

# Beauveria bassiana to control the mealworm Alphitobius diaperinus in chicken barns

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## Introduction

One of the most common insects in poultry houses is the mealworm *Alphitobius diaperinus*, also known as the darkling beetle. Immature (larvae) and adults feed on seeds spilled on the ground or from poultry droppings. In addition to structural damage, this insect can also be a vector of diseases that can affect birds. In addition, the indigestible shell of the insect can cause digestion problems for birds, and thus affect the profitability of production. It is considered impossible to eliminate the populations of mealworms, and in organic poultry production, the control options are limited. The mycoinsecticide BioCeres WP, based on the fungus *Beauveria bassiana*, and which controls aphids, has been proposed to control the mealworm *A. diaperinus* in chicken barns.

## Objective

Determine if *Beauveria bassiana* can be used as a biological solution to control mealworm infestations in poultry production.

## Methods

The use of animals was approved by the CRSAD Animal Ethics Committee (CPA-CRSAD) and all procedures were performed according to the guidelines of the Canadian Council on Animal Care. Trials were conducted at CRSAD, Deschambault, Quebec, Canada.

### Trial #1: Adverse effects study on broilers

640 Cobb 500 males, in 32 pens (3.6 m<sup>2</sup> per pen)  
From 0 to 35 days old  
6 repetitions per treatment  
Full necropsy on 2 chickens per pen, 16 birds per treatment

### Trial #2: Efficiency assay on mealworms *Alphitobius diaperinus*

450 adult mealworms from a commercial chicken barn in 9 containers (1 m<sup>2</sup> each) containing 10 cm of wood shavings litter and chicken feed.  
28 days follow-up  
3 repetitions for control and 6 for BioCeres WP.

Data were analyzed using a mixed model including treatment as fixed effect, and block, representing the section of the building, as random effect. Comparisons between pairs were made using Student's test.

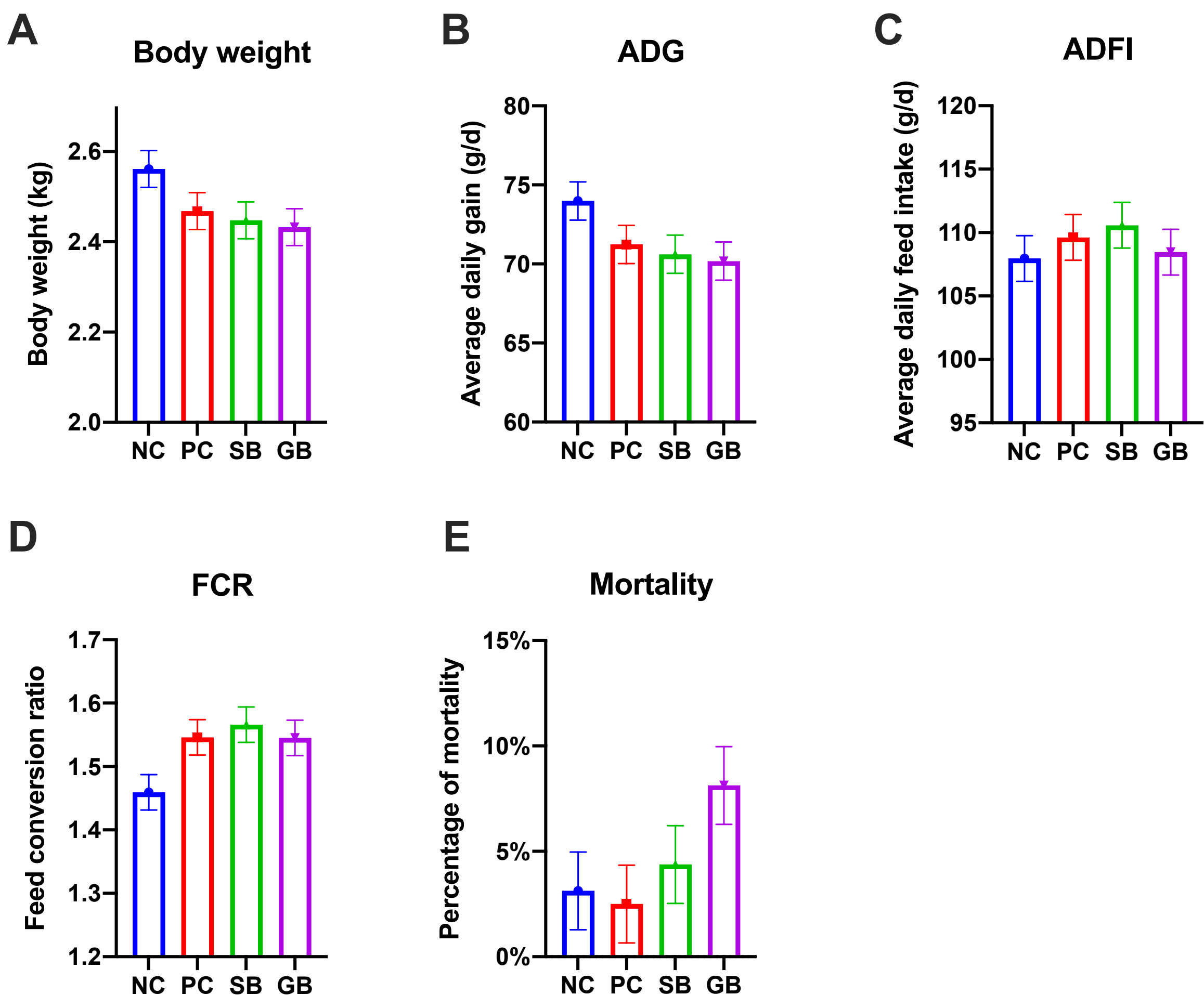
Table 1. Treatments

Treatments	Description
NC	Negative, no treatment
PC	Positive control, commercial pesticide (Tempo 20 WP™)
SB	10 g/L water-soluble BioCeres WP (4 x 10 <sup>9</sup> conidia per m <sup>2</sup> )
GB	20 g/m <sup>2</sup> granular BioCeres Gr

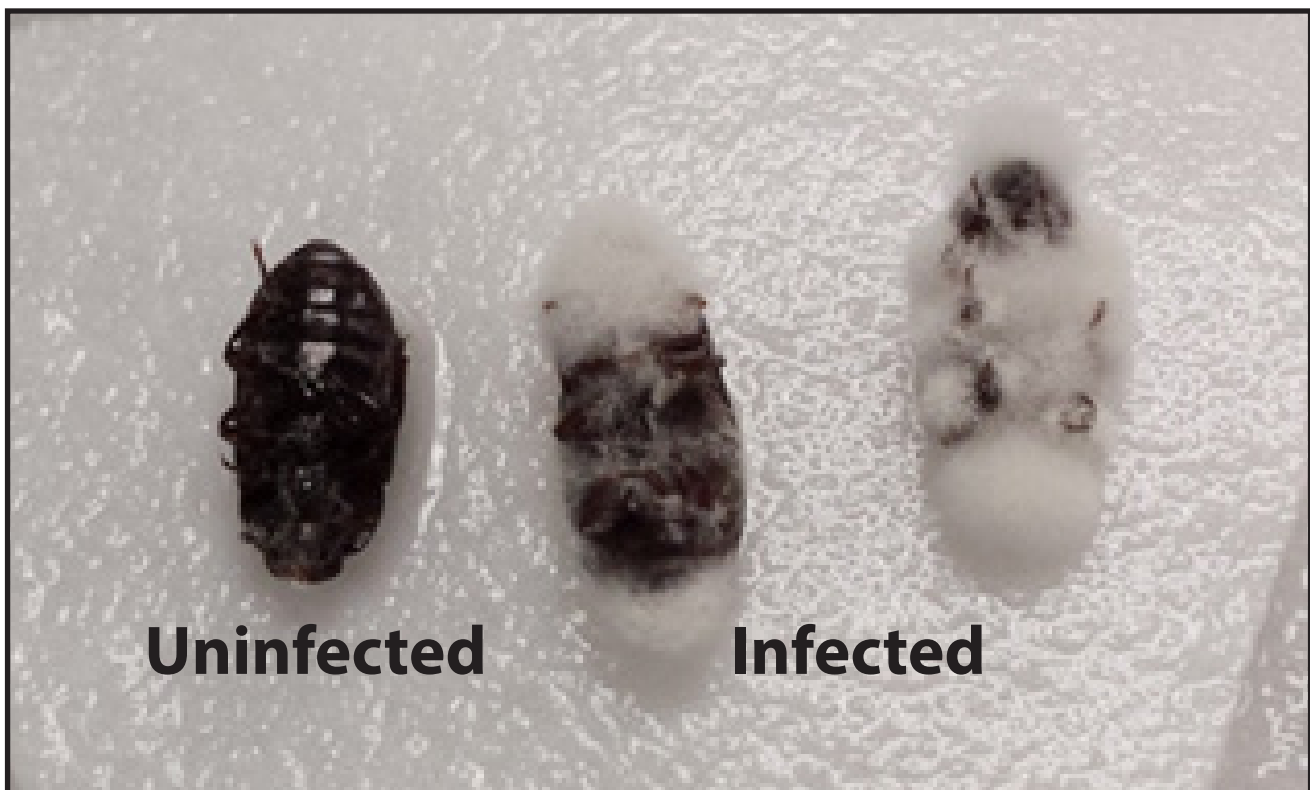
## Results

### Trial #1: Adverse effects study on broilers

#### 1. BioCeres (*B. bassiana*) shows no adverse effect on broilers



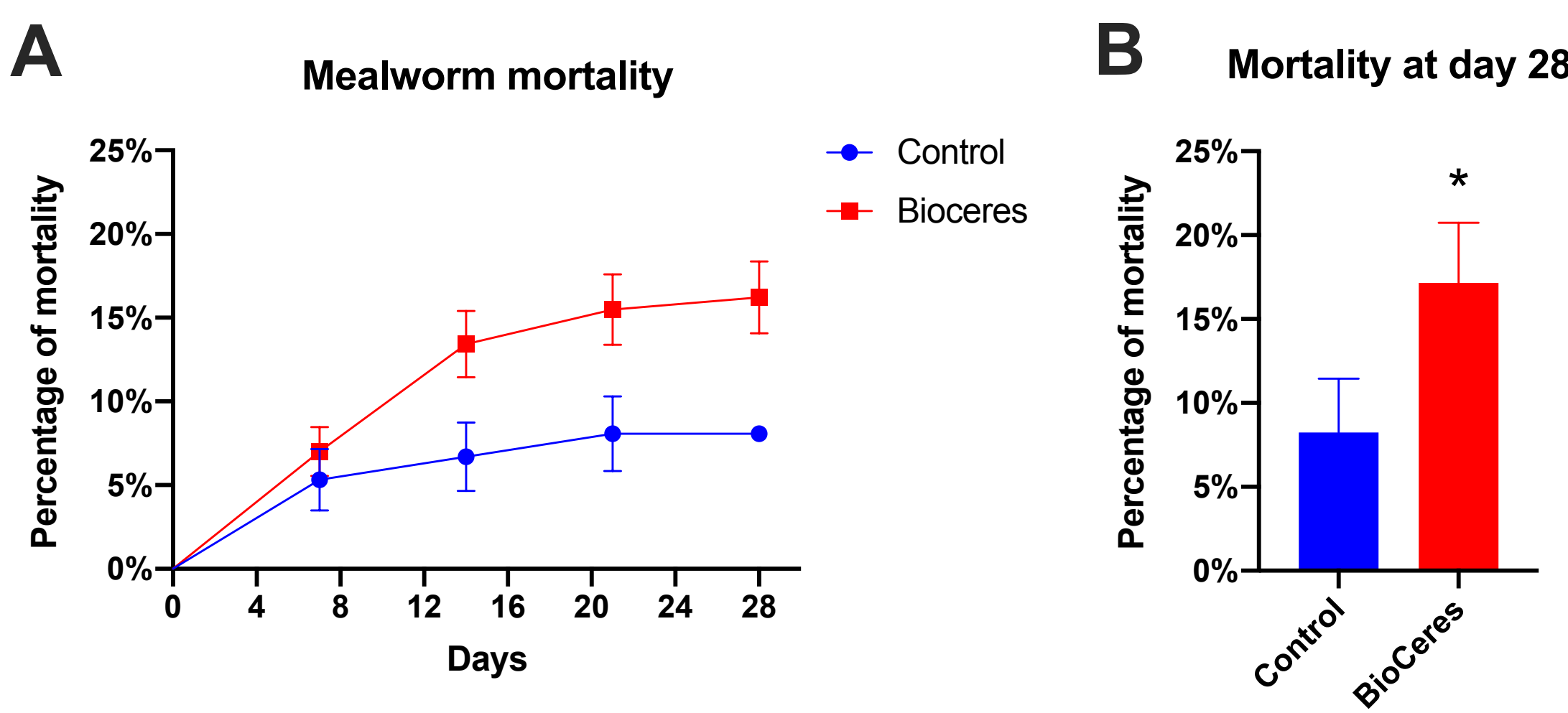
**Figure 1.** Zootechnical performance data and mortalities during the test, from 0 to 34 days of age. Body weight (A), average daily gain (ADG) (B), average daily food intake (ADFI) (C), feed conversion ratio (FCR) (D), and percentage of mortality (E) during the test, from day 0 to day 34. The bars represent the least squares means  $\pm$  standard error. No significant differences were observed, according to a value of  $p < 0.05$ . NC, untreated negative control litter, PC, positive control litter treated with commercial pesticide (Tempo 20 WP™), SB, litter treated with BioCeres WP (water-soluble powder), GB, litter treated with BioCeres Gr (granules).



**Figure 2.** Representative images of uninfected and *Beauveria bassiana*-infected mealworm *Alphitobius diaperinus* in this study.

### Trial #2: Efficiency assay on mealworms

#### 2. BioCeres (*B. bassiana*) shows insecticidal effects against mealworms



**Figure 3.** Insecticidal effect of BioCeres WB on a population of adult mealworms. Weekly cumulative mealworm mortality (A), and total mortality on day 28 of broiler farming (B). The bars represent the least squares means  $\pm$  standard error.

## Conclusion

- BioCeres, based on *Beauveria bassiana*, has shown insecticidal effects against the mealworm *Alphitobius diaperinus* in poultry houses without causing any negative effects in broilers.
- BioCeres could therefore be involved in a biological strategy for combating the mealworm *Alphitobius diaperinus* in chicken barns.
- Trials on several consecutive flocks would determine the effect of BioCeres against mealworms in the long term in poultry houses.

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