



PEST CONTROL CONSULTS vzw-asbl

**REPORT**  
**EFFICACY ASSESSMENT OF HOUSE-DUST MITE CONTROL PRODUCTS**

Experiment n° : PA/115/01

Title of experiment : Limitation of house dust mite populations  
in fabrics - Polyester Fabric Samples Treated  
with Ultra-Fresh FT-7 (PCC-00-AA and  
PCC-00-ZZ)

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## CONFIDENTIALITY

Test on the limitation of house dust mite populations in fabrics -  
Polyester Fabric Samples Treated with Ultra-Fresh FT-7 (PCC-00-AA and PCC-00ZZ)

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Experiment n° : PA/115/01

Period of experiment : from 12/12/2000 to 13/02/2001

Date of report : 16/02/2001

## **AUTHENTICITY**

The signer hereby declares that the experiment described in this report has been performed by Dr. Danielle Gridelet, specialist in Acarology and responsible of the Medical Entomology Department, and this in accordance with the standard protocol.

He certifies that the results obtained during the essays reflect the facts precisely and exactly.

Date: 16/02/2001

PA/115/01

Limitation of house dust mite populations

in fabrics-Polyester Fabric Samples Treated with Ultra-Fresh FT-7

(PCC-00-AA and PCC-00-ZZ)

Ing. Erny DE WINNE

Directory - President

**RESPONSIBLE INSTITUTE****PEST CONTROL CONSULTS**

Pest Control Consults vzw-asbl is an independent organisation composed of scientists and academicians who perform, in the broad sense of the term, studies, research and tests requested or not by the Belgian or European legislation concerning efficient control of all nuisance of acarological, entomological and mycological nature.

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## INTRODUCTION

### RESEARCH OBJECTIVE

The assays were performed in order to verify the efficacy of a certain chemical treatment for the limitation of house dust mite populations in home textiles. It concerns the assessment of the acaricidal efficacy of **pre-treated** material according to a newly developed strategy for the control of *Dermatophagoides*.

There are a number of insecticidal, biocidal and fungicidal agents commonly used in the textile industry that could be well worth systematically screening for their effect on house dust mites. The resistance of the *Dermatophagoides* against most classic pesticides is a well-known fact. There are few efficient acaricides against the house dust mites and they generally present a low efficacy below a concentration of 1%.

The THOMSON RESEARCH ASSOCIATES company has developed several anti-microbial products for different applications in the home area. Activity against house dust mites was assessed. The TRA products appeared to be very efficient when applied on bedding materials such as PVC laminates and polyester fibres (test report PA/073/99). The efficiency was verified on loose fibres as well as on finished textiles (report PA/076/99), on mattress ticking (report PA/077/99) as well as on floor covering (reports PA/075/99 and PA/078/99). Other assays performed on foams, carpets, loose rayon fibres, fabrics, polyester staple fibres and mattress ticking attested the efficacy of the TRA treatment (reports PA/082/99 through PA/085/99, PA/088/00, PA/092/00, PA/093/00, PA/096/00, PA/097/00, PA/103/00 through PA/106/00).

The precise objective of the actual assays was to assess the acaricidal **effect of certain application conditions on samples of polyester fabric treated with Ultra-Fresh FT-7**.

## **MATERIALS**

### **TEST ORGANISM**

The mite used in the test was *Dermatophagoides pteronyssinus*. This species was selected because of its world-wide geographical distribution.

Laboratory cultures are maintained on a mixture of human skin scales, yeast powder and nutritive animal proteins (1:1:1) under optimal thermohygrometric conditions (25°C; 75% R.H).

## TEST OBJECTS

The test material consisted of two samples of polyester fabric (under reference letters AA and ZZ). An untreated control sample was included.

The biological assays were conducted in triplicate on 10 x 10 cm units.

The samples were soiled with natural dust and acclimated to a specific humidity prior to inoculation with mites.

Acaricidal efficacy of the test material was assessed according to the semi-natural test system. The semi-natural test system takes into account the eventual role of the dirt. Dust and dirt that is present on and in all surfaces in the home have a markedly protective effect against chemical and mechanical destruction methods. The semi-natural test is performed under a sufficiently long period of incubation, it allows the assessment of any direct as well as indirect (fungicidal) effects on mite population growth.



## DUST SUBSTRATE

Since all surfaces were normally more or less soiled under home conditions, each test unit was covered with a standard dirt - natural dust originating from the same domestic surface type as was to be tested in the trial - in order to obtain the best possible representative dust. The dwelling dust was a mixture of dust of 3 different homes in which no insecticides or acaricides have been used.

The protein content of dwelling dust may vary. To ensure the nutritional requirements of mites, skin scales and powdered yeast (particles  $\leq 50 \mu\text{m}$ ) were added to the dust in the ratio 3:1:12 (w/w).

Each test unit was soiled with 100 mg of this standard dirt.

## EXPERIMENTAL SET UP

After homogenizing, dust substrate was exposed for 72 hours to UV-c light (germicidal maximum 253.7 nm) at a distance of 10 cm. The dust was spread out over a paper surface at a density of 100 mg dust / 25 cm<sup>2</sup> and agitated 3 times every 24 hours to ensure complete exposure to the radiation.

This procedure, tested before, reduces pre-existent microbiological infestation (fungi and mites) without changing the chemical nature of the substrate.

After the addition of the skin scale mixture in the correct proportion, the dust substrate was divided in units of 100 mg.

Dust was spread out with aid of a sieve at a 2-cm distance than rubbed in the test surface. Soiled units were placed on the bottom of a glass Petri dish (diameter 15 cm).

To prevent the mites from escaping, the rims of the Petri dishes were ringed with sticky tanglefoot (Tangle Trap® non-toxic to mites).

The different units of test material were placed for one week in an incubator at specific mite optimal growth conditions (i.e. for the *Dermatophagoides pteronyssinus* species a temperature of 25° C and 75% relative humidity).

After acclimatation, each test unit was inoculated with 50 mites (25 male and 25 female young adults) picked from a flourishing culture. The mites were placed separately on the test material in order to avoid aggregation phenomenon due to the effects of stress.

Incubation continued for 6 weeks after mite inoculation in order to allow the development of at least 2 generations of *Dermatophagoides pteronyssinus* under such optimal thermohygro-metric conditions.

## QUANTIFICATION METHOD OF THE MITES

### Necessity to adapt the technique to the type of tested textile

The technique to expel the mites by heat (Heat Escape Method) represents undoubtedly the fastest technique to count the number of mites and it is also a technique suitable for large samples. Like other "dynamic" techniques it does not allow the extraction of eggs and molting mites (pupae). Nevertheless a good estimation of the number of active individuals is obtained. The numerical importance of the living populations is the best measurement for testing the acaricidal activity.

The efficacy of this technique may vary according to the characteristics of the tested textile (density, thickness, back ...) This is the reason why it is necessary to adapt the extraction temperature of the samples with a known number of mites.

This technique has been originally tested on tufted carpets of polyamid poles fixed on flat foam base with a pile thickness of about 5 mm. An adhesive plastic film is fixed onto the carpet and the backside of the carpet is heated progressively during 1 hour at 65 °C.

From several assays it appears that the end-temperature of the heating plates and length of time period for extraction depends on the test material. The end-temperature may vary from 55°C to 85°C.

A end-temperature of 55°C is used for thin test surfaces. Thick padding materials or thick carpets with dense back require an extractive temperature of 75-85°C.

For each sample unit, the procedure will be repeated in order to optimise the efficiency.

## RESULTS

The data on efficiency of any anti-mite formulation or measure are usually presented in terms of reduction of mite population (growth reduction). This reduction is obtained by comparing the population of the treated pieces to the corresponding non-treated populations.

Treated and non-treated samples were not here identified prior to the test. Nevertheless an acaricidal effect of the TRA treatment clearly appeared in the present essay (table 1).

No live mites were recorded from replicates of the samples AA while a mite population growth appeared on the sample ZZ.

## CONCLUSIONS

The treatment performed on polyester fabric treated with Ultra-Fresh FT-7 appeared to be very effective when tested in a semi-natural test system.

A complete inhibition of *Dermatophagoides* population growth was shown after a 6-week period of incubation.

## GENERAL PERSPECTIVES

Several points have to be considered to ensure an efficient long term treatment:

1. **perfect distribution/penetration of the product** (optimal deposition rate, ...) in order to avoid possible refuges for the mites
2. **stability of the acaricidal treatment** to be verified by endurance tests (cleaning process, abrasion..) under different application conditions according to the type of textile material. The frequent washing of the treated fibres is absolutely necessary to remove the dead mites and the allergenic faecal particles coming from external sources that can accumulate in it. The acaricidal treatment has to resist dry cleaning as well as wet cleaning.
3. **duration of the effectiveness of the treatment.** We remind that residual activity in the biological meaning of the term is concerned here. The effectiveness measured on the mites *Dermatophagoides* needs to be assessed at different periods according to the estimated life of the treated material, even according to different storage conditions.

**Author :**

The test n° PA/115/01 has been performed by Dr. Danielle GRIDELET responsible for the Department of Medical Entomology.

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Director - President

TABLE 1 : **EFFICACY ASSESSMENT OF Ultra-Fresh FT-7 APPLIED ON SAMPLES OF POLYESTER FABRIC. POPULATIONS OF THE MITE *DERMATOPHAGOIDES PTERONYSSINUS* ON EACH UNIT AFTER SIX WEEKS OF INCUBATION AT 25° C AND 75% RELATIVE HUMIDITY.**  
**(starting population: 25 male and 25 female young adults)**

	3 replicates/sample			Mean	S.D.
<b>AA</b>	0	0	0	<b>0</b>	0.00
<b>ZZ</b>	408	375	320	<b>368</b>	44.46

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