RESEARCH NOTE

POTENTIAL OF *Paecilomyces fumosoroseus* IN CONTROL OF CABBAGE CATERPILLARS

C.KUDAGAMAGE[1], R.S. MUNASINGHE[1], ROHAN RAJAPAKSE[2] AND DISNA RATHNASEKARA[2]

[1]*Division of Entomology, Horticultural Crops Research and Development Institute, Gannoruwa, Peradeniya.*

[2]*Department of Agricultural Biology, University of Ruhuna, Mapalana, Kamburupitiya.*

ABSTRACT

A collection of diseased insect specimens at two locations of cabbage growing areas in Kandy district yielded the isolation of two entomogenus fungi from several insect pest larvae and one of which was *Paecilomyces fumosoroseus*. The media tested for mass production of *Paecilomyces fumosoroseus* were boiled rice, boiled maize, water soaked rice, boiled greengram, boiled Kurakkan and water soaked Kurakkan. The boiled rice was the best medium for mass production and gave a yield of 2.4125 x 10^9 conidia /g at four weeks after inoculation. *P. fumosoroseus* was tested against larvae of *Crocidolomia binotalis* Zeller (Lepidoptera: Piralidae) and *Plutella xylostella* L. (Lepidoptera: Yponomeutidae). The results indicated that concentrations of 1.86 x 10^6 spores/ ml and 1.8625 x 10^5/ ml were effective on *C.binotalis* while innoculum concentrations above 1.8625 x 10^3 spores/ ml were effective on *P. xylostella*.

KEY WORDS: Cabbage caterpillars, Entomopathogens, Microbial control, *Paecilomyces fumosoroseus*.

INTRODUCTION

Cabbage caterpillars, diamond back moth, *Plutella xylostella* (L.), cabbage looper, *Plusia eriosoma* (F.), *Crocidolomia binotalis* Zell., *Prodenia litura* (F.) and *Hellula undalis* (F.) are the main insect pests of cabbage and other crucifers in Sri Lanka (Bandara and Kudagamage, 1991). Several pesticides Chlorofluzuron, Quinalphos, Profenophos have been recommended for the control of cabbage caterpillars in Sri Lanka (Anon, 1990). However misuse of pesticides especially in the form of blanket spraying has become a major problem in intensive small-scale vegetable production (Wijerathna, 1995). Therefore alternative insecticides with favourable properties are required for successful cabbage production. Recently, there has been increased emphasis on the investigation of the use of entomopathogens as a complete or partial alternative to chemical insecticides and there are many commercial preparations available based on bacteria, viruses, fungi, protozoa and nematodes, which show great potential. The largest number of insect pathogenic fungi was in the class Zygomycetes but today the most useful fungi have come from the Deuteromycetes, which contains a large number of insect pathogens (Ferron, 1978) such as, *Beauveria bassiana*, *Metarhizium anisopliae*, *Verticillium lecanii*, *Nomuraea releyi*, *Paecilomyces fumosoroseus*, *P.farinosus*, *Aschersonia* spp, *Hirsutella thompsonii* and *H. citriformis* (Maniania, 1991). Some success has been obtained with

B.bassiana, *M. anisopliae*, *V.lecanii* and *H.thompsonii*, which are registered and marketed as biocontrol insecticides. (Wilding, 1986). There were only few attempts in the past to utilize entomopathogens for the control of insect pest in Sri Lanka. Therefore, the present study was undertaken to investigate the feasibility of using entomopathogenic fungi for the control of cabbage insect pests. The specific objectives were the identification and isolation of entomopathogenic fungi in selected cabbage growing area of Kandy district in Sri Lanka, culture of selected entomopathogenic fungi using inexpensive media and testing efficacy of selected entomopathogenic fungi on cabbage caterpillars.

MATERIALS AND METHODS

Experiment 1-: Isolation, identification and culture of selected entomopathogenic fungi

The collection of diseased insect specimens was carried out at Marassana and Yatawatta in the Kandy district in mid country, Sri Lanka. The entomopathogenic fungi species in samples were identified by the key described by Barnett and Hunter (1972). The growth and mass production of *Paecilomyces fumosoroseus* on different inexpensive media such as rice (boiled), rice (soaked), Kurakkan (boiled), Kurakkan (soaked), greengram (boiled), and maize (boiled) was tested.

Experiment 2-: Testing efficacy of selected entomopathogenic fungi virulent on cabbage caterpillars

This experiment was carried out separately for the two species of cabbage catterpillar larvae, *Plutella xylostella*, and *Crocidolomia binotalis*. Randomized complete block design was used with seven treatments and five replicates. The spore concentrations were 1.8625×10^9, 1.8625×10^8, 1.8625×10^7, 1.8625×10^6 and 1.8625×10^5, 1.8625×10^4, and 1.8625×10^3 spores/ ml. The field-collected larvae of the two species of cabbage caterpillar were reared in the laboratory and 2nd instar larvae were used in the experiment.

Three Cabbage leaf discs of 9 cm diameter were placed in each plastic petri dish lined with moistened filter paper. Five 2nd instar larvae were introduced into each petri dish and inoculated with different concentrations of aqueous suspension of fungal spores. After every twenty-four hour of inoculation, observations were made on mortality and pupation of larvae. The dead larvae were incubated at 25°C and dissected to identify the causes of mortality.

RESULTS AND DISCUSSION

Experiment 1-: Isolation, identification and culture of selected entomopathogenic fungi

Only two species of pathogenic fungi *Penicillium* spp. and *Paecilomyces fumosoroseus* were isolated from cabbage caterpillars in Marassana in Kandy district. *Paecilomyces fumosoroseus* was found to grow successfully on all media tested for the production of this fungus. Boiled rice was the best medium for mass production and optimum conidia production, achieved 4 weeks after inoculation was 2.4×10^9 spores/ g . (Table 1)

Experiment 2-: Testing efficacy of selected entomopathogenic fungi virulent on cabbage caterpillars.

The spore concentration 1.8625×10^9 spores/ ml and 1.8625×10^8 spores/ ml caused significantly higher mortality of *Crocidolomia binotalis* than the other concentrations. (Table 2). The mean LT_{50} for these two

concentrations were 2.6 and 3.8 days. The mortality of larvae of *Plutella xylostella* treated with all concentrations were low at 2nd day after treatment except 1.8625×10^4 spores/ ml. From the 6th day onwards all concentrations caused 100 % mortality (Table 3). Mean LT_{50} for all concentrations were between 2.1-2.9 days. It has been reported that field application of *P.fumosoroseus* resulted in reduction of fall armyworm, *Spodoptera frugiperda* populations on maize (Maniania and Fargues, 1985). *Paecilomyces fumosoroseus* is also used for successful control of peach fruit moth *Carposina hiponensis* (Aizawa, 1982).

Table 1. Conidia yield of *P. fumosoroseus* on different media.

Medium (100g)	Spore count / g Weeks After Inoculation			
	2WAI	4WAI	6WAI	8WAI
Rice (Boiled)	3.5625×10^8	2.4125×10^9	2.03×10^9	1.049×10^9
Rice (Soaked)	1.4375×10^8	5.375×10^8	5.201×10^8	5.01×10^7
Kurakkan (Boiled)	1.8125×10^8	5.239×10^8	4.97×10^8	4.23×10^7
Kurakkan(Soaked)	1.750×10^8	3.8125×10^8	3.07×10^8	2.01×10^6
Greengram(Boiled)	9.375×10^7	2.5625×10^8	2.43×10^8	7.56×10^6
Maize (Boiled)	2.3125×10^8	3.00×10^8	2.81×10^8	2.47×10^6

WAI= Week After Inoculation

Table 2. Mortality of *Crocidolomia binotalis* larvae treated with different concentrations of *P. fumosoroseus*.

Treatment spores/ ml	Mean Mortality %			
	2 DAI	4 DAI	6 DAI	8 DAI
1.8625×10^9	40.00^a	72.00^a	88.00^a	92.00^a
1.8625×10^8	12.00^b	56.00^{ab}	64.00^{ab}	72.00^{ab}
1.8625×10^7	4.00^b	32.00^{bc}	60.00^b	64.00^b
1.8625×10^6	4.00^b	24.00^{cd}	32.00^c	48.00^{bc}
1.8625×10^5	16.00^b	24.00^{cd}	28.00^c	32.00^c
1.8625×10^4	0.00	12.00^{cd}	20.00^{cd}	32.00^c
1.8625×10^3	0.00	12.00^{cd}	24.00^{cd}	24.00^{cd}
Control	0.00	0.00	0.00	0.00

DAI = Day After inoculation

Means followed by the same letter are not significantly different from each other according to LSD test at 5% level.

Table 3. Mortality of *Plutella xylostella* larvae treated with different concentrations of *P. fumosoroseus.*

	Mean Mortality %		
Treatment spores/ ml	2 DAI	4 DAI	6 DAI
1.8625 x 10^9/ml	60.00^a	100.00^a	100.00^a
1.8625 x 10^8/ml	44.00^{abc}	96.00^{ab}	100.00^a
1.8625 x 10^7/ml	40.00^{abc}	92.00^{ab}	100.00^a
1.8625 x 10^6/ml	48.00^{ab}	92.00^{ab}	100.00^a
1.8625 x 10^5/ml	24.00^c	84.00^{bc}	100.00^a
1.8625 x 10^4/ml	40.00^{abc}	64.00^d	99.00^a
1.8625 x 10^3/ml	28.00^{bc}	76.00^{cd}	100.00^a
Control	0.00	0.00	0.00

DAI = Day After inoculation

Means followed by the same letter are not significantly different from each other according to LSD test at 5% level.

REFERENCES

Anon, 1990. Technoguide Department of Agriculture, Peradeniya.

Aizawa, K. 1982. Microbial control of insect pests. *In* Studies in the Agricultural and Food Sciences "Advances in Agricultural Microbiology" pp 704. Oxford and IBH Publishing Co. New Delhi.

Barnett, H.L. and B.B.Hunter. 1972. Illustrated Genera of Imperfect Fungi, pp 241. USA.

Bandara, K.A.N.P. and C. Kudagamage. 1991. Potential of chitin inhibitors and botanical insecticides for the control of cabbage caterpillars. Trop. Agric. Vol. 125-127.

Ferron, P. 1978. Biological control of insect pest by entomogenous fungi . Annu .Rev. Entomol. 23: 409-442.

Maniania, N.K. and J. Fargues. 1985. Susceptibility of the fall armyworm, *Spodoptera frugiperda* to the fungal pathogens *Paecilomyces fumosoroseus* and *Nomuraea rileyi*. Fla.Entomol. 68.

Wijerathne, .M. 1995. Pesticide in vegetable cultivation: Misuse in blanket spraying. Sri Lanka J. Agri. Sci. 32: 81-88.

Wilding, N.(1986). The pathogens of diamond back moth and their potential for its control a review. *In* Diamond back moth management, pp 471. The Asian Vegetable Research and Development Centre, Taiwan.