# APPLICATION TEST FOR BIOLOGICAL CONTROL OF WAX MOTH

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## INTRODUCTION

The wax moth, *Galleria mellonella* (photos 1 and 2), is one of the many curses that beekeepers must face, particularly in areas where winter temperatures do not cause its biological cycle to slow. This parasite is ubiquitous and lives in bee colonies without causing serious damage until the family consists of a very large number of bees.

In the absence of individuals to look after cleaning the combs, the eggs deposited by the moth hatch and produce young larvae that find the food they need to develop in the wax, pollen and residues from the brood.

Only at temperatures below 10 - 13°C does the biological cycle slow noticeably, and it becomes rapid as soon as the ambient conditions become favourable.

The fight against this moth involves treatments based on sulphur anhydride or insecticides, which causes damage to the materials, risks of product contamination and possible poisoning for the operator.

Considering the economic value that frames containing combs have for beekeepers, it is extremely important to ensure appropriate and lasting protection while they are in storage. For this reason, it was considered useful to perform a comparative test using sulphur anhydride, normally used by beekeepers to control *G. mellonella*, and a microbiological insecticide, to evaluate the validity of the treatments by means of a visual estimate of efficacy.

## MATERIALS AND METHODS

The experiment was performed at the Experimental Centre for Zootechnical Innovation (Ce.S.I.ZOO) at the Università degli Studi di Milano, at Cornaredo (Milan), in a basement location with a high level of humidity (75 - 85% RH) and an almost constant temperature (23°). These provided the ideal conditions for hatching the eggs and development of the larvae of the wax moth (photo 3). Thirty honey chambers from eight combs were used, divided into three groups of ten chambers each.

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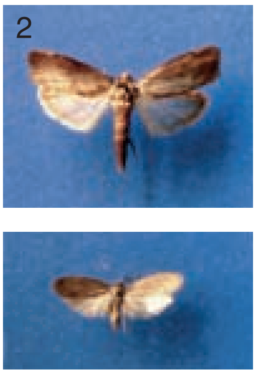

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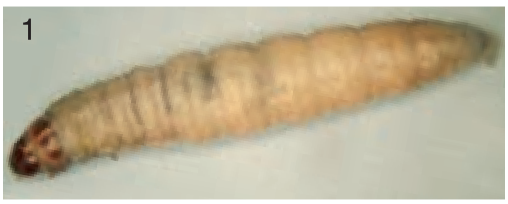


Photo 1 - Larva of Galleria mellonella.
Photo 2 - Adult G. mellonella.
Photo 3 - Storage environment.
Photo 4 - Initial phases of the experiment: numbering the frames.

The material was stored in a honey extraction laboratory for a period of 40 days following the extraction of acacia honey, to permit the *Galleria* eggs that are naturally present on the combs to hatch. Each individual frame was then classified and numbered (photo 4).

The treatments began on 11 July 2005 and the following were used on the three groups:

- Sulphur anhydride spray distributed from above the chamber stack (Group A);
- The product B. *thuringiensis*, variety *aizawai* serotype 7 (commercial product B 401 - Vita-Swarm sas), diluted in water and sprayed in accordance with the manufacturer's instructions, on each side of the frame (photo 5, Overleaf);
- Control (Group C) treated in the same way as the previous group but using only water.

At the end of the treatments, the frames were returned to the environment described above, in the presence of three hives with honeycombs containing *Galleria* at the mature larva, chrysalis and adult stage (photo 6, Overleaf), to re-infest the material and evaluate the effect of treatment over time.
The checks were performed at the start of the experiment and after 1, 2 and 7 weeks, with a purely visual check performed on the frames, to divide them into four classes:

- No damage (frames intact).
- Presence of debris (harmful trophic activity but insufficient to damage the combs).
- Presence of larval tunnels (combs damaged but still recoverable).
- Combs compromised (serious damage making them unusable).

Chart 1: Group A (11/07/05)

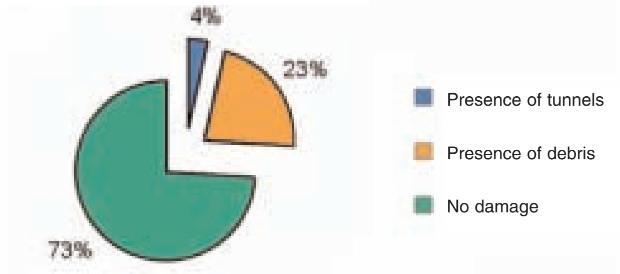



Chart 2: Group A (06/09/05)

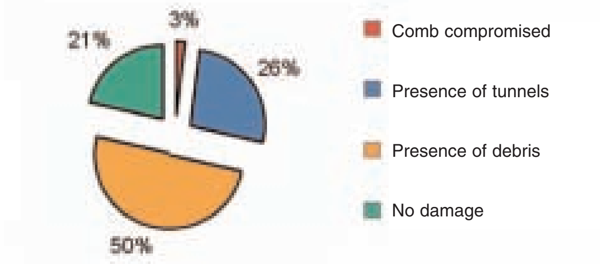



Chart 3: Group B (11/07/05)

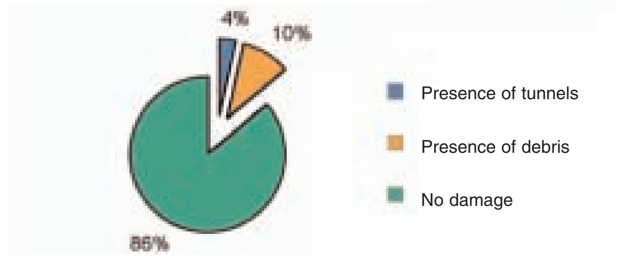



Chart 4: Group B (06/09/05)


Chart 5: Group C (11/07/05)

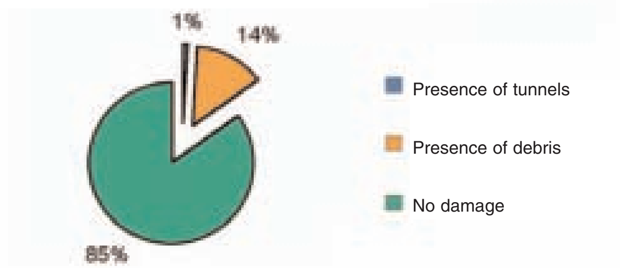
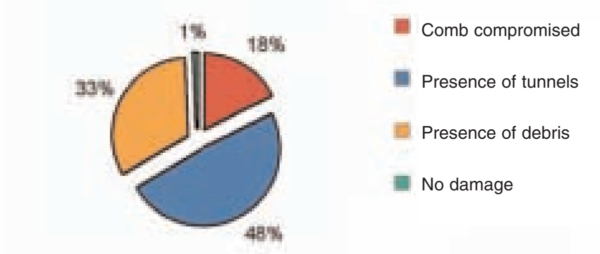



Chart 6: Group C (06/09/05)



- Photo 5 - Method of applying the B. thuringiensis-based product.
- Photo 6 - Example of a comb used for re-infestation.

**RESULTS**

For Group A, observing the progress of infestation in detail, we noted that, following an initial slowing of activity resulting from the killing activity of the sulphur anhydride, the damage subsequently resumed, which led to 3% of the combs being compromised by the time of the final check. The proportion of intact combs changed from 73% at the start of the test to 21% (Charts 1 - 2) at the end of the experiment.

In Group B, in which the product based on B. *thuringiensis* was used, we note (Charts 3 - 4) that, even in the final phase, i.e. seven weeks after treatment, the total of compromised combs remained at zero, while a good 56% showed no sign of any form of trophic activity.

The control (Group C) showed 18% of combs to be completely compromised, while only 1% remained intact (Charts 5 - 6). To obtain a clearer image of the efficacy of these treatments, the following table is intended to show the possibility of re-using the frames or not.

Table 1

| | Re-usable frames | Compromised frames |
|---|---|---|
| Sulphur anhydride | 97% | 3% |
| B 401 | 100% | 0% |
| Control | 82% | 18% |

The first column consolidates the first three classes: those covering the intact frames and the two with varying degrees of damage but not preventing their re-use; the second shows the percentage of frames definitively compromised.

**CONCLUSIONS**

We may derive some useful indications by observing the changes in damage over time: in Group A (treatment with sulphur anhydride) and, even more so in the control (Group C), the infestation, and thus the subsequent damage, continued to develop, and it is certain that if the test had continued beyond seven weeks, the number of completely compromised frames would have been even higher.

In the case of Group B (treatment with *B. thuringiensis*), the new-born larvae died after having begun to cause a small amount of debris and then ceased feeding. The level of damage did not affect the possibility of re-using the frames (see Table 1).

Bearing in mind that the experiment was conducted with a view to creating, as far as possible, the ideal conditions for development of *Galleria*, which is naturally present on the combs, and providing the possibility of subsequent re-infestation, we may hypothesise as a matter of course that early use of the product, e.g. after the bees have cleaned the honey chambers and before they are stored away, could offer complete protection against an attack by *G. mellonella* over time.

In conclusion, we may affirm, despite the empirical nature and the resulting scientific limits on this test, that this product based on *B. thuringiensis* has a comparably effective action on the development of *G. mellonella* and that it may provide an effective device for beekeepers in protecting combs in storage.