Research on the control effect of *Beauveria bassian* in common pests in frigid region

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Abstract: Study on the control effect of ***B. bassiana*** on 4 kinds of pests of conservatory pests in frigid region. The content of ***B. bassiana*** was measured by plate counting method. ***B. bassiana*** was prepared into 5 concentrations of fungal suspension, named as G_1 to G_5, and LD_{50} lethal dose for experimental measurement standard, selecting median lethal concentration.The results showed that ***B. bassiana*** had significant effect on the death of 4 kinds of pests of conservatory, and G_1 lethal rate was as high as 62%; the lethality of G_3 was 50%; G_5 had the lowest mortality rate that was 34%. Therefore, in the control of pests of conservatory in frigid region, ***B. bassiana***, which was between G_1 and G_5, can be formulated as a biological pesticide for the control of conservatory damage by pests, but taking the control effect and the dosage of biological pesticides and many other factors into account, the experiment proved it was more suitable that concentration of ***B. bassiana*** strain G_3 suspension.

Introduction

Due to the increasing of conservatory planting area in the northeast of the cold region, and the phenomenon of crop continuous cropping is prevalent, the outbreak of crop pests and diseases is increasing[1]. For a long time, the prevention and control of pests and diseases over-reliance on chemical pesticides, resulting in some pest and disease resistance was significantly increased, resulting in a vicious circle[2]. At the same time high chemical pesticide residues to cause harm to human body health, cause serious pollution to the ecological environment, destroy the ecological balance, this a series of problems spurred the search for a friendly to humans and the environment and has good control effect of plant diseases and insect pests prevention and control measures. As an emerging force in crop pest integrated control system, biological pesticides have become more and more prominent in the control of crop diseases and pests[3]. They have the characteristics of low toxicity, high efficiency and low residue, and are not easy to produce pest resistance[4]. ***B. bassiana*** is a more concerned class, its host a wide range of strong pathogenic, with a wide range of biological control[5]. In this paper, the ***B. bassiana*** suspension was prepared as a bio-pesticide by the culture of ***B. bassiana***, and applied to four kinds of common pest parasites in cold conservatory. LD_{50} was used as the experimental standard to obtain the optimal lethal concentration, Provide the experimental basis for B. bassiana as a biological pesticide to control pests and diseases.

Materials and Methods

Powder

B. bassiana strains, Jiangxi Talent Ecology Co., Ltd.

Test insects

Trialeurodes vaporariorum, ***Brevicoryne brassicae***, ***Pieris rapae*** and ***Plutella xylostella*** 4

common conservatory pests were collected at the experimental planting base of vegetables in Jianan Experimental-Farm of Jiamusi University.

Preparation of PDA medium and PBS

PDA medium: 200.0 g / L of potato (peeled), 20.0 g / L of glucose, 20.0 g / L of agar and 1.0 L of distilled water were placed in a 0.1 MPa autoclave, sterilized for 20 min and stored at room temperature; PBS buffer: NaCl 8.00g, KCl 0.20g, Na_2HPO_4 1.44g dissolved in 800mL distilled water, and adjust the pH of the solution to 7.4 with HCl, constant volume to 1.0L, placed in 0.1MPa autoclave, sterilized 20min, stored at room temperature.

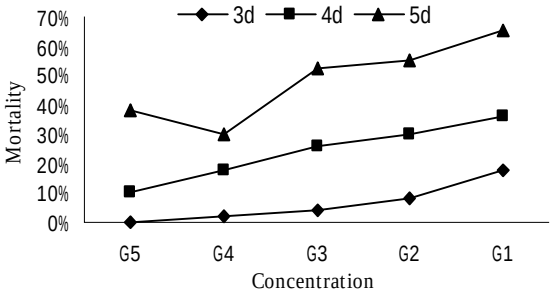

Figure 1. Lethality of Beauveria bassiana suspension to different concentrations of B. tabaci larvae

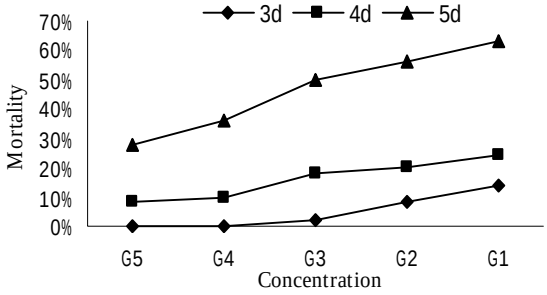

Figure 2. Different concentrations of Beauveria bassiana suspension to Gan Blue-eyed lethality

B. bassiana strain culture

Analytical balance accurately weighed 0.1000g *B. bassiana* powder was dissolved in 10.0mL distilled water and shock 3 min, to obtain a concentration of 1×10^{-2}g / mL bacterial suspension, take 1.0mL 1×10^{-2}g / mL of the bacterial suspension was dissolved in 9.0mL of distilled water and shaken for 3 min to obtain a bacterial suspension having a concentration of 1×10^{-3}g / mL. This step was repeated and diluted to a dilution of 10^{-10}g / mL, 10^{-4}-10^{-10}g / mL dilution of *B. bassiana* suspension, with a sterile pipette suck 100μL bacterial suspension, transferred to PDA medium, and evenly coated with a coating agent in the medium, 27 ℃ constant temperature culture 72h .

B. bassiana suspension preparation

According to the above culture results, it can be calculated that 1.5×10^{11} cfu / g of *B. bassiana* spores are contained in 1.0 g of *B. bassiana* spores and 0.02 g of *B. bassiana* is dissolved in 100 mL of PBS buffer to obtain a concentration. As 3×10^{7} cfu / mL suspension of *B. bassiana*, recorded as G_1; Pipette 10mL G_1 suspension into 90mL of PBS buffer solution to give a concentration of 3×10^{6} cfu / mL suspension of *B. bassiana*, recorded as G_2. The suspension of *B. bassiana* with the concentrations of 3×10^{5} cfu / mL, 3×10^{4} cfu / mL and 3×10^{3} cfu / mL were obtained by the above methods and recorded as G_3, G_4 and G_5 respectively.

B. bassiana control pest detection

The concentration of G_1-G_5 suspension of *B. bassiana* evenly applied to the *Trialeurodes vaporariorum*, *Brevicoryne brassicae*, *Pieris rapae* and *Plutella xylostella* larvae surface and PBS buffer solution instead of *B. bassiana* suspension as control group, 20 groups of experiments, 4 groups of control, observe the number of deaths and deaths and record analysis; all data were treated with SPSS 16.60.

Result analyses

Effect of *B. bassiana* suspension on Trialeurodes vaporariorum

According to the lethal test of *B. bassiana* suspension against *B. tabaci* larvae showed that different concentrations of *B. bassiana* suspension caused different mortality rates to *B. tabaci larva*, the increase of liquid concentration led to the increase of lethality of *T. tabulaeformis* larvae in conservatory. The lethal rates of B. tabaci larvae in G_1 and G_2 were over 50% on the 5th day, that is the lethality at half the lethal concentration and G_3 concentration the lethality of *B. tabaci* larvae on the 5th day was 50% in suspension-infected larvae, while the lethality of *B. tabaci* larvae in G_4 and G_5 suspension did not reach 50%, which was 30% and 38% respectively. Therefore, the G_3 concentration *B. bassiana* suspension is the semi-lethal dose (LD_{50}) for this experiment (Figure 1).

Effect of *B. bassiana* suspension on *Brevicoryne brassicae*

According to *B. bassiana* suspension lethal test on *Brevicoryne brassicae* showed that: Different concentrations of *B. bassiana* suspensions of *Brevicoryne brassicae* lethal rate is different, 1-4d period G_1-G_5 mortality curve is more gentle, from the 5th day, *B. bassiana* lethal to *Brevicoryne brassicae* significantly increased, of which G_1 to *Brevicoryne brassicae* lethal rate as high as 63% G_3 on *Brevicoryne brassicae* lethality was 50%, G_5 *Brevicoryne brassicae* lethality was only 28%. Therefore, the suspension of *B. bassiana* at G3 concentration is the LD_{50} for this experiment (Figure 2).

Effect of *B.bassiana* suspension on Pieris rapae

According to the *B. bassiana* suspension lethal to *Pieris rapae* results show that: *B. bassiana* suspension within 1-4 days had less effect on the mortality of *Pieris rapae*. On the 5th day, the mortality of *B. bassiana* to *Pieris rapae* was significantly higher than that of *Pieris rapae* in the first 4 days, and the mortality of G_1 to *Pieris rapae* was 59%, G_2 bacterial suspension on cabbage worm mortality was 51%, the lethality of G_3 bacterial suspension to *Pieris rapae* was 48%. Therefore, the suspension of *B. bassiana* at both G_2 and G_3 concentrations was the LD_{50} for this experiment (Figure 3).

Effect of *B. bassiana* suspension on *Plutella xylostella*

According to the *B. bassiana* suspension lethal to *Plutella xylostella* results show that: Mortality of *Plutella xylostella* larvae after different concentrations of *B. bassiana* suspension were different, and the lethal effect was obvious on the 5th day, among them, the lethal rate of G_1 to *Plutella xylostella* larvae was as high as 62%, the lethality of G_2 suspension to *Plutella xylostella* larvae was 58%, the lethality of G_3 bacterium to *Plutella xylostella* larva was 51%, The lethality of G_4 suspension to *Plutella xylostella* larvae was 44%, and the lethality of G_5 suspension to *Plutella xylostella* larvae was only 34%. Therefore, the concentration of G_3 concanavalin suspension was the LD_{50} for this experiment (Figure 4).

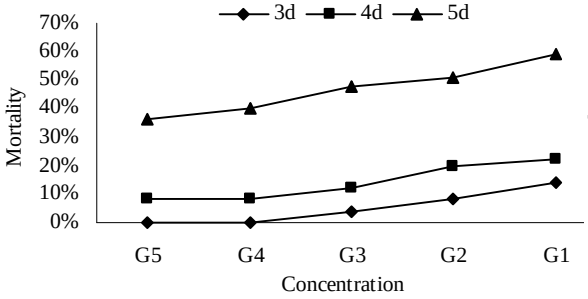

Figure 3. Mortality of cabbionella different concentrations of Beauveria bassiana to Pieris rapae

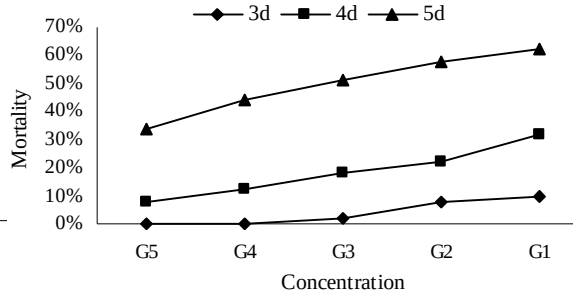

Figure 4. Lethality of Beauveria bassiana suspension to Plutella xylostella larvae at different concentrations

Discussion

B. bassiana suspension in conservatory *Trialeurodes vaporariorum*, *Brevicoryne brassicae*, *Pieris rapae* and *Plutella xylostella* larvae 4 kinds of cold conservatory common pests, have a significant lethal effect. The control group did not find lethal phenomenon. In the prevention and control experiment of conservatory beetle larvae, experimental mortality of G_4 was lower than that of G_5, because non-infected larvae existed in the suspension of *B. bassiana* at G_4 concentration. The experimental data analysis shows that the concentration of *B. bassiana* suspension can be formulated into biopesticide between G_1 and G_5, but taking into account many factors such as control effect and dosage of biological pesticide, etc. They priority should be given to practical application G_3. Since this experiment is done indoors, it has some limitations. Therefore, applying the results of this experiment to conservatory, we need to consider many influencing factors such as temperature and humidity, and conduct concrete multi-faceted studies on the basis of theory. Therefore, in the comprehensive management of conservatory pests, for this aspect of fungal control conservatory pests, this experiment can provide more detailed and accurate experimental basis and technical support.

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