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BRIEF COMMUNICATION

EFFECTIVENESS OF HOUSE DUST MITE ACARICIDE TRI-N-BUTYL TIN MALEATE ON CARPETS, FABRICS AND MATTRESS FOAM: A STANDARDIZATION OF METHODOLOGY

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SUMMARY

The aim of this study was to determine the effectiveness of the acaricide tri-n-butyl tin maleate, industrially applied to samples of carpets, mattress foam, and fabrics used for furniture upholstery, soft toys and shoe uppers. Approximately 100 adult house dust mites of the species *Dermatophagoides pteronyssinus* were inoculated into a Petri dish containing the sample (a piece of carpet, mattress foam, or fabric), treated with the acaricide, randomly collected. Mite-maintenance culture medium was added on top of each sample. After one, two, three, seven and 30 days of incubation at 25 °C and 75% relative humidity, each dish was examined using a 40X stereoscopic microscope (40X). One hundred percent acaricide effectiveness was obtained in treated materials by the end of the 30th-day postinoculation period, under optimal conditions for mite maintenance.

KEYWORDS: House dust mites; Acaricide; Mattresses; Fabrics and carpets.

INTRODUCTION

The house dust mites present in household dust have been indicated as the main source of allergens associated to manifestations of respiratory allergies, such as allergic rhinitis, bronchial asthma and the mites can induce atopic dermatitis[2]. Anemophilous fungi of the genera *Aspergillus* and *Cladosporium* are also triggers for allergic processes[4].

There are various species of mites found in household dust, where they nest and reproduce easily, in carpets, rugs, mattresses, bedding, upholstered furniture, cracks in wood-tiled floors and baseboards, as long as there are suitable conditions of humidity, temperature and food. The latter is provided mostly by flaking from the epithelium of humans and pets, coupled with anemophilous fungi[2]. which predigest the human skin, thus aiding in its digestion, while also serving as a source of essential nutrients and humidity, necessary for mite metabolism[5]. The most common house dust mite species in these environments are *Dermatophagoides pteronyssinus*, *Euroglyphus maynei* and *Blomia tropicalis*[2].

The antigens associated with house dust mites have been identified with various sources: their fecal particles, digestive tract, glandular secretions, cuticular membrane, genital fluids and fragments of dead specimens. It is difficult to limit one's exposure to the allergens of house dust mites, being particularly complicated to reduce the number of house dust mites in carpets and sofas, even when these are well cleaned[1,2]. It is necessary to reproduce standard methodology to analyze effectiveness of house dust mite acaricide.

The aim of the present study was to verify the acaricidal effectiveness of tri-n-butyl tin maleate, applied to samples of carpets, mattress foam, and fabrics used for furniture upholstery, soft toys and shoe uppers, standardizing a methodology.

METHODS

This study involved 23 industrially treated with acaricide and randomly collected samples: shoe fabric (numbers 1 to 4), mattress foam (5 and 6), upholstery fabric (7 to 11), stuffed-animal fabric (12 and 13) and carpets (14 to 23); four untreated samples of these materials (controls - C1, C2, C3 and C4 - respectively shoe fabric, mattress foam, fabric and carpet), as well as four mite-growth controls (C1A, C2A, C3A and C4A).

The house dust mite species *Dermatophagoides pteronyssinus* was collected in house dust and was cultivated on a specific medium containing wheat germ, wheat grits, meat-based cat food and brewer's yeast[3]. The medium containing the mites was incubated at 25 °C in a BOD incubator for 30 to 40 days. The mites were extracted from the

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maintenance medium by way of a live-mite extraction device consisting of a modified Berlese funnel[1]. Approximately 100 adult mites were inoculated into a Petri dish (20 x 200 mm) containing the material (3 x 3 cm piece of mattress foam, carpet or fabric) treated with the product. Mite-maintenance medium was placed on the material, to provide for their intake of food and moisture.

The same untreated materials (controls) were inoculated with the mites in the same way. Each sample was examined after one, two, three, seven and 30 days of incubation at 25 °C and 75% relative humidity. The dishes containing the samples were analyzed under a stereoscopic microscope (40X). The experiment was carried out in triplicate, with photographs taken of all the steps.

RESULTS

The comparative results for the number of alive mites were assigned a score: +++++, ++++, +++, ++ or +, corresponding to approximately > 100, 100, 75, 50 and 25 mites, respectively.

After one day of incubation, alterations were observed in the fabrics inoculated with mites. The mites were avoiding the treated samples (+++ = 75%), this evasion being greater in sample 6 (++ = 50%), with the presence of some dead mites on these samples. The mites concentrated themselves atop the mite-maintenance medium spread over the samples, presenting a viable population. The control samples, which lacked the acaricide treatment, as well as the mite-growth controls, remained unchanged (++++ = 100%).

After two days of incubation, the evasion of the treated samples continued, with countless dead mites being observed. Samples 2, 3 and 6 presented the greatest reduction in the number of mites (+ = 25%). The controls continued unchanged (++++ = 100%), with various matings observed (Table 1).

At the third reading (three days after inoculation), samples 2, 3, 6 and 9, presented an absence of mites (–); samples 1, 4 and 7 presented reduced populations (++ = 50%); while the rest of the samples presented a reduction greater than this (+ = 25%). A high number of eggs were observed on both the acaricide-treated samples as well as on the controls, from which countless nymphs emerged. Seven days after inoculation, most of the treated samples presented an absence of mites, with the exception of samples 1, 4, 10 and 16. The controls presented an increase in the number of mites (+++++). Due to the optimal conditions of temperature (25 °C) and relative humidity (approximately 75%), there was also contamination by anemophilous fungi (molds), which are important sources of nutrients for house dust mites, as well as countless young mites (tritonymphs) (Fig. 1).

Observation of the treated samples 30 days postinoculation revealed that the contaminating fungi and the mite-sustaining medium on the samples had dried, with the presence of dead tritonymphs. This did not occur in the controls, which presented more than 100 live mites per sample.

Table 1
Presence of mites on different types of samples treated or not with tri-n-butyl tin maleate

Sample	Identification	Mites 1 day	Mites 2 days	Mites 3 days	Mites 7 days	Mites 30 days
1	Shoe fabric	+++	++	++	+	-
2 and 3	Shoe fabric	+++	+	-	-	-
4	Shoe fabric	+++	+++	++	+	-
5	Mattress foam	+++	++	+	-	-
6	Mattress foam	++	+	-	-	-
7	Upholstery fabric	+++	+++	++	-	-
8	Upholstery fabric	+++	++	+	-	-
9	Upholstery fabric	+++	++	-	-	-
10	Upholstery fabric	+++	+++	+	+	-
11	Upholstery fabric	++++	++	+	-	-
12	Stuffed-animal fabric	+++	+++	+	-	-
13	Stuffed-animal fabric	+++	++	+	-	-
15, 17-19, 21-23	Carpet	+++	++	+	-	-
14	Carpet	+++	+++	+	-	-
16	Carpet	+++	+++	+	+	-
20	Carpet	+++	+	+	-	-
C1-C4	Samples without acaricide	++++	++++	++++	+++++	+++++
C1A, C2A, C3A, C4A	Mite-growth controls	++++	++++	+++++	+++++	+++++

+++++ > 100 mites; ++++ ≅ 100 mites; +++ ≅ 75 mites; ++ ≅ 50 mites; + ≅ 25 mites; - without mites; 1-23: samples treated with the acaricide; C1-C4: samples without acaricide. C1A-C4A: no samples (only maintenance medium).

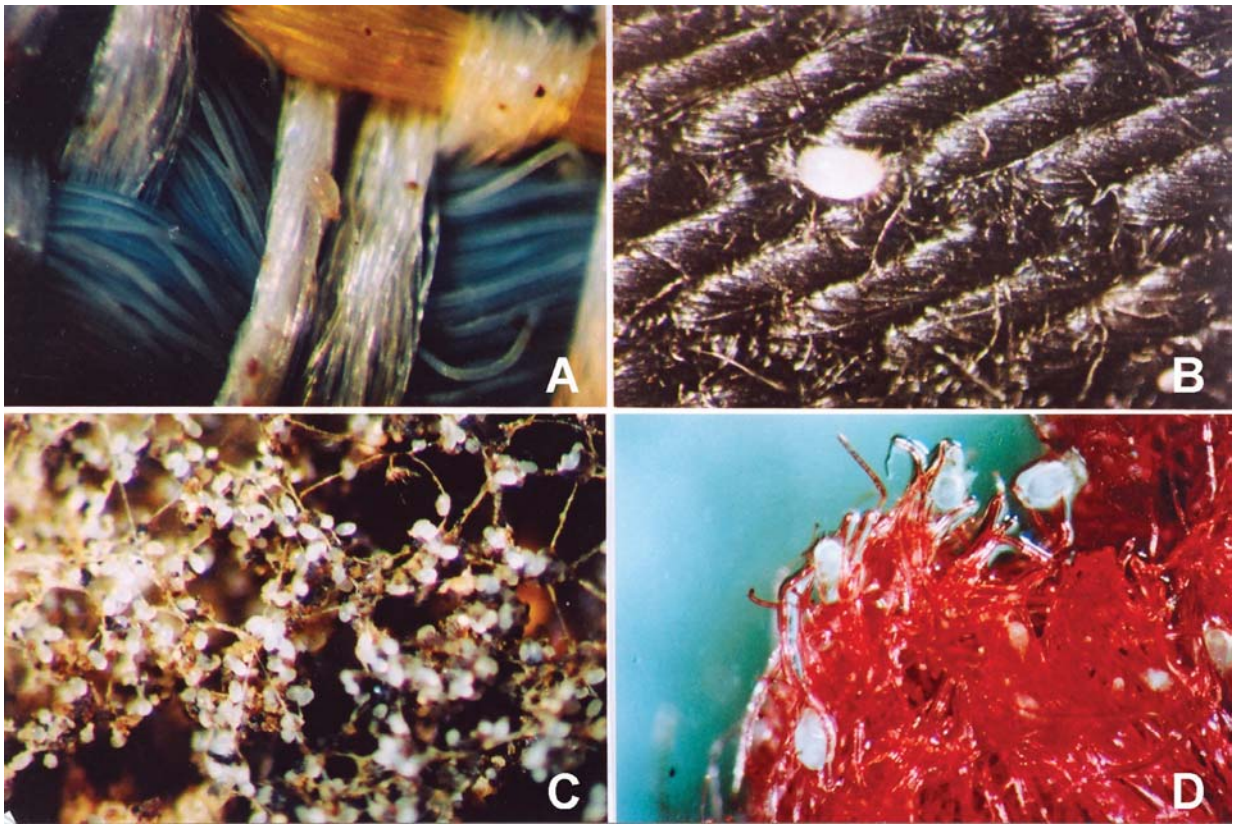

Fig. 1 - A, B: viable mites on the fibers of the untreated control samples seven days postinoculation; C: formation of hyphae of contaminating fungi on the mite-maintenance medium, with countless eggs and viable mites; D: dead mites on the samples of carpet treated with acaricide.

DISCUSSION

Basic mite-control measures consist of the systematic cleaning of the environment using a high-powered vacuum cleaner, together with the elimination of all dispensable accessories, thereby reducing the accumulation of inorganic and organic particles that contribute to a favorable habitat for the mites, coupled with the control of ambient temperature and humidity. The use of acaricide products and/or fungicides also contributes to the elimination of house dust mites in the household environment, especially those found in places that are hard to reach by vacuum or to otherwise clean[1,2].

The methodology employed in the present study was adequate to test the effectiveness of the acaricide. The treated samples did not absorb much moisture, they dried up the mite-sustaining medium, and presented practically no vestiges of mold, despite the high humidity and temperature, 25 °C, thus displaying the treated fabric's tendency to preserve its characteristics.

The acaricide presented 100% acaricide effectiveness by the end of the 30-day postinoculation period, under optimal conditions for mite maintenance. The acaricide was more effective in two samples of fabric for shoe uppers, in one sample of mattress foam and one sample of furniture upholstery material, since these presented 100% acaricide effectiveness after a shorter period of three days.

RESUMO

Eficácia do acaricida maleato de estanho tri-n-butílico contra ácaros de poeira em carpetes, tecidos e espuma de colchão. Padronização de metodologia

O objetivo do presente estudo foi verificar a eficácia do acaricida maleato de estanho tri-n-butílico, aplicado industrialmente em amostras de carpetes, tecidos de revestimentos de móveis e de calçados, assim como de espumas de colchão. Aproximadamente 100 ácaros adultos da espécie *Dermatophagoides pteronyssinus* foram inoculados em placa de Petri contendo a amostra (pedaço de colchão, tecido ou carpete), tratada com o produto acaricida, coletados aleatoriamente. Foi acrescentado sobre a amostra, meio de cultivo para a manutenção dos ácaros. Cada placa foi examinada após 1, 2, 3, 7 e 30 dias de incubação a 25 °C e 75% de U.R.A. (umidade relativa do ar), sob microscópio estereoscópico com 40X de aumento. O acaricida maleato de estanho tri-n-butílico apresentou 100% de eficácia acaricida após 30 dias da aplicação, em condições ótimas para a manutenção dos ácaros.

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