

# BACILLUS SP. PB6 IMPROVES PERFORMANCE AND ALTERS THE MICROBIOME OF BREEDING PHEASANTS UNDER COMMERCIAL CONDITIONS IN POLAND



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## Introduction

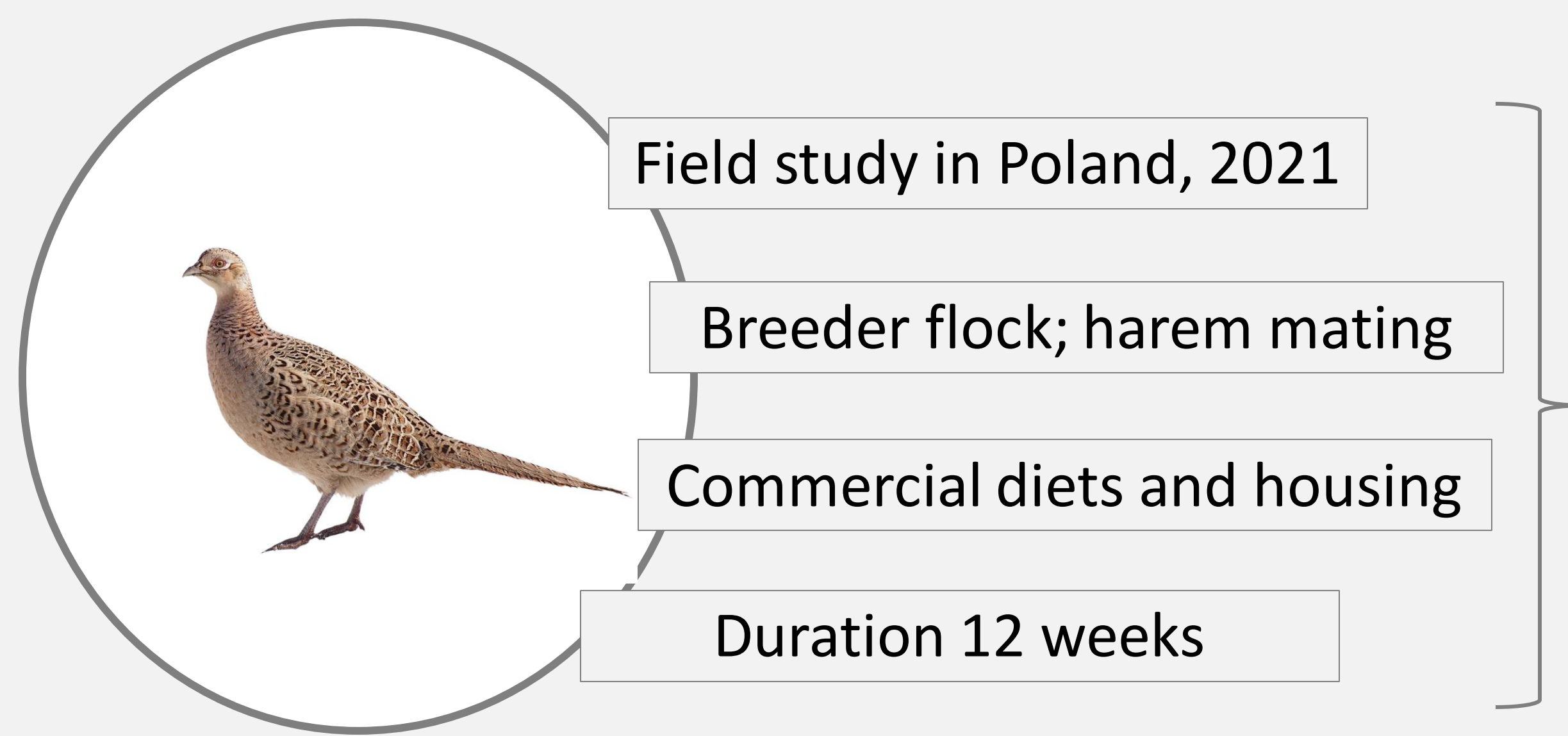
Game birds, like domesticated poultry, are susceptible to outbreaks of clostridial disease, including Necrotic Enteritis caused by *C. perfringens*, as well as infections of *C. colinum* and *C. sordelli*. These outbreaks tend to occur early in rear, and infected birds fail to thrive, presenting with diarrhoea, weight loss, and elevated levels of mortality. Pathogenic Clostridia can be controlled in other poultry using probiotic *Bacillus* species, including a commercially available strain called PB6.

Little is known about the microbiome of breeding pheasants, or the way in which it interacts with probiotic supplementation.

## Methods

Laying performance and hen and rooster mortality were monitored throughout the trial.

Ileal and caecal content was collected from 6 birds per house at the end of lay for assessment of microbiome structure



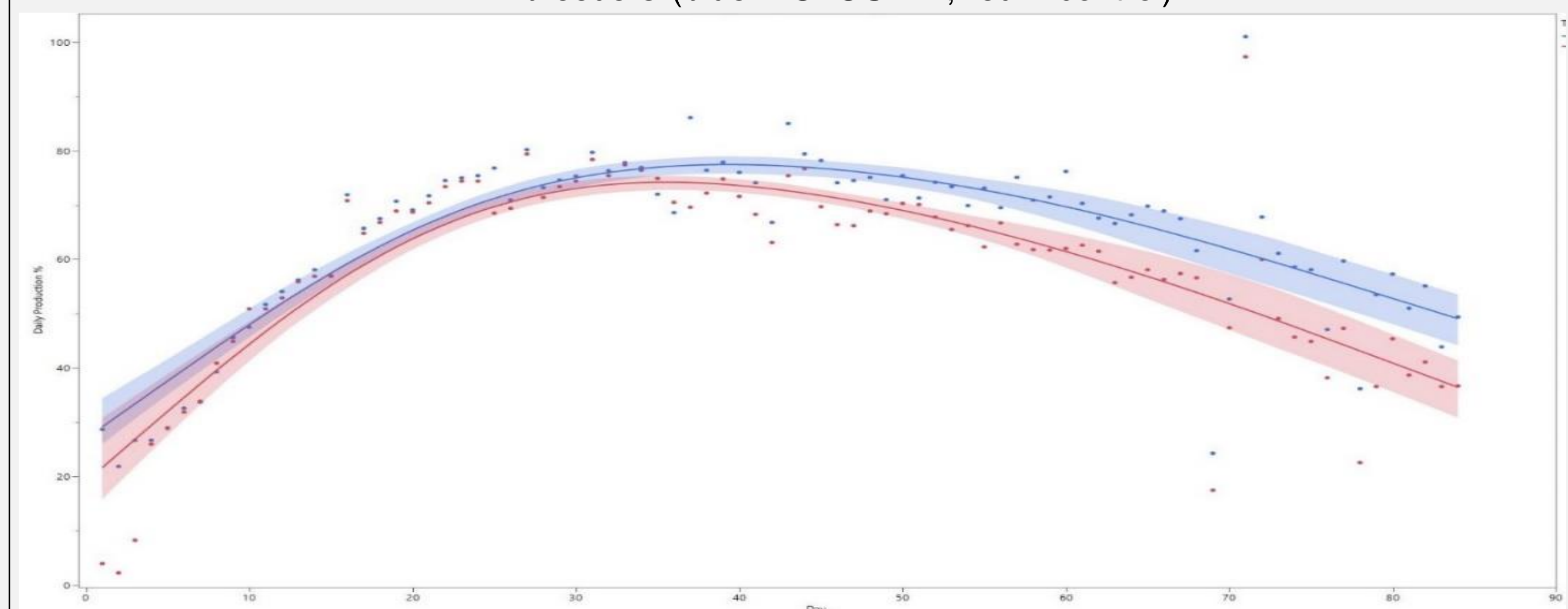
T1 – Unsupplemented commercial diets and practice

T2 – *Bacillus* spp. PB6 (CLOSTAT®) at  $2 \times 10^8$  cfu/kg feed

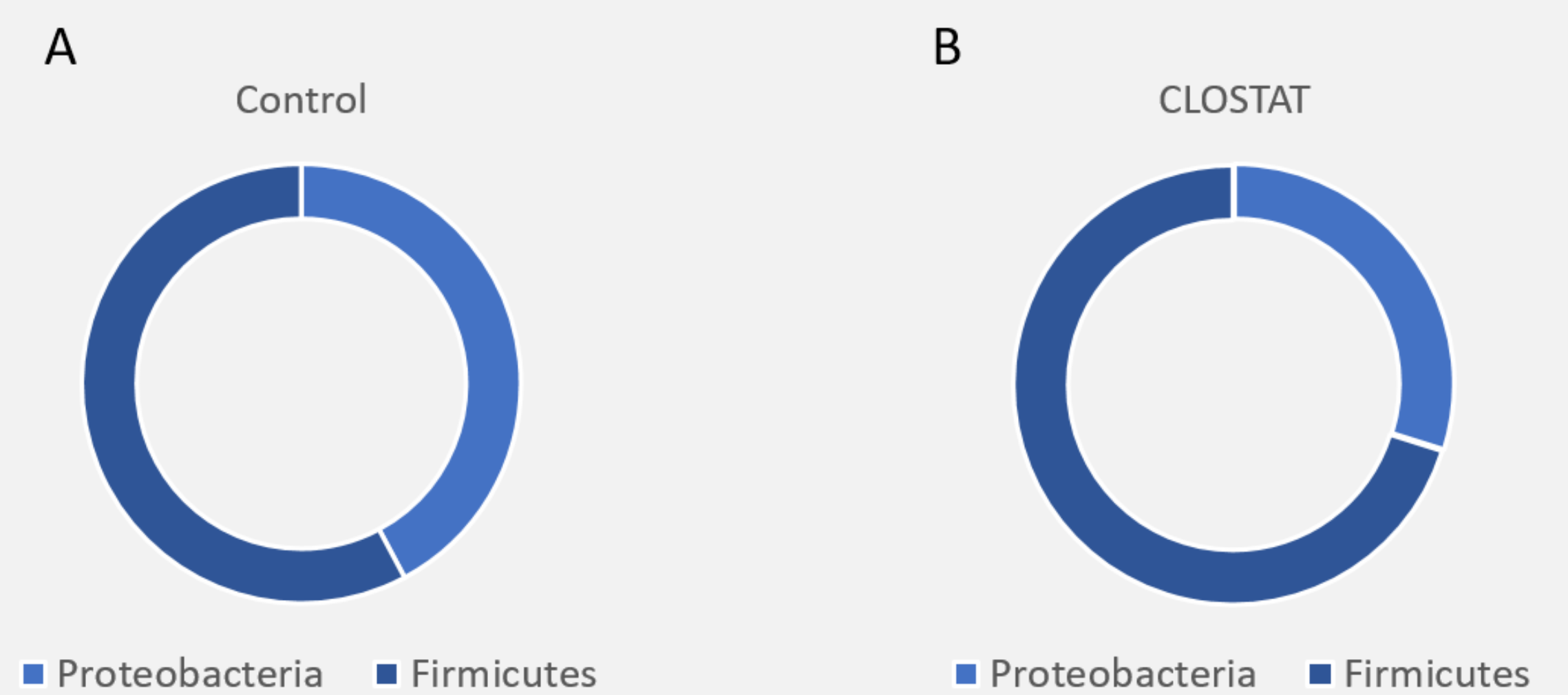
## Results

- Bacillus* sp. PB6 significantly increased the laying rate in weeks 7, 8, 9 and 12, with PB6 increasing daily production rate by 9.3, 8.1, 16.4 and 34.5 %, respectively
- There was a substantial decrease in rooster mortality with PB6 supplemented diets (12.11 % control vs 4.95% PB6), though hen mortality was unaffected
- In the microbiome assessment, supplementation of *Bacillus* sp. PB6
  - reduced pathogenic *Clostridia* numbers in the ileum
  - improved microbiome uniformity amongst individual birds
  - improved Firmicutes : Proteobacteria ratio in the caecum

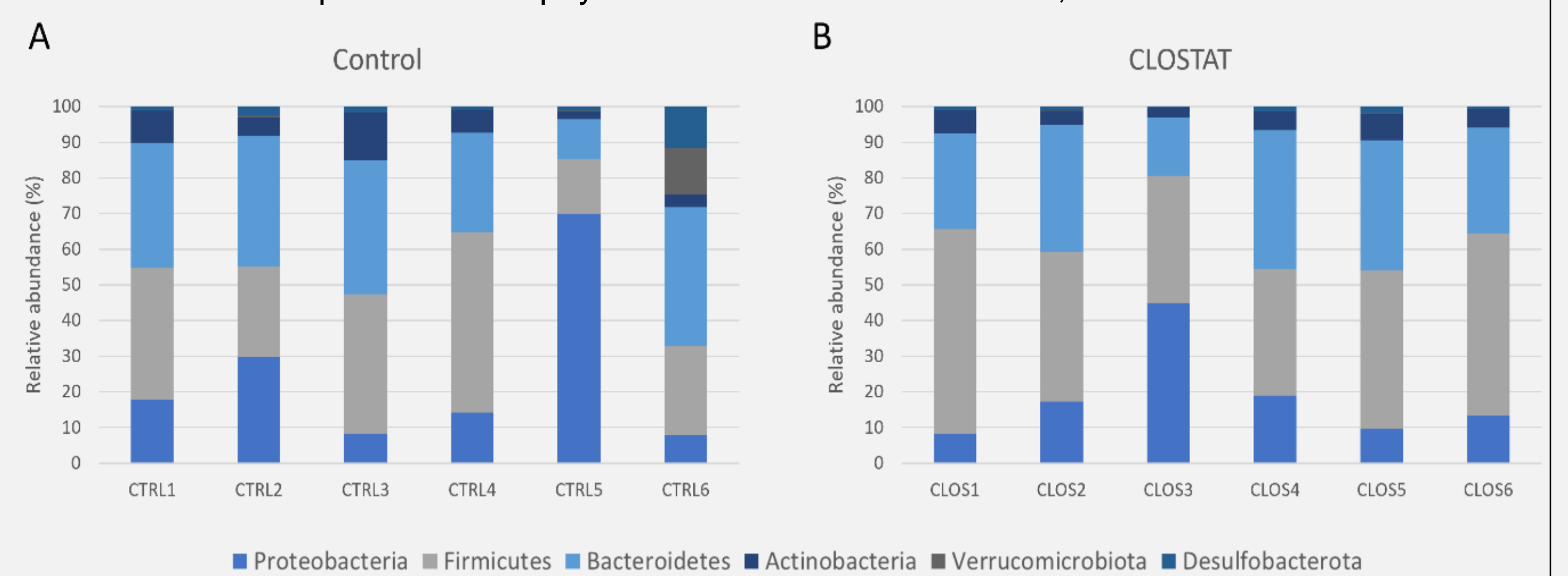
**Figure 1.** Impact of *Bacillus* sp. PB6 supplementation on daily laying rate of pheasant breeders (blue = CLOSTAT; red = control).



**Figure 2.** Relative abundance of Firmicutes and Proteobacteria in the caecal content of control birds (A) and birds receiving *Bacillus* sp. PB6. Administering CLOSTAT to the feed of breeder birds improved the Firmicutes/Proteobacteria ratio from 1.36 in control birds to 2.35 in treated birds.



**Figure 3.** Relative abundance of the most important bacterial phyla on the level of the individual bird. *Bacillus* sp. PB6 supplementation (B) induced higher uniformity of the cecal microbial composition compared to control birds (A). Each bar represents the cecal microbiome of an individual pheasants on phylum level. CTRL = CONTROL, CLOS = CLOSTAT.



## Discussion

The impact of *Bacillus* sp. PB6 supplementation on pheasant breeder performance and microbiome was assessed in a field trial under commercial Polish conditions. Across the trial:

- The use of *Bacillus* sp. PB6 increased daily laying rate in pheasant breeders (+5.9%,  $P < 0.05$ ), increasing and prolonging peak lay
- In the assessment of the breeder microbiome, supplementation with *Bacillus* sp. PB6:
  - reduced pathogenic *Clostridia* numbers in the ileum
  - improved microbiome uniformity amongst individual birds
  - improved Firmicutes : Proteobacteria ratio in the cecum
  - significantly altered the cecal microbial composition towards a healthier state