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Evaluation of mycopathogens against the sweet potato weevil *Cylas formicarius* (F.)

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ABSTRACT

The entomopathogenic fungi *viz., Beauveria bassiana* (Bals.) Vuill., *Metarhizium anisopliae* (Metsch.) Sorokin var. *anisopliae, M. flavoviride* Gams & Rozsypal var. *minus* Rombach, Humber and Roberts., *Verticillium lecanii* Zimm., *Paecilomyces lilacinus* (Thom.) Samson., and *P. fumosoroseus* (Wize) Brown & Smith were pathogenic to the sweet potato weevil *Cylas formicarius* (F.). Among these, the first three mycopathogens, listed above, were highly virulent and *V. lecanii, P. lilacinus* and *P. fumosoroseus* proved to be weak pathogens against this pest. *B. bassiana* was the most effective recording the lowest LC_{50} and LT_{50} values followed by *M. anisopliae* and *M. flavoviride.*

Key Words : *Cylas formicarius* mycopathogens, laboratory evaluation

The sweet potato weevil *Cylas formicarius* (F.) is a cosmopolitan and destructive pest inflicting heavy damage to sweet potatoes in the field and in storage resulting in 5-80 per cent losses (Sutherland, 1986). Because of problems associated with insecticidal control, research was focussed on biological control methods. Under natural conditions, curculionid adults and larvae are attacked mainly by two species of mycopathogens *viz., Beauveria bassiana* (Bals.) Vuill. and *Metarhizium anisopliae* (Metsch.) Sorokin (Zimmermann, 1981, 1984). In India however, there are no reports on studies with entomogenous fungi against *C. formicarius.*

MATERIALS AND METHODS

The six entomopathogenic fungi utilized for the pathogenicity tests were *B. bassiana, M. anisopliae, M. flavoviride* Gams & Rozsypal var. minus Rombach, Humber and Roberts., *Verticillium lecanii* Zimm., *Paecilomyces lilacinus* (Thom.) Samson and *P. fumosoroseus* (Wize) Brown & Smith. All the mycopathogens were grown on standard mycological media. *B. bassiana* was cultured on Sabouraud dextrose agar enriched with 1% yeast extract. Emerson's yeast phosphate soluble starch agar was used for the two species of *Metarhizium,* while potato dextrose agar was used for culturing of *Paecilomyces* species. Conidia were harvested using 0.02% Tween-80^R in distilled water and the spore load adjusted to 10^8 conidia ml^{-1} using an improved Neubaur haemocytometer.

Thirty adult weevils were taken in Petri dishes (15 cm) and sprayed with 7 ml of the spore suspension with an atomizer. After two minutes, the treated weevils were transferred to test tubes (15x3 cm) containing a few sweet potato pieces and a vine, as feed for the weevils. The test tubes were closed with muslin cloth. Each treatment was replicated thrice. Control insects were sprayed with Tween-80^R (0.02%) alone. Observation on the mortality was recorded every six hours for seven days.

The three mycopathogens found to be highly virulent in the pathogenicity tests *viz., B. bassiana, M. anisopliae* and *M. flavoviride* were used for further bioassay tests. Spore concentrations of 10^8 through 10^4, for each fungus were prepared and bioassayed against the weevils. Thirty insects were used for each treatment and there were three replications. Observations on the mortality were recorded every six hours for seven days. For determination of LT_{50} of the fungal pathogens, hundred insects were sprayed with a dose of 10^7 conidia

ml^{-1}. Mortality counts were taken at six hour interval upto seven days.

The mortality data were converted to angles and after analysis of variance, the means were separated by Duncan's Multiple Range Test. Dosage and time-mortality responses were subjected to probit analysis (Finney, 1962).

RESULTS AND DISCUSSION

All the six mycopathogens in the present investigation produced mortality confirming their pathogenicity to the sweet potato weevil *C. formicarius*. However, the degree of pathogenicity varied significantly among the mycopathogens tested. *B. bassiana, M. anisopliae* and *M. flavoviride* were highly virulent.

Table 1. Pathogenicity of different fungal pathogens to *Cylas formicarius* adults

Fungus@	Mean per cent mortality
Beauveria bassiana	91.10[a]
Metarhizium anisopliae	71.10[b]
M. flavoviride	62.23[c]
Verticillium lecanii	13.33[d]
Paecilomyces lilacinus	18.90[e]
P. fumosoroseus	16.67[e]

@10^8 conidia ml^{-1}

* Means followed by the same letters do not

Table 2. Probit analysis of dosage-mortality response of *C. formicarius* adults to certain entomogenous fungi

Fungus	Chi^2*(3)	Regression equation	LT_{50} (Conidia ml^{-1}) x 10^4	Fiducial limits (95%) x 10^4
B. bassiana	0.29	Y = 2.54049 + 0.59748x	1.30	0.84 -2.03
M. anisopliae	0.84	Y = 1.57353 + 0.738412x	4.36	3.26 -5.84
M. flavoviride	0.08	Y = 1.50781 + 0.69823x	10.03	7.62 13.20

* All lines significantly a good fit (P<0.05)

There were significant differences between *B. bassiana, M. anisopliae* and *M. flavoviride* with respect to mortality. *V. lecanii, P. lilacinus* and *P. fumosoroseus* caused significantly low mortalities. There was no significant difference in mortality between the two species of the genus *Paecilomyces,* while *V. lecanii* caused the lowest mortality (Table 1).

Probit analysis of the mortality data indicated that *B. bassiana* was the most effective mycopathogen recording the lowest LC_{50} and LT_{50} values followed by *M. anisopliae* and *M. flavoviride* (Table 2,3).

Diaz and Grillo (1986) reported 90-100% mortality of sweet potato weevil within 5-8

Table 3. Probit analysis of time-mortality response of *C. formicarius* adults to certain mycopathogens at a dose of 10^7 conidia ml^{-1}

Fungus	Chi^2* (3)	Regression equation	LT_{50} (Conidia ml^{-1}) x 10^4	Fiducial limits (95%) x 10^4
B. bassiana	1.58	Y = 4.74029x - 18.33436	83.66	80.81 -86.62
M. anisopliae	1.16	Y = 3.97130x - 14.91224	103.28	99.08 107.65
M. flavoviride	2.43	Y = 5.38257 - 22.50529	128.84	124.96 132.84

* All lines significantly a good fit (P<0.05)

days due to *B. bassiana*. Castinerias *et al.* (1986a), while testing the virulence of four strains of *B. bassiana* recorded mortality upto 47.51 per cent. Further, a mortality range of 44.2 - 50 per cent of sweet potato weevil with three strains of *M. anisopliae* was also reported (Castinerias *et al.*, 1986b). Comprehensive green house experiments with these two fungi against another weevil *Sitona lineatus* (L.) were highly successful (Muller-Kogler and Stein, 1970, 1976). On different potted plants, a prophylactic treatment with a spore suspension of *M. anisopliae* resulted in 80-100% control (Prado, 1980; Zimmermann 1981, 1984). Recently, *B. bassiana* and *M. anisopliae* have also gained considerable attention as potential biological control agents for the pecan weevil *Curculio caryae* (L.) (Gottwald and Tedders, 1983). The authors consider *B. bassiana* as the most potential mycopathogen for the microbial control of *C. formicarius*.

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