppressed the activity of house dust mites,[2–4] but there are few data on the use of the components volatilized from woods in a simulated real-life environment. This study was undertaken to determine the effect of volatilized components from thin softwood veneers in tatami (Japanese floor matting) on the activity of house dust mites (*Dermatophagoides pteronyssinus*).

Materials and methods

Adult female *Dermatophagoides pteronyssinus* were used as typical house dust mites. Generally, *Tyrophagus putrescentiae* breed on straw and are often found in new houses, but it has been reported that *T. putrescentiae* decrease whereas *D. pteronyssinus* (considered to be the most serious allergen), increase after human occupation and the passage of time.[5,6] Therefore, *D. pteronyssinus* were used in this study. A 1:1 mixture of powdered animal food (CE-2; CLEA, Japan) and dry yeast (Ebios; Ashahi Beer Pharmaceutical) was used for the mite culture medium. As shown in Fig. 1, tatami mats 45 × 45 × 7.5 cm were divided into two parts (top part 3 cm, bottom part 4.5 cm) and a thin softwood veneer (2 mm) was put on top of the bottom tatami. The upper part had six cavities for placing the exposure chambers (cavity of 3 × 10 mm diameter), described later. Three kinds of thin softwood veneer (heartwood) were used: hinoki (*Chamaecyparis obtusa*), hiba (*Thujopsis dolabrata* var. *hondai*), and sugi (*Cryptomeria japonica*).

We used two kinds of tatami as controls. In the first control experiment, tatami mats alone were used; in the second, there was no tatami but odoriferous substances from the tatami were used. The exposure chamber (2.5 cm × 7.5 cm × 5 mm (Fig. 2), a rearing container modified from Matsumoto et al.,[7] was separated by a filter cloth (Axtar, H306-10; Toray Industries). About 10 mites were placed in the hole of the exposure chamber. Six exposure chambers were placed on each of the three species of thin softwood veneers on the tatamis. The experiment was conducted at 25°C under 85% relative humidity (RH), using a saturated KCl solution in a desiccator (50 × 50 × 50 cm).

The degree of activity of the mites was classified into three categories: (1) walking; (2) moving (e.g., legs, chelicerae, pedipalpi); and (3) immobilized. The activity was measured with a stereoscopic microscope after 3, 6, 12, 24, 48, 72, 96, and 120 h of exposure. Differences between the values were analyzed by Student's *t*-test and were considered significant when the p value was <0.05 compared to the control with the tatami alone.

Results and discussion

The suppressive effect of three kinds of softwood veneer on the mites of *D. pteronyssinus* are shown in Fig. 3. The vola-

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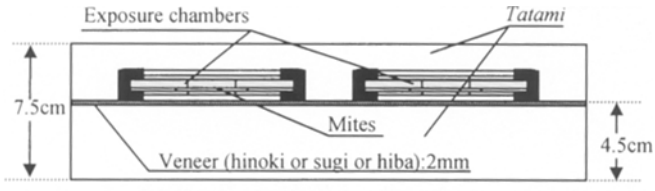

Fig. 1. Cross section of a tatami with a thin softwood veneer

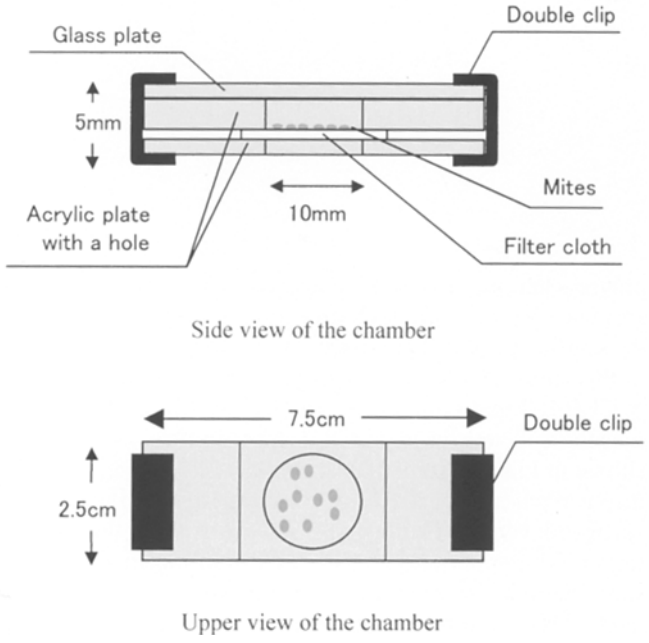

Fig. 2. Exposure chamber for testing the effect of volatile matter from softwood veneers on *Dermatophagoides pteronyssinus*[7,8]

tile substances from hiba (*Thujopsis dolabrata* var. *hondai*) and Japanese cypress (*Chamaecyparis obtusa*) veneers caused immobilization in 32% ($p < 0.05$) and 26% ($p < 0.05$) of mites after 12 h, respectively. After 120 h more than 90% of the mites were immobilized by exposure to hiba and Japanese cypress. Miyazaki et al.[2] and Yamamoto et al.[9] reported that the essential oils extracted from Japanese cypress and hiba had a significant effect on immobilizing the mites. The same results were obtained in the present study. Japanese cedar (*Cryptomeria japonica*) helped decrease the activity of mites by 32% and 41% after 48 and 72 h, respectively. After 96 and 120 h of exposure the ratios of immobilized mites were 54% ($p < 0.05$) and 66% ($p < 0.05$), respectively.

Hiramatsu et al. examined the effect of volatile matter from various wood chips on *D. pteronyssinus* and found that Japanese cedar had a moderate effect on mites.[8] These results are similar to ours. In the present study there was no difference between the first control experiment (with tatami alone) and the second control experiment (no tatami). This result indicates that there was no effect from volatile matter from the tatami on the mites. We therefore concluded that volatilized components from thin softwood veneers in tatami affected the activity of house dust mites. There is thus a possibility that thin softwood veneers in tatami can be utilized for mite control.

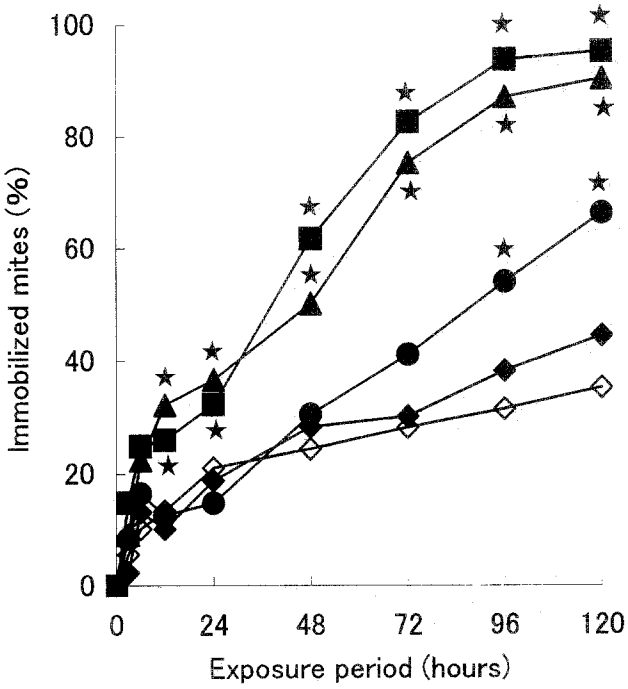

Fig. 3. Changes in the activities of *Dermatophagoides pteronyssinus* during 120 h of exposure to a thin softwood veneer in a tatami mat. Significant differences from control (tatami only) values are marked with a *star* ($P < 0.05$ by Student's *t*-test). *Squares*, *Chamaecyparis obtusa*; *triangles*, *Thujopsis dolabrata* var. *hondai*; *circles*, *Cryptomeria japonica*; *closed diamonds*, control (tatami); *open diamonds*, control (nontatami)

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