



The effect of biofungicide Prestop Mix on metabolic rate, water loss and longevity of bumblebee *Bombus terrestris* L.



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INTRODUCTION

Prestop Mix is based on a natural soil fungus *Gliricium catenulatum* J1446, which is applied to control fungal plant diseases. Bees can be used as vectors in carrying the biofungicide powder onto crop flowers; this has two benefits: pollination and plant protection from fungal pathogens. An important precondition is for the biopreparation to be safe for bees, therefore lethal and sublethal effects have to be tested. One way to assess sublethal effects of pesticides is to measure the metabolic rate (MR) and water loss rate (WLR) of an insect.

OBJECTIVE: to determine the effect of dermal contact with Prestop Mix to MR, WLR and longevity of bumblebee *Bombus terrestris* L.

METHODS

Laboratory experiments were conducted with bumblebee foragers from commercially reared hives. Contact treatments were performed by dusting the bees with three powdery substances: Prestop Mix, wheat flour (negative control) and entomopathogenic fungus *Beauveria bassiana* GHA (positive control); one group of bumblebees were left untreated. The MR and WLR were measured 3h before and 3h after treatment. Longevity of treated and untreated bees was followed daily after treatments. For measurements of MR and WLR the LI-7000 differential CO₂/H₂O Analyzer was used.

RESULTS

Prestop Mix had no significant effect on the mean MR of bumblebees, neither did the other treatments (Fig.1). However, after treatment with Prestop Mix there was a significant increase in WLR, whereas other treatments had no significant effect on WLR (Fig. 2). Prestop Mix and *B. bassiana* also significantly decreased the mean lifespan of bumblebees, as compared to the untreated bees; wheat flour had no significant effect on the mean lifespan of bumblebees (Fig. 3).

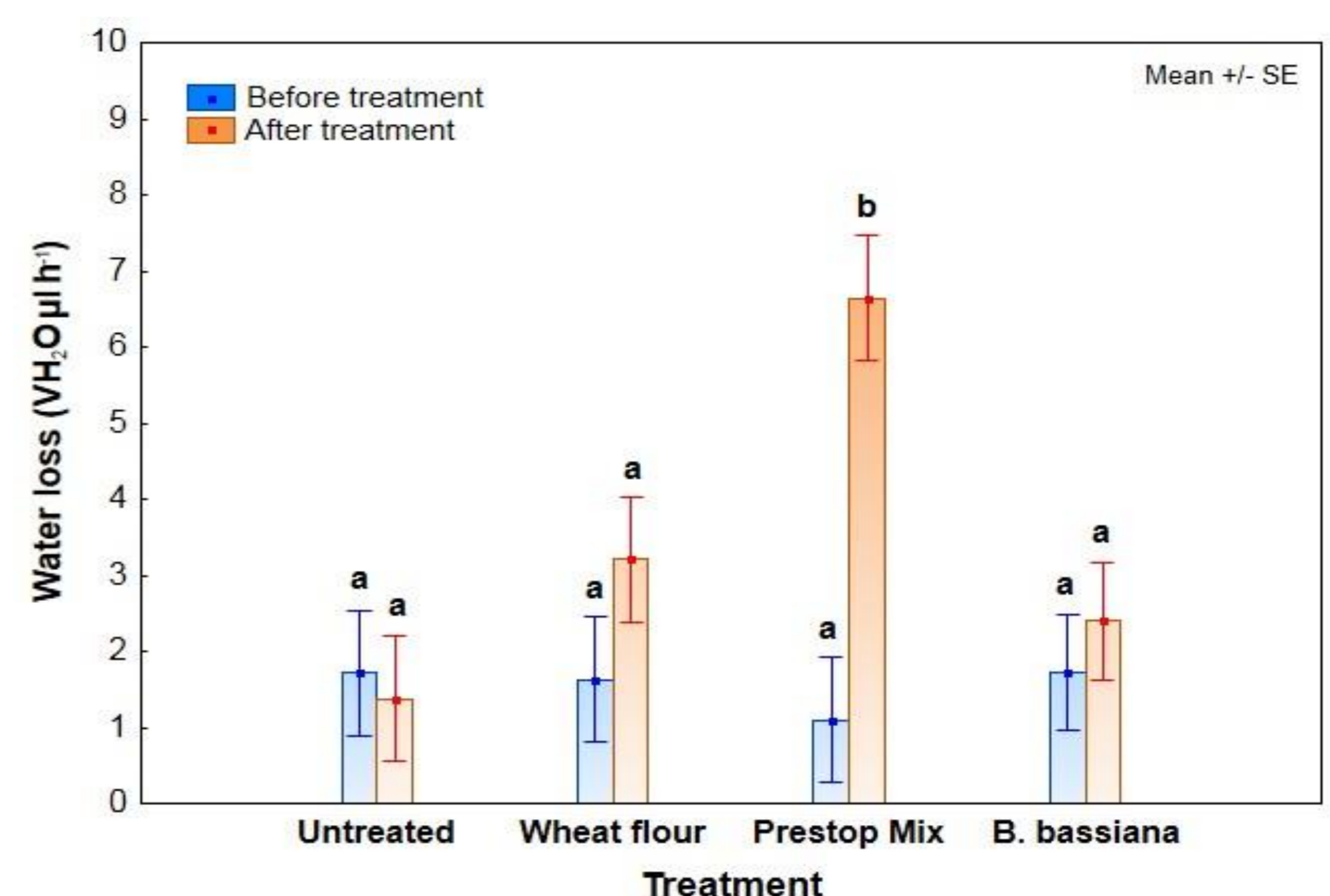


Fig. 2. Effect of different contact treatments on the mean WLR of *B. terrestris* ($F_{(3, 42)}=4,98$). Different letters denote a difference level of $p<0,05$.

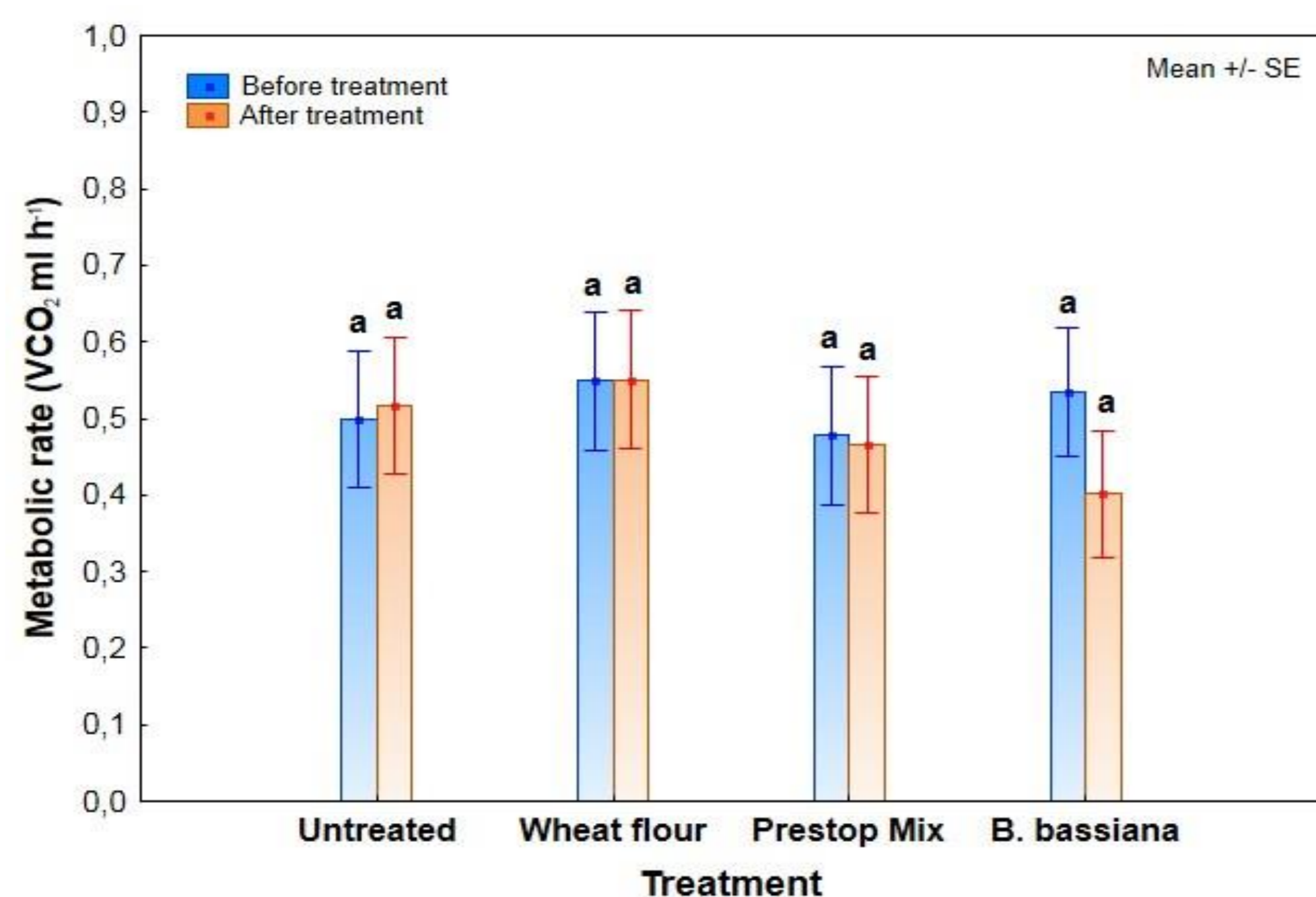


Fig. 1. Effect of different contact treatments on the mean MR of *B. terrestris* ($F_{(3, 42)}=0,33$).

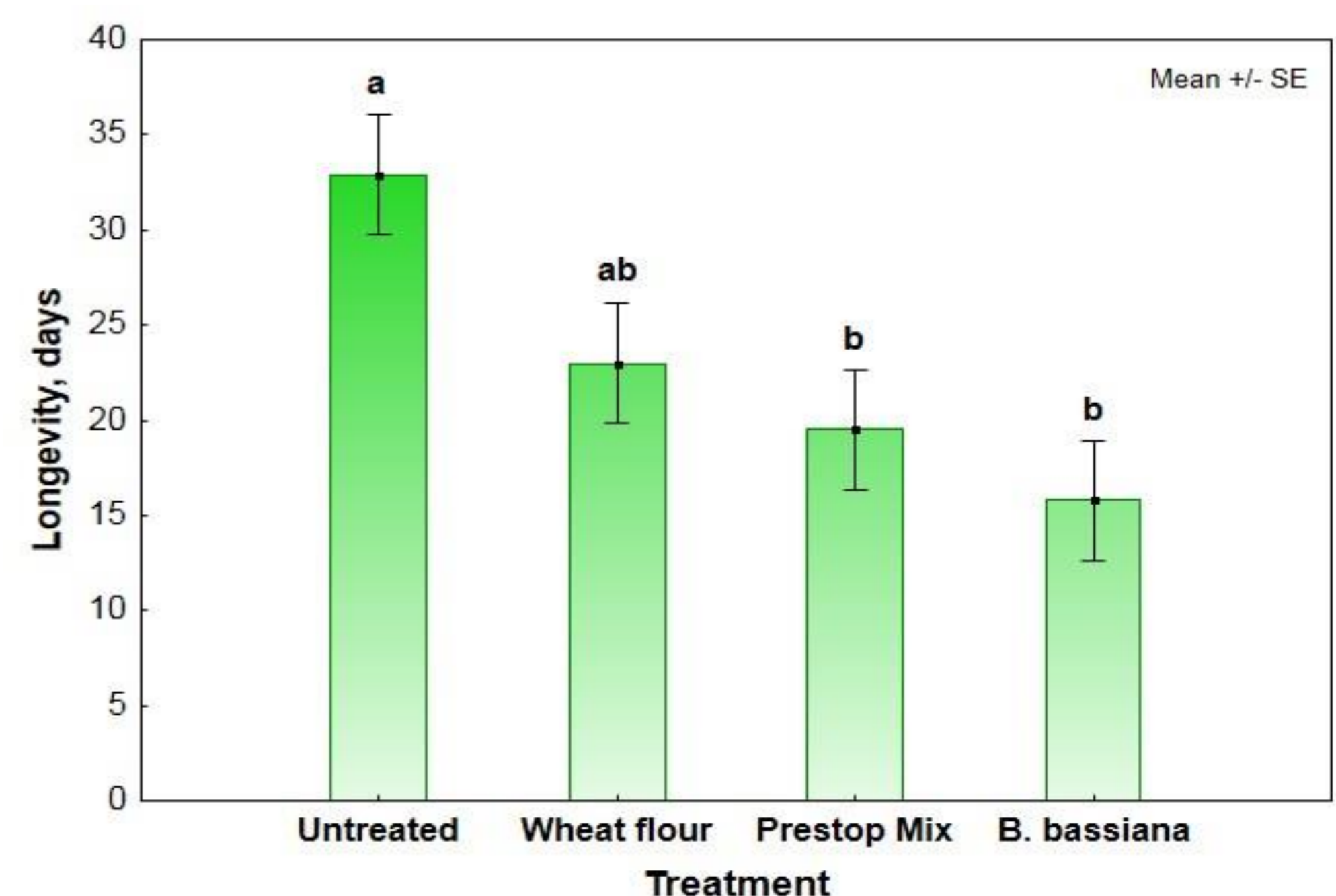


Fig. 3. Effect of different contact treatments on longevity of *B. terrestris* ($F_{(3, 36)}=5,40$). Different letters denote a difference level of $p<0,05$.

CONCLUSIONS

Prestop Mix cannot be considered completely safe for bumblebees: dermal contact with the biofungicide may significantly increase water loss and shorten the lifespan of foragers. The detrimental effect of Prestop Mix may not result from the fungus itself; it could rather be the effect of carrier substances in the biopreparation powder, which could absorb the lipid layer of the insect cuticle, leading to increased WLR. Excessive water loss can be very hazardous on hot summer days, if foragers are not able to regulate water loss and may die because of desiccation.