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Efficacy of Entomopathogenic Fungus *Fusarium pallidoroseum* (Cooke) Sacc. Against Gypsy Moth (*Lymantria obfuscata* Walker)

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Abstract: *Fusarium pallidoroseum* isolated locally from cadaver of *Lymantria obfuscata* was evaluated as bio-control agent against caterpillars of same pest at concentrations of 1×10^{10}, 1×10^{9}, 1×10^{8}, 1×10^{7}, 1×10^{6}, 1×10^{5}, 1×10^{4}, 1×10^{3}, 1×10^{2} and 1×10^{1} spores mL^{-1}. No mortality was observed up to 3rd day of inoculation. 1×10^{10} spores mL^{-1} was the most promising concentration as it inflicted an initial mortality of 43% on the 4th day and cent percent mortality on the 9th day. The LC_{50} values ranged from 1.969×10^{3} (16th day) to 1.256×10^{11} (4th day). A linear positive association was observed between mortality and days of observation.

Key words: *Fusarium pallidoroseum*, susceptibility, *Lymantria obfuscata*

INTRODUCTION

The gypsy moth, *Lymantria dispar* (L.), is a highly destructive forest pest with a wide host range (Liebhold *et al*., 1995). Evidence indicates that infestation area and host range of *Lymantria obfuscata* Walker has increased tremendously in Kashmir Valley of Jammu and Kashmir State, posing a serious threat to horticulture industry (Masoodi *et al*., 1990). The pest has also emerged as serious defoliator of some other economically important trees like poplar (*Populus deltoides*) and Willows (*Salix purpurca*). Use of sex pheromone traps in controlling this leaf defoliator has been reported by Beroze *et al*. (1973), Punjabi *et al*. (1974) and Masoodi *et al*. (1990). However, use of persistent pesticides is still the only reliable and practical option to control this pest. There is a renewed interest in the adoption of alternative management strategies for this pest, as the deleterious effects of pesticides are well known now. Biological control is one of the promising methods of pest control and constitutes an eco-friendly alternative strategy. Among entomopathogens, fungi are important, as they are virulent, infect insect by contact, persist in the environment for a long time and have one of the largest host list. The present study was, therefore, undertaken to explore the possibility and effectiveness of *Fusarium pallidoroseum* (isolated locally from dead caterpillars) as a biocontrol agent against gypsy moth (*Lymantria obfuscata*).

MATERIALS AND METHODS

The present studies were carried at Division of Plant Pathology, (Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir) Shalimar campus during spring (April-May) seasons of 2004-2006. The test fungus (*Fusarium pallidoroseum*) was isolated from dead caterpillars of *Lymantria obfuscata* collected during heavy infestation of *Populus deltoids* by this pest at Sanatnagar

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Srinagar Kashmir. The fungus was cultured on Richards agar medium and test spore concentrations (1×10^{10}, 1×10^{9}, 1×10^{8}, 1×10^{7}, 1×10^{6}, 1×10^{5}, 1×10^{4}, 1×10^{3}, $1x\times10^{2}$ and 1×10^{1}) were prepared in double distilled sterilized water with the help of haemocytometer. The freshly hatched healthy populations of pest were collected from infested poplar plantation, mixed together and reared on host leaves. The caterpillars were used after 2nd week of collection for evaluation against test fungus. For each treatment three replications were run and each replication was consisting of 100 caterpillars. Caterpillars of each replicate was inoculated by spraying with 30 mL spore suspension of test concentration. The control was run to rule out any natural infection. Mortality was recorded after every twenty four hours.

For working mortality percentage, mortalities were converted to correct per cent mortalities for control by Abbott's (1925) formulae. The data thus obtained were subjected to probit regression analysis by the method of Finney (1952) and LC_{50} values were worked out.

RESULTS AND DISCUSSION

The results (Table 1) indicated that there was a linear association between probit mortality and log concentration (spores mL^{-1}). Chi-square of each test day indicated good fit of points about the lines at 0.05% level of significance. The LC 50 ranged from 1.969×10^{3} (16th day) to 1.256×10^{11} (4th day). A perusal of Table 2 indicated that *Fusarium pallidoroseum* inflicted an initial mortality of 43% at the highest concentration of 1×10^{10} spores mL^{-1} on the fourth day. This was closely followed by next highest concentration (1×10^{9} spores mL^{-1}) with a mortality of 40%. The lowest concentration (1×10^{1} spores mL^{-1}) was effective in causing mortality of 7% on 6th day. Cent percent mortality

Table 1: Dose-mortality response of *Fusarium pallidoroseum* against *Lymantria obfuscata*

Days	Regression equation (Y = a + bx)	χ^2 value	LC_{50} (spores mL^{-1})	Fiducial limits (spores mL^{-1})
4th	-2.53+0.250x	6.055	1.256×10^{11}	7.275^{11}-3.282^{10}
5th	-2.14+0.245x	15.930*	5.225×10^{9}	5.122^{10}-1.003^{9}
6th	-1.77+0.233x	7.458	3.968×10^{8}	1.152^{9}-1.569^{8}
7th	-1.61+0.227x	7.705	1.221×10^{8}	3.367^{8}-4.733^{7}
8th	-1.48+0.243x	7.010	1.241×10^{7}	2.885^{7}-5.559^{6}
9th	-1.51+0.289x	17.510*	1.621×10^{6}	5.518^{6}-4.663^{5}
10th	-1.46+0.310x	8.289	5.095×10^{4}	9.874^{5}-2.568^{5}
11th	-1.54+0.346x	9.125	3.009×10^{4}	5.560^{5}-1.591^{5}
12th	-1.58+0.371x	14.513	1.805×10^{4}	4.572^{5}-6.699^{4}
13th	-1.67+0.427x	13.889	8.170×10^{3}	1.887^{5}-3.347^{4}
14th	-1.73+0.465x	15.416	5.249×10^{3}	1.215^{5}-2.142^{4}
15th	-1.91+0.551x	31.677*	2.913×10^{3}	8.806^{4}-8.890^{3}
16th	-1.82+0.553x	24.871*	1.969×10^{3}	5.233^{4}-6.827^{3}

*: Indicate heterogencity at p = 0.05, **: Fiducial limit at 0.95 confidence interval

Table 2: Cumulative per cent mortality of *Lymantria obfuscata* at different days at different concentrations

Treatment (concentration spores mL^{-1})	Cumulative mortality (%) at different days												
	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th
1×10^{10}	43	60	77	80	87	100	100	100	100	100	100	100	100
1×10^{9}	40	53	60	63	73	87	90	97	100	100	100	100	100
1×10^{8}	37	53	57	60	73	77	83	87	93	100	100	100	100
1×10^{7}	23	30	37	40	53	63	73	77	77	87	97	100	100
1×10^{6}	13	20	33	40	43	53	63	67	67	80	83	100	100
1×10^{5}	10	17	30	37	40	43	53	57	57	63	63	67	73
1×10^{4}	7	10	17	23	30	33	37	37	40	43	47	50	53
1×10^{3}	3	10	13	20	27	33	33	33	37	40	43	43	47
1×10^{2}	3	10	13	13	17	20	23	23	23	23	23	23	27
1×10^{1}	0	0	07	10	10	13	13	13	13	13	13	13	13

at the highest concentration (1×10^{10} spores mL^{-1}) was recorded on 9th day followed by 1×10^{9} spores mL^{-1} and 1×10^{8} spores mL^{-1} which inflicted cent per cent mortality on 12th and 13th day, respectively.

Comparatively medium concentrations of 1×10^{7} and 1×10^{6} spores mL^{-1} were also effective in complete annihilation of target organism on 15th day. In general an increasing trend in mortality was observed with advancement of time with most concentrations, which indicated that there was a linear positive association between mortality and days of observation. An increase in mortality with increase in doze of inoculum in the present study is in conformity with findings of Mohi-ud-din *et al*. (2007) in case of *Beauveria bassiana* against white grub (*Holotricha* sp.). Gupta *et al*. (1991) also isolated beauvertcin as an insect toxin from *Fusarium semitectum* (Syn. *F. pallidoroseum*) and reported that ethylene chloride soluble extract from the mycelium of *F. pallidoroseum* showed toxicity against Colorado potato beetle (*Leptinotarsa decemlineata coleopteran*) in a foliar spray assay. It is cytotoxic as reported by Grove and pople (1980) and possess some insecticidal properties against mosquito larvae and blowfly. The first reported isolation of beauvercin from the genus *Fusarium*, *F. monoliforme* which is known to produce the mycotoxins fumonisins, monoliformin (Wiebe and Bjeldanes, 1981) fusarin (Cole *et al*., 1973). The present study indicated the effectiveness of entomopathogenic fungus, *F. pallidoroseum* as a bio control agent against gypsy moth (*Lymantria obfuscata*) as it inflicted initial mortality of 43% on the 4th day and lead to complete annihilation of target pest on the 9th day of application at a concentration of 1×10^{10} spores mL^{-1}. Strategies for the use of entomopathogenic organisms for insect control are basically the same as that for other biological control agents. They may be used to augment naturally occurring pathogens (augmentation), conserved or activated in nature (conservation), introduced into pest populations as classical biological control agents to become established and exert long-term regulation of the pest or are used for rapid short-term control.

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