# CONTROL OF EUROPEAN HOUSE DUST MITE *DERMATOPHAGOIDES PTERONYSSINUS* (TROUESSART) WITH *BACILLUS* SPP.

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*DERMATOPHAGOIDES PTERONYSSINUS* (TROUESSART), *BACILLUS SPHAERICUS* 1593, *BACILLLUS SPHAERICUS* 2297, *BACILLUS THURINGIENSIS* VAR. *ISRAELENSIS*

ABSTRACT : Effect of Bacteria strains were investigated against the tritonymphs of the so-called European house dust mite *Dermatophagoides pteronyssinus* (Trouessart). The tritonymphs exposed to *Bacillus* spp. spores mixed in the feeding medium at different concentrations showed different rate of toxicity. *Bacillus sphaericus* spores were more toxic than *B. thuringiensis*. Treating the tritonymphs with *Bacillus* spp. caused prolongation of the times needed for the development of adult stage.

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RÉSUMÉ : Les effets de souches de Bacteries sur des tritonymphes de *Dermatophagoides pteronyssinus* (Trouessart) sont étudiés. Les Bacteries mélangées à la nourriture dans différentes concentrations produisent différents taux de toxicité.

Les spores de *Bacillus sphaericus* sont plus toxiques que les spores de *B. thuringiensis*. L'activité de ces Bacteries provoque aussi l'allongement de la durée du développement de l'adulte.

## INTRODUCTION

The control of house dust mite by chemical alone often leads to the rapid development of resistance. The pyroglyphids are resistant to a great variety of chemicals, including DDT and Lindane which are the most common conventional insecticides for house pest control (BRONSWIJK *et al.*, 1971). New acaricides are needed for integrated mite in house dust and stored products. In addition, a trial was made for the introduction of new non-conventional control measures that do not affect the quality of stored materials and do not polute them of the environment, and are safe enough to mammals in general and man in particular (Shadduck 1980).

The effect of *Bacillus* spp. on mites and ticks is less well known. KRIEG (1968) demonstrated the effectiveness of a surpernatant of a ß-exotoxin positive strain of *B. thuringiensis* on active stages of *Tetranychus telarius* (L.). HALL *et al.* (1971) showed that ß-exotoxin isolated from *B. thuringiensis* was highly toxic to adult and immature *Panonychus citri* (Mc Gregor). GRAU (1986) reported that ABC 6162, a pure formulation of ß-exotoxin evaluadted for registration was effective against *T. urticae* and *T. pacificus* an cotton in 1985. MARJORIE *et al.* (1987) reported that the ß-exotoxin of *B. thuringiensis* was toxic to adult female *T. pacificus* and *Metaseiulus occidentalis* within 48-96 hours.

No information is available on the toxicity of *Bacillus* spp. to *Dermatophagoides pteronyssinus*

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(Trouessart). In the present investigation was tested the control effect of the *Bacillus* spp. against the common subject mite, *D. pteronyssinus* (Trouessart).

## Material and methods

Stock rearing of *D. pteronyssinus* :

One hundred newly emerged tritonymphal stages of *D. pteronyssinus* were introduced into jar, filled up to its half with wheat bran as a feeding medium, previously heated at 90° C for 6 hrs to avoid the presence of other insects or mites (c.f. Donia *et al.*, 1961). The jars then were kept in a rearing chamber at 25 ± 0.1° C and 75 ± 2 % R. H. In this way, and after nearly six months, great numbers of different instars of *D. pteronyssinus* (Samia *et al.* 1988), were available.

Bacteria strains :

*Bacillus thuringiensis* H-14 and *B. sphaericus* 1593, 2297 and 2362, in respect, used in this study were spore impregnated filter strips obtained from Pasteur Institute, France. Nutrient broth was used to recover bacteria from the filter strips. Each strip was dropped into a 100 ml flask of nutrient broth and incubated at 30° C for 24 to 48 hr with gentle agitation. The stock suspension obtained from *B. thuringiensis* H-14 and *B sphaericus* 1593, 2297 and 2362 was $1.08 \times 10^7$, $1.60 \times 10^7$, $0.8 \times 10^7$ and $1.7 \times 10^7$ cell/ml, in respect. The number of viable spores were counted by means of standard plate-colony-count procedure (Kiraly *et al.* 1970) using 0.1 ml of spore suspension per testing sample.

Experiment test :

0.2 mg of wheat bran were kept in thin layer in clean Petri dishes (1.5 cm in diameter and 1.5 cm deep). A liquid of 10 microliter from different concentrations of each *Bacillus* spp. was added, by micropipe on the considered food-stuff layer.

Five concentrations at least were used for each bacteria strain, then mixed thoroughly in order to spread the material homogeneously among the food-stuffs. Twenty five tritonymphs were kept in each Petri-dish among the treated food-stuffs particle till the end of the experiment. Every tested concentration was triplicated and so were the controls. The check treatments were prepared. These prepared dishes were daily investigated under a suitable binocular microscope. Both tritonymphal mortality and tritonymph duration were recorded and compared with those of the checks under laboratory conditions at 25 ± 0.1° C and 75 ± 2 % R. H.

Statistical analysis :

All the data obtained were analyzed following the probit analysis technique (LCp line) of Litchfield & Wilcoxin (1949).

## Results and discussion

The susceptibility levels of European house dust mite after its treatment with different concentrations of *Bacillus sphaericus*, 1593 (Fig. 1), *Bacillus sphaericus* 2297 (Fig. 2), *Bacillus sphaericus* 2362 (Fig. 3) and *Bacillus thuringiensis* var. *israelensis* (Fig. 4), the medium lethal concentration $LC_{50}$ and statistical parameters were established. The toxicity data in Table (1) show that *B. sphaericus* spp. were more potent against *D. pteronyssinus* than *B. thuringiensis* var. *israelensis*, inversely to that which was found for the mosquito by Kelada and Shaker (1988).

Also, the data show that there is a variation between *B. sphaericus* spp., spore species No. 2297 being the most potent after 24 hr. for tritonymph treatment, spore species No. 2362 the most effective after 5 days of treatment. *B. spahericus* 1593 was the least potent one against mite after one or five days of treatment. The Table I shows that *B. sphaericus* 1593 and *B sphaericus* 2362 spores were much effective on more than one site of action, which appears from their effect on rate of transformation of treatment mite from 1.0 to 1.37 and 1.25 respectively.

The present findings prove that *Bacillus* spp.

affect and retard the development of the tritonymphs of *Dermatophagoides pteronyssinus* (Trouessart) towards the adult stage. They could be considered as an indication for a new mode of control. The same effect was found with the insect grow regulators altosid and altozar, both compounds ranked, according to their effective concentration, as potent acaricides inhibiting adult formation and prolonging its duration (SAMIA *et al.* 1976).

In conclusion it appears that *Bacillus* spp. can control mite by killing it with safe concentration or by interfering on its life cycle without affecting

TABLE 1. — Effect of four strains of *Bacillus* spp. on European house dust mite *Dermatophagoides pteronyssinus* (Trouessart) under laboratory conditions of 25 ± 0.1°C and 75 ± 2 % R. H.

| | Days of treatement | No. of spore × $10^3$/0.2 g Whale cohent $LC_{16}$ | $LC_{50}$ | $LC_{84}$ | Rate of slope (S) | Slope 1/S | Rate of of transformation |
|---|---|---|---|---|---|---|---|
| *Bacillus sphaericus* 1593 | 1 | 24 | 140 | 880 | 1.4 | 0.71 | 1.37 |
| | 5 | 22 | 68 | 230 | 2.1 | 0.47 | |
| *Bacillus sphaericus* 2297 | 1 | 8.0 | 65 | 550 | 1.1 | 0.90 | 1.00 |
| | 5 | 9.0 | 37 | 190 | 1.4 | 0.71 | |
| *Bacillus sphaericus* 2362 | 1 | 14 | 100 | 900 | 1.0 | 1.00 | 1.25 |
| | 5 | 5.0 | 33 | 250 | 1.1 | 9.00 | |
| *Bacillus thruringiensis* var. *israelensis* | 1 | 0.6 | 200 | 800 | 0.4 | 2.50 | 1.00 |
| | 5 | 0.65 | 90 | 140 | 0.9 | 1.11 | |

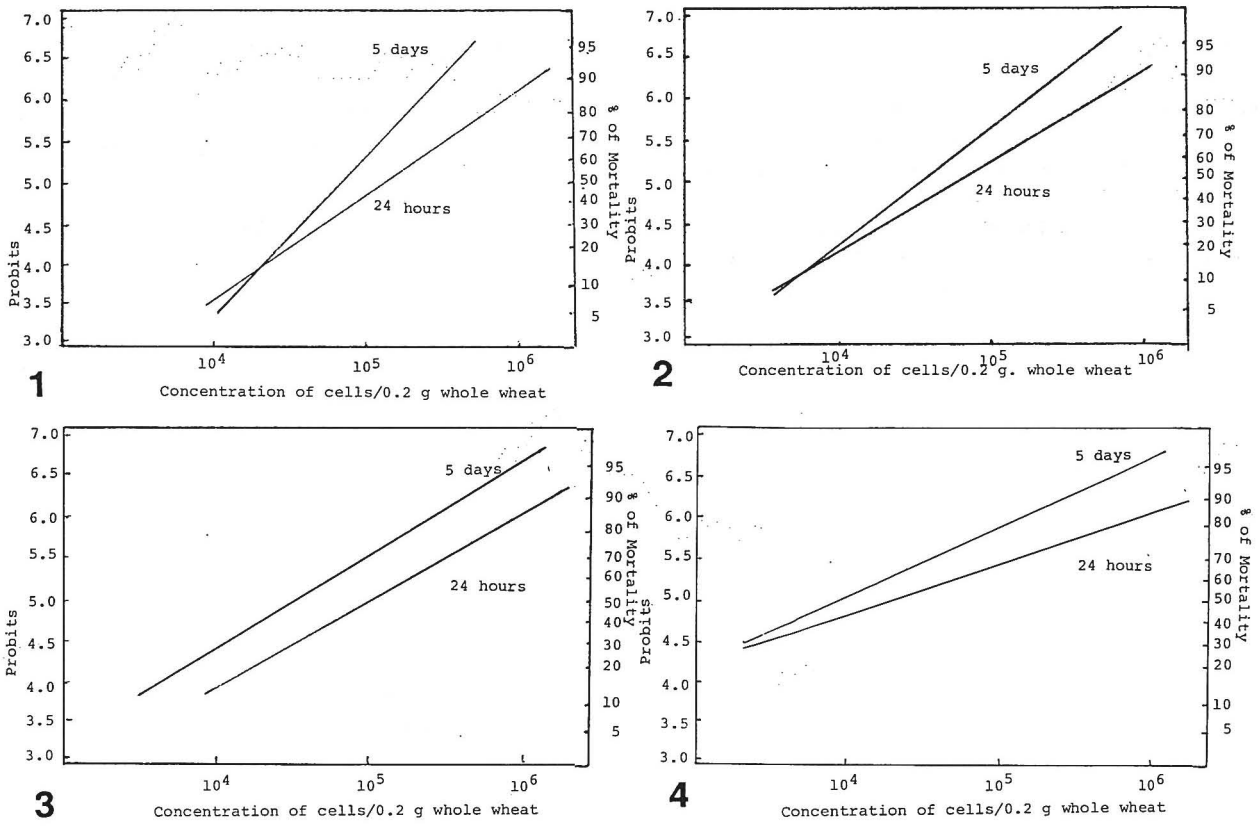


FIG. 1-4. — LCp lines of *Bacillus* spp. against *Dermatophagoides pteronyssinus* after 1 and 5 days of treatment.
1. — *B. sphaericus* 1593. 2. — *B. sphaericus* 2297. 3. — *B. sphaericus* 2362. — 4. *B. thuringiensis* var. *israelensis*.

wheat material or contaminating it like acaricides, providing the same effect found by SHAKER *et al.*, (1985), who showed that using pesticide to protect wheat depends on different other surrounding factors as humidity, grain moisture and temperature and also, causes contamination to protected material.

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