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BIOCONTROL POTENTIAL OF *Metarhizium anisopliae* AND *Beauveria bassiana* AGAINST DIAMONDBACK MOTH, *Plutella xylostella*

Nguyen Thi Loc and Vo Thi Bich Chi
Cuu Long Delta Rice Research Institute, Can Tho, Vietnam

ABSTRACT

The diamond back moth (DBM), Plutella xylostella (L.) (Lepidoptera: Plutellidae) is a serious worldwide pest of cruciferous crops which has developed resistance to all categories of chemical insecticides and to toxins of the bacterium, Bacillus thuringiensis. Potential sources of novel control options for DBM include the use of microbial agents such as entomopathogenic fungi. Studies were conducted on Metarhizium anisopliae and Beauveria bassiana to exploit their potential for controlling the diamondback moth. The results in laboratory and greenhouse showed that all of four selected isolates of M. anisopliae and B. bassiana which have been isolated from different naturally infected insects were found to be pathogenic to the tested DBM. The M.a (OM_3-STO) isolate which was isolated from naturally infected DBM exhibited the highest infectivity to DBM. In the field experiments, all of four selected isolates of M. anisopliae and B. bassiana were found to be effective for controlling the DBM. The efficacy could be seen from 5 DAT. Among them, M.a (OM_3-STO) isolate, which was isolated from naturally infected DBM exhibited highest efficacy for controlling the DBM, next is B.b (OM_2-SDO) and then M.a (OM_1-R). The cauliflower yield of the three above fungal treatments was not significantly different as compared to that of the specific bioinsecticide (Crymax®35WP) treatment. There was 73.2, 68.2 and 66.7 percent increased in cauliflower yield in M.a (OM_3-STO), B.b (OM_2-SDO) and M.a (OM_1-R) treatment, respectively, as compared to untreated control. These results indicated that M.a (OM_3-STO), M.a (OM_1-R) and B.b (OM_2-SDO) have good potential as microbial control agents for diamondback moth of cruciferous crops.

Key words: *Beauveria bassiana*, efficacy, *Metarhizium anisopliae*, pathogenicity, *Plutella xylostella*,

INTRODUCTION

The diamondback moth *Plutella xylostella* L.(DBM) is an important and cosmopolitan pest of cruciferous crops in many parts of the world. DBM has been controlled by various chemical pesticides. In recent years, resistance to most of the conventional insecticides has developed (Sun *et al*. 1986). *Bacillus thuringiensis* is used also to control this pest but there are reports that DBM has developed resistance against the bacteria (Tabashink *et al*.1990). The rapid development of resistance is probably associated with the very rapid reproduction of DBM *i.e.* more than 25 generations per year in the tropics (Keinmeesuke *et al.* 1985). The problems of insecticide resistance as well as the environmental and consumer health hazards associated with insecticide residues in plant material have focused attention on alternative methods for the control of DBM, hence the search for biocontrol agents for incorporation into IPM programmes against this insect is a dire need.

Microbial control aims at biological suppression of insect pests, by the use of entomopathogens like viruses, fungi, bacteria, protozoa and nematodes which usually posses the special features required for implementation of IPM system *viz*., host specificity, high virulence, safety to natural enemies of the target pest and ecologically non-disruptive.

There are approximately 750 species of fungi from 56 genera that infect arthropods. Insect pathogenic fungi are mostly found in the orders Moniliales (Deuteromycotina: Hyphomycetes syn. Deuteromycetes) and the Entomophthorales (Zygomycotina: Zygomycetes). DBM populations are commonly regulated by two entomophthoralean species, *Zoophthora radicans* and *Erynia blunckii*, but are also susceptible to several species of Hyphomycetes, which are not usually found in DBM populations. These include *Beauveria bassiana, Metarhizium anisopliae* and *Paecilomyces fumosoroseus* (Flexner & Belnavis 1998).

Like viruses, entomopathogenic fungi are ubiquitous and in appropriate hosts are capable of natural recycling. Unlike other microbials discussed, they cause infection by direct penetration through the host cuticle without the requirement for ingestion. This is advantageous as it limits the potential for the target to avoid consuming a lethal dose, but it also means that fungi are reliant on appropriate environmental conditions to infect and multiply. Like viruses, speed of kill can be variable and host specificity varies between species and even among isolates of a single species. Hyphomycetes can have broad host ranges in contrast to Entomophthorales, which are usually highly host specific (Pell *et al. 2*001).

The development of fungal entomopathogens as biological control agents has been the subject of considerable research, particularly since the 1970s. However, there are only limited examples of currently available marketed products. Exploitation of fungi, like other microbial agents, has focused on using them in a similar way to conventional insecticides, *i.e.* as an inundative spray application or 'mycoinsecticide' with no requirement for secondary cycling. For example, *Beauveria bassiana* (Mycotrol®) applied to seedlings grown in a nursery was effective at controlling DBM before they were transplanted into the field. In open field trials in the USA, *B. bassiana* significantly reduced the numbers of DBM larvae when used alone and when integrated with *Bt* could control three lepidopteran pests on brassicas (Vandenberg *et al.* 1998). This approach reduces the number of applications of *Bt* and therefore contributes to resistance management.

In Vietnam, Thuy (2001) reported that direct conidial application *B. bassiana* at the dose of $9x10^8$ conidia ml^{-1} gave effective control of DBM 8 days after treatment and recorded 81.25 per cent reduction of DBM.

However, the data of previous study were limited in the greenhouse and to only one isolate of *B. bassiana.* There is much scope for study of various isolates of *M. anisopliae* and *B. bassiana* in controlling the DBM. The present study has been taken up to exploit the biocontrol potential of *Metarhizium anisopliae* and *Beauveria bassiana* against diamondback moth, *Plutella xylostella*.

MATERIALS AND METHODS

Materials

- Equipments for fungal study in laboratory and necessary tools were used in different experiments at laboratory, greenhouse and field.
- Four selected new isolates of *M. anisopliae* and *B. bassiana,* Crymax®35WP and Atabron 5EC as bioinsecticide and chemical control were used.
- Materials for multiplication of different isolates of the *M.a* and *B.b* fungi such as potato, dextrose, agar, rice bran, and corn powder and rice husk were used.

Methods

The pathogenicity tests in the laboratory

The pathogenicity tests with different isolates of *M. anisopliae* and *B. bassiana* against the larvae of DBM were done in laboratory of Biocontrol Department. The larvae of DBM were used for pathogenicity tests. The conidial concentration of different *M. anisopliae* and *B. bassiana* isolates were standardized at 10^7 conidia ml^{-1} with 0.02 percent Tween 80 (R) surfactant. Crymax®35WP concentration

was 0.1 per cent and Atabron 5EC concentration was 0.3 per cent. Thirty-second instar DBM larvae on a young mustard greens leaf in the glass jar were directly sprayed with the above fungal suspension or Crymax® or Atabron solution. The jars were covered with muslin cloth for aeration. Control DBMs were spray with 0.02 percent Tween 80 (R) surfactant. There were four replications. Mortality counts were taken at 3, 5 and 7 days after inoculating. Percent mortality was corrected by a formula as suggested by Abbott (1925).

The pathogenicity tests in the greenhouse

The pathogenicity tests were also done in the greenhouse of Biocontrol Department. The nymphs of DBM were used for pathogenicity tests. The pure fungal culture of each fungal isolate was multiplied on potato-dextrose-agar (PDA) medium for 10 days. Conidia were harvested from the surface of the petri dishes by washing with sterile distilled water containing 0.02 percent Tween 80® surfatant. The conidial suspension was agitated in household mixer for 5 minutes and then filtered through double-layered muslin cloth. Conidial concentration was 10^7 conidia ml^{-1} in the prepared suspension. This suspension was applied directly on the second instar DBM larvae on a potted cauliflower plant by spraying with a sterilized atomiser at the rate of 6 ml per a plant. Control insects were sprayed with 0.02 percent Tween 80® solution (Nguyen thi Loc 1995). Only 30 insects were retained on each potted cauliflower plant in a net cage and the net cage were closed after spraying. There were four replications. The mortality were recorded after 3, 5 and 7 days, the percent mortality of insect were corrected by a formula as suggested by Abbott (1925).

Field efficacy of *M. anisopliae, B. bassiana* isolates against DBM

To confirm the efficacy of some new isolates of *M. anisopliae* and *B. bassiana* against DBM, some field experiments were conducted at Tra Noc ward, Binh Thuy district, Can Tho city during 2005 Spring – Summer season. The experiments were laid out in a randomized complete block design with three replications; the plot size was 30 m^2. The conidial concentration of different fungal isolates was standardized at 10^7conidia ml^{-1} with 0.02 percent Tween 80® solution that was a surfatant. The conidial dose was used 6 x 10^{12} conidia ha^{-1} (Nguyen Thi Loc 1995). The fungal suspension was sprayed with a sprayer. The control plot was not sprayed. Crymax®35WP concentration was 0,1 per cent and Atabron 5EC concentration was 0.3 per cent. The count of live DBM was taken 1 day before treatment and at 3, 5 and 7 days thereafter. Number of live insects in 5 points on two crisscross lines of plot was recorded. For each point, the number of live insects on four cauliflower plants was counted. The average number of live insects per square meter was calculated (Plant Protection Department 2004). The field efficacy of different *M. anisopliae* and *B. bassiana* isolates against DBM were calculated by formula as suggested by Henderson – Tilton. The commodity cauliflower ratio (%) and yield of different treatments were recorded.

The commodity cauliflower ratio (%) = Number of commodity cauliflowers/ total cauliflowers x 100.

RESULTS AND DISCUSSIONS

Infectivity of certain *M. anisopliae, B. bassiana* isolates against DBM

In the laboratory pathogenicity studies, results in table 1 indicated that all of the four different isolates of *M. anisopliae* and *B. bassiana,* which selected in 2005, were found to be pathogenic to the DBM. However, there was a variation in their infectivity against DBM. The mortality (%) of DBM in four fungal treatments ranged from 35.9 to 54.3% at three days after treatment (DAT). The mortality of DBM in *B.b* (OM_2-SDO) treatment was 44.3 % and that of *M.a* (OM_3-STO) treatment was 54.3%, which was not significantly different as compared to that in the bioinsecticide (Crymax®35WP) treatment and chemical control at three DAT. The mortality of DBM in *M.a* (OM_3-STO) treatment was highest as

compared to that of other three fungal treatments and was not significantly different as compared to the mortality of DBM in the chemical control at three DAT. At five DAT, the mortality of DBM in four fungal treatments ranged from 63.8 to 76.9% and *M.a* (OM_3-STO) treatment was highest as compared to other treatments. The mortality of DBM in *B.b* (OM_2-SDO) treatment was 73.9 % and that of *M. a*(OM_3-STO) treatment was 76.9%, which was not significantly different as compared to the mortality of DBM in the bioinsecticide (Crymax®35WP treatment) and was significantly higher as compared to that of chemical control at 5 DAT. The mortality of DBM in four fungal treatments ranged from 71.4 to 87.3% at seven DAT and chemical treatment was lowest as compared to other treatments. The mortality of DBM in *B.b* (OM_2-SDO) treatment was 82.7 % and that of *M.a* (OM_3-STO) treatment was 87.3%, which was not significantly different as compared to that in the bioinsecticide (Crymax®35WP) treatment. The mortality of DBM in *M.a* (OM_3-STO) treatment was the highest as compared to others. These results showed that *M.a*(OM_3-STO) isolate, which was isolated from naturally infected Diamondback moth (DBM) exhibited very high infectivity, which was not significantly different as compared to that of Crymax®35WP at 3, 5 and 7 DAT.

Table 1. Infectivity of certain *M. anisopliae, B. bassiana* isolates against DBM larvae, *Plutella xylostella (*CLRRI Laboratory, 2005*)*

No	Treatment	Concentration	Corrected mortality (%)		
			3 DAT	5 DAT	7 DAT
1	*B.b* (VL_1-SCL)	10^7conidia /ml	35.9 c	63.8 b	71.4 c
2	*B.b* (OM_2-SDO)	10^7conidia /ml	44.3 bc	73.9 a	82.7 ab
3	*M.a* (OM_1-R)	10^7conidia /ml	38.9 c	69.3 ab	79.1 b
4	*M.a*(OM_3-STO)	10^7conidia /ml	54.3 a	76.9 a	87.3 a
5	Crymax®35WP	0.1%	50.5 ab	75.5 a	85.6 ab
6	Atabron 5EC	0.3%	48.8 ab	62.6 b	70.0 c
	CV (%)		12.8	9.2	6.3

Means followed by a common letter are not significantly different at the 5% level by DMRT; DAT: days after treatment

Pathogenicity of M. anisopliae, B.bassiana isolates against DBM

The results in Greenhouse of 2005 also indicated that all of the four selected isolates of *M. anisopliae* and *B. bassiana* were found to be pathogenic to the DBM. A variation in their pathogenicity against DBM was noticed. The mortality (%) of DBM in four fungal treatments ranged from 28.5 to 50.5% at three DAT, 58.2 to 74.7% at five DAT and 67.6 to 80.8% at seven DAT. The mortality of DBM in two fungal treatments as *B.b* (OM_2-SDO) and *M.a*(OM_3-STO) was significantly higher as compared to that in Atabron 5EC treatment and not significantly different to that in the bioinsecticide (Crymax®35WP) treatment at every time of the observation. The mortality of DBM in *M.a* (OM_3-STO) treatment was the highest as compared to that of other three fungal treatments. The mortality of DBM in *B.b* (VL_1-SCL) treatment, which gave lowest mortality among four fungal treatments, was not significantly different as compared to that of Atabron 5EC treatment at three DAT. At five DAT and seven DAT, the mortality of DBM in Atabron 5EC treatment was the lowest as compared to five other treatments (Table 2).

Table 2. Pathogenicity of certain *M. anisopliae, B. bassiana* isolates against DBM larvae, *Plutella xylostella (*CLRRI Greenhouse, 2005*)*

No	Treatment	Concentration	Corrected motality (%)		
			3 DAT	5 DAT	7 DAT
1	*B.b* (VL_1-SCL)	10^7conidia /ml	28.5 b	58.2 cd	67.6 bc
2	*B.b* (OM_2-SDO)	10^7conidia /ml	47.0 a	71.7 ab	79.1 a
3	*M.a* (OM_1-R)	10^7conidia /ml	46.5 a	64.9 bc	73.0 b
4	*M.a*(OM_3-STO)	10^7conidia /ml	50.5 a	74.7 a	80.8 a
5	Crymax®35WP	0.1%	48.0 a	74.2 a	79.7 a
6	Atabron 5EC	0.3%	29.0 b	52.0 d	65.5 c
	CV (%)		19.2	8.0	5.1

Means followed by a common letter are not significantly different at the 5% level by DMRT; DAT: days after treatment

Field efficacy of M. anisopliae, B. bassiana isolates against DBM

Based on successful control of DBM in laboratory and greenhouse, the field experiments were conducted on cauliflower field at Tra Noc ward, Binh Thuy district, Can Tho city during 2005 Spring – Summer to evaluate the efficacy of four selected new isolates of *M. anisopliae* and *B. bassiana* against the DBM.

Because of favourable weather, DBM appear quite early in the cauliflower field, about 15 days after planting. The experiments were conducted on second and third instar nymphs of DBM with average number per m^2 from 75 to 96, which were not significantly different within seven different treatments. The number of DBM per m^2 in six different treatments was gradually reduced after treatment and was significantly lower as compared to untreated control from five DAT. However, there were not significantly different among the number of DBM per m^2 of fungal treatments and that of bioinsecticide (Crymax®35WP) treatment or chemical treatment (table 3).

Table 3. Population density of Diamondback moth larvae, *Plutella xylostella* on experimental cauliflower field at Tra Noc, Can Tho, 2005)

No	Treatment	Average number of DBM per m^2				
		1 DBT	1 DAT	3 DAT	5 DAT	7 DAT
1	*B.b* (VL_1-SCL)	90.0 a	77.6 a	56.4 a	44.0 b	30.4 b
2	*B.b* (OM_2-SDO)	96.4 a	80.8 a	55.2 a	32.8 b	22.4 b
3	*M.a* (OM_1-R)	84.8 a	75.6 a	50.4 a	32.8 b	25.6 b
4	*M.a* (OM_3-STO)	94.8 a	77.2 a	46.0 a	24.8 b	19.2 b
5	Crymax®35WP	87.2 a	68.4 a	42.4 a	26.4 b	20.0 b
6	Atabron 5EC	80.4 a	71.6 a	56.4 a	41.6 b	32.8 b
7	Đối chứng	75.6 a	75.2 a	76.4 a	75.6 a	72.4 a
	CV (%)	18.9 a	22.6 a	23.4a	28.5	35.1

Means followed by a common letter are not significantly different at the 5% level by DMRT; *DBT: days before treatment; DAT: days after treatment*

The results of field experiments at Tra Noc, Binh Thuy, Can Tho during 2005 Spring-Summer (table 4) indicated that all of the four selected different isolates of *M. anisopliae* and *B. bassiana* were found to be effective for controlling the DBM. The corrected mortality (%) of DBM in four fungal treatments ranged from 38.6 to 52.4% at three days after treatment (DAT). The mortality of DBM in *B.b* (OM_2-SDO)

treatment was 43.2 % and that of *M.a*(OM_3-STO) treatment was 52.4% which were not significantly different as compared to that in the bioinsecticide (Crymax®35WP) treatment (53.5 %), but they were significantly higher as compared to that in Atabron 5EC treatment (30%) at three DAT. The mortality of DBM in *M.a* (OM_3-STO) treatment was the highest as compared to that of other three fungal treatments. At five DAT, the mortality of DBM in four fungal treatments ranged from 51 to 74.2% and *M.a* (OM_3-STO) treatment was the highest as compared to other treatments. Except *B.b* (VL_1-SCL) treatment, the mortality of DBM in all of other three fungal treatment was not significantly different to that in the bioinsecticide treatment (70%), but they were significantly higher as compared to that in Atabron 5EC treaetment at five DAT. The mortality of DBM in four fungal treatments reached to its peak at seven DAT and ranged from 64.3 to 78.5%. The mortality of DBM in *M.a* (OM_3-STO) treatment was the highest as compared to others in all the time of observation. These result showed that *M.a* (OM_3-STO) isolate, which was isolated from naturally, infected Diamondback moth (DBM) exhibited very high efficacy for controlling the DBM.

Table 4. Field efficacy of certain *M. anisopliae* and *B. bassiana* isolates against DBM larvae, *Plutella xylostella* (Binh Thuy, Can Tho, 2005)

No	Treatment	Concentration	Corrected mortality (%)		
			3 DAT	5 DAT	7 DAT
1	*B.b* (VL_1-SCL)	6 x 10^{12}conidia	38.6 cd	51.0 bc	64.3 bc
2	*B.b* (OM_2-SDO)	6 x 10^{12}conidia	43.2 abc	65.2 ab	75.3 ab
3	*M.a* (OM_1-R)	6 x 10^{12}conidia	39.7 bcd	60.7 ab	67.4 ab
4	*M.a*(OM_3-STO)	6 x 10^{12}conidia	52.4 ab	74.2 a	78.5 a
5	Crymax®35WP	0.1%	53.5 a	70.0 a	76.1 ab
6	Atabron 5EC	0.3%	30.0 d	44.8 c	53.7 c
	CV (%)		16.7	13.2	10.7

Means followed by a common letter are not significantly different at the 5% level by DMRT; *DAT: days after treatment*

According to farmer's experience, each commodity cauliflower should have a weight more than 350 grams, it has a good appearance, without infection by insects. The results in table 5 indicated that the ratio of commodity cauliflower was the lowest in the untreated control (13.3%). Except *B.b* (VL_1-SCL), other three fungal treatments as M.a *(OM_1-R), B.b* (OM_2-SDO) and *M.a* (OM_3-STO) had quite high ratio of commodity cauliflower, they were 83.3, 85.0, and 91.7%, respectively. The commodity cauliflower ratio of the above three treatments was not significantly different as compared to that of specific bioinsecticide (Crymax®35WP) treatment (93.3%) and was significantly higher as compared to that of Atabron 5EC treatment (63.3%) (Table 5).

The highest cauliflower yield was obtained in the specific bioinsecticide (Crymax®35WP) treatment (7.04 t/ha) and the lowest cauliflower yield was in the untreated control treatment (4.03 t/ha). Among four fungal treatments, *M.a* (OM_3-STO) obtained the highest cauliflower yield (6.98 t/ha), followed by *B.b* (OM_2-SDO) (6.78 t/ha) and then *M.a* (OM_1-R) (6.72 t/ha). The cauliflower yield of the three above fungal treatments was not significantly different as compared to that of the specific bioinsecticide (Crymax®35WP) treatment and was significantly higher than Atabron 5EC treatment. There was 73.2, 68.2 and 66.7 percent increased in cauliflower yield in *M.a* (OM_3-STO), *B.b* (OM_2-SDO) and *M.a* (OM_1-R), respectively, as compared to untreated control. *B.b* (VL_1-SCL). They increased 58.1 percent of cauliflower yield as compared to untreated control. There was 74.7 percent increased yield over untreated control, which was observed in specific bioinsecticide (Crymax®35WP) treatment, whereas, there was only 48.1 percent increased yield over untreated control in Atabron 5EC treatment (Table 5).

Table 5: Effect of *M. anisopliae* and *B. bassiana* on ratio of commodity cauliflower and cauliflower yield *(*Binh Thuy – Can Tho, *2005)*

No	Treatment	Ratio of commodity cauliflower (%)	Yield	
			t/ha	Increased over control (%)
1	*B.b* (VL_1-SCL)	68.3 b	6.37 b	58.1
2	*B.b* (OM_2-SDO)	85.0 a	6.78 a	68.2
3	*M.a* (OM_1-R)	83.3 a	6.72 ab	66.7
4	*M.a* (OM_3-STO)	91.7 a	6.98 a	73.2
5	Crymax®35WP	93.3 a	7.04 a	74.7
6	Atabron 5EC	63.3 b	5.97 c	48.1
7	Untreated control	13.3 c	4.03 d	-
	CV (%)	8.4	2.4	-

Means followed by a common letter are not significantly different at the 5% level by DMRT

The results of the field experiments were in accordance with those obtained in laboratory and Greenhouse. The three selected new isolates of *M. anisopliae and B. bassiana* such as *M.a* (OM_3-STO), *B.b* (OM_2-SDO) and *M.a* (OM_1-R) offered very high efficacy in controlling of DBM at the dose of 6×10^{12} conidia /ha and among them, *M.a* (OM_3-STO) was the best. The results of the field experiments showed that Atabron 5EC gave quite low efficacy in controlling of DBM, this indicated that might be DBM has developed resistance against Atabron 5EC.

Ignoffo and Garcia (1985) reported that two cultures of the same insect species obtained from different sources also responded differently to the same fungal biotype. In nature, living organisms, particularly the microbes, undergo selection, recombination and mutation depending upon the ecological situations, which ultimately influence their genetic make up. Sikura and Bevzenco (1972) found variations in toxin production in different strains of *B. bassiana*, which could be correlated with their virulence. In the present investigation, the *M.a* (OM_3-STO) isolate was most infective to DBM which may be due to its origin as this isolate was obtained from naturally infected DBM.

Valda et *al*. 2003 reported that DBM larvae were more susceptible to *M. anisopliae* than to *B. bassiana* and that *M. anisopliae* isolates IPA-207 and ESALQE9 may be valuable component for the integrated management of DBM larvae.

Base on the results presented in the study, we can conclude that *M. anisopliae* isolates: *M.a* (OM_3-STO), *M.a* (OM_1-R) and *B. bassiana* isolate *B.b* (OM_2-SDO) have good potential as microbial control agents for diamondback moth of cruciferous crops. This study suggests that they can become effective components in developing IPM programme for cruciferous crops.

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Tiềm năng của nấm xanh, *Metarhizium anisopliae* và nấm trắng, *Beauveria bassiana* trong phòng trừ sinh học đối với sâu tơ, *Plutella xylostella.*

Sâu tơ, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae) là một loài dịch hại nghiêm trọng trên rau họ thập tự ở khắp nơi trên thế giới. Loài côn trùng này đã phát triển tính kháng với hầu hết các loại thuốc hóa học và độc tố của vi khuẩn *Bacillus thuringiensis*. Hai dòng nấm xanh, *Metarhizium anisopliae* và 2 dòng nấm trắng, *Beauveria bassiana* phân lập từ sâu tơ và vài loài sâu hại khác nhiễm bệnh tự nhiên đã được thử nghiệm hiệu lực trừ sâu tơ hại cải bông (súp lơ) trong các điều kiện khác nhau: phòng thí nghiệm, nhà lưới và ngoài đồng ruộng. Các thí nghiệm trong phòng và nhà lưới cho thấy cả 4 dòng nấm đã lựa chọn đều có khả năng gây bệnh cho sâu tơ. Dòng nấm xanh, *M.a* (OM_3-STO) phân lập từ con sâu tơ nhiễm bệnh tự nhiên biểu hiện khả năng gây bệnh cao nhất đối với sâu tơ. Xử lý nấm xanh và nấm trắng để trừ sâu tơ ngoài đồng ruộng thì kết quả cho thấy cả 2 dòng nấm xanh và 2 dòng nấm trắng đều có hiệu lực phòng trừ sâu tơ. Hiệu lực được thể hiện từ 5 ngày sau khi phun. Trong 4 dòng nấm đã khảo nghiệm thì dòng nấm xanh, *M.a* (OM_3-STO) phân lập từ sâu tơ nhiễm bệnh tự nhiên ngoài đồng ruộng cho hiệu lực trừ sâu tơ cao nhất, kế đến là *B.b* (OM_2-SDO) và sau đó là *M.a* (OM_1-R). Năng suất cải bông của ba nghiệm thức xử lý 3 dòng nấm nói trên không khác biệt có nghĩa so với năng suất cải bông của nghiệm thức sử dụng thuốc sinh học đặc trị (Crymax®35WP). Năng suất cải bông ở 3 nghiệm thức *M.a* (OM_3-STO), *B.b* (OM_2-SDO) và *M.a* (OM_1-R) đã tăng tương ứng với 73,2, 68,2 và 66,7% so với đối chứng không phun thuốc. Hai dòng nấm xanh: *M.a* (OM_3-STO), *M.a* (OM_1-R) và dòng nấm trắng, *B.b* (OM_2-SDO) là các tác nhân phòng trừ sinh học có tiềm năng đối với sâu tơ hại rau họ thập tự tại Đồng bằng sông Cửu Long.