

DEVELOPMENT OF BIOPESTICIDE FOR THE SUPPRESSION OF CABBAGE CATERPILLARS

Yusof Ibrahim and Dzolkhifli Omar Mohammad Matthieu Abdullah,
Faculty of Agriculture
Universiti Putra Malaysia, 43400 UPM, Serdang, Selangor,
Malaysia

Keywords: entomopathogenic fungi, cabbage caterpillars, bioefficacy, formulation, bioinsecticide.

Introduction

Biological controls using entomopathogenic fungi are some of the promising approaches for the control of lepidopterous pests. Wilding (1986) reported that the diamondback moth *Plutella xylostella* was susceptible to strains of several deuteromycetes. Among these are *Beauveria*, *Paecilomyces* and *Metarhizium* which have shown to having wide spectrum of activity against insect pests. In crucifers, *B. bassiana* and *P. fumosoroseus* have been shown to inflict high mortality on diamondback moth. However, the unformulated spores lost infectivity within weeks. Attempts to make dry and oil formulations for ease in application and storage have not met with success. This project attempts to develop and test fungal bioinsecticides for the suppression of cabbage caterpillars in the production of insecticide residue free cabbages.

Materials and Methods

Procurement, isolation and identification of the three major entomopathogenic fungal species were carried out using standard microbiological techniques. An attempt was made to mass-produce these three fungal species using padi grains as substrate. Bioefficacy and potency tests on the three fungal species against three economically important species of cabbage caterpillars were conducted in laboratory bioassays and analysed using probit analysis. Histopathological examinations of infected larvae will be conducted under electron microscopy. Two dry inert materials and palm oil and several of its derivatives were used as carriers or diluents in developing the fungal formulations. The most promising fungus, *P. fumosoroseus*, was used in the test for spore viability in the oil formulations, while two dry formulations and an oil formulation will be tested on cabbages in the field against one of the cabbage caterpillars, *Crocidolomia binotalis*.

Results and Discussion

Three fungal species successfully obtained were *Paecilomyces fumosoroseus*, *Beauveria bassiana* and *Metarhizium anisopliae* var *major*. All were maintained on potato dextrose agar and kept under refrigeration. All species were successfully mass-produced on padi grains under ambient laboratory conditions and 50% wetness (w/w). The conidia were successfully harvested through a wash and suction device consisted of buchner funnel (sieve) and a vacuum pump. Storage

for about one month or longer as dry spores in refrigeration suffered progressive reduction in larval infectivity. Field sprays with spores (*P. fumosoroseus*) stored for one month did not effect satisfactory control, as opposed to fresh spores, against *P. xylostella* under protected cultivation at the OMX organic farm in Kuala Pilah, Negeri Sembilan. Comparison of the bioefficacy (ED_{50}) and potency (LT_{50}) of the three fungal isolates in a series of laboratory bioassays against the cabbage caterpillars *Plutella xylostella*, *Crocidolomia binotalis* and *Hellula undalis* showed that at a dose level of as high as 2×10^7 spores ml^{-1} , all the fungal species were found to be 100% infective on the second instar larvae of all the test insect. These fungi were earlier passaged through *P. xylostella* first and then reisolated as single-spore isolates before carrying out any treatment. Based on the ED_{50} and LT_{50} values, the degree of efficacy of these entomopathogenic fungi against the three insect species was in the order of *P. fumosoroseus* > *B. bassiana* = *M. anisopliae* var. *major*, and all were able to effect 100% larval mortality within three days of post-treatment. It was also observed that the movement and feeding activities were arrested within the first day of infection when the signs of the state of moribund began to manifest. Preliminary laboratory observations made on two dry formulations revealed that both could be used as carriers with the ordinary spray equipment such as the knap-sack sprayer. However, spore viability dropped to less than 50% upon storage at room temperature for one month. Except for the vegetable oil Vesawit®, POME, PKOME, and two long C-chain derivatives (CE1618 and CE1897) were found to be unsuitable as carriers. The POME and PKOME showed very poor spore germination rate while CE1618 and CE1897 did not surpass 50% germination. Only Vesawit® gave over 50% germination, however, the rate dropped to below 50% upon storage for more than one month. Additives such as antioxidant may have to be added to the palm oil in order to improve the duration of spore viability. Outdoor experiment with various spore formulations has yet to be carried out, and tests for suitable application equipment may be conducted once a suitable formulation is found.

Conclusions

All three species of fungal isolates were found to be pathogenic to all the three test species of caterpillars. Larval movement and feeding activities were arrested within the first day of infection. Spore viability progressively diminished upon storage for more than one month. Vesawit® has potential as oil formulation for fungal pathogen.

References

- Wilding, N., 1986. *The pathogens of diamondback moth and their potential for its control - A review*. In Diamondback Moth Management: Proceeding of the First International Workshop (N.S. Talekar and T.D. Griggs, Eds.) p. 219-229, AVRDC, Shanhua, Taiwan. p. 471.