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PATHOGENICITY OF Fusarium subglutinans TO SUGARCANE SCALE INSECT, Melanaspis glomerata (Green)

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ABSTRACT

The fungus *Fusarium subglutinans* isolated from an unknown forest scale insect was pathogenic to sugarcane scale insect, *Melanaspis glomerata* (Green). Under laboratory conditions, first and second instar nymphs were more susceptible to the fungus than third and fourth instar nymphs and adults. The fungus when sprayed at higher dosage of 10^7 to 10^9 spores/ml caused about 60.0 per cent mortality of first and second instar nymphs. Mortality ranged from 36.7 to 53.7 and 48.5 to 54.9 per cent at 10^3 to 10^5 spores/ml in first and second instars respectively. Temperature regimes of 15-20°C and relative humidity of 90-95 per cent appeared to be favourable for the fungus fo cause high mortality of the host. Increase in temperature above 25°C and decrease in relative humidity below 85 per cent showed decreasing trend in mortality.

Key words : *Fusarium subglutinans, Melanaspis glomerata,* Pathogenicity.

Among the different sucking pests of sugarcane, the black scale insect, *Melanaspis glomerata* (Green) is one of the most harmful. The pest was considered to be of minor importance until 1951 (Rao, 1951), but currently, scale insect epidemics are of common occurrence in several states of the country posing a serious threat to sugarcane production (Easwaramoorthy and Kurup, 1986). Several attempts have been made in the biological control of scale insect using parasites and predators (Seshagiri Rao, 1975; Raghunath and Krishnamurthy Rao, 1980; Raghunath, 1983; Easwaramoorthy *et al.*, 1983), but no work has been done on the use of pathogenic micro organisms.

Recently, a fungus, *Fusarium subglutinans* infecting scale insect was isolated from an unknown forest scale insect (Easwaramoorthy and Santhalakshmi - Unpubl.). In the present study, the dosage mortality response of the fungus in different stages of scale insect and influence of temperature and relative humidity on its pathogenicity were studied.

MATERIALS AND METHODS

Fungus culture: Stock culture of *F. subglutinans* was maintained on Czapek-dox agar medium and subcultured at an interval of one month. For pathogenicity studies, the pathogen was mass multiplied on moist sterile sorghum grains (100 g in 250 ml Ehrlenmeyer flask). Three week's old culture was used in all the experiments, by which time the fungus sporulated abundantly.

Multiplication of scale insect: Scale insects colonized on sugar-

cane pieces (variety CoC 671) as per the techniques described by Rao (1983) were used for the study.

Pathogenicity studies: Suspensions of fungus having concentrations of 10^3, 10^4, 10^5, 10^6, 10^7, 10^8, and 10^9 spores/ml were prepared out of fungus grown on moist sterile, sorghum grains by using Neubauer double ruled haemocytometer. Each of the above concentrations along with 0.05 per cent teepol was used against different stages of scale insect. Before treatment, initial count on number of scale insects of concerned instar and adults in a single internode was recorded. Treated cane pieces were planted in plastic trays and mortality counts were recorded 10 days after treatment.

Effect of temperature and relative humidity: First instar nymphs were treated with fungal spore suspension at 10^4 and 10^8 spores/ml along with teepol 0.05 per cent. Treated cane pieces were planted in plastic trays and placed for one week at 15, 20, 25, 30 and 35 C°. After the incubation period, mortality count was recorded.

Four different relative humidity levels *viz.*, 80, 85, 90 and 95 per cent were maintained at 20°C using salt solutions following the method of Wal stad *et al.* (1970). Sugarcane pieces containing first instar nymphs were treated with the fungus at 10^4 and 10^8 spores/ml along with teepol 0.05 per cent and incubated at different humidity levels for a week. Mortality count was recorded and analysed statistically.

RESULTS AND DISCUSSION

The differences in the susceptibility of different stages of scale insects to the fungus was found to be highly significant (Table 1). Maximum per cent mortality was observed in second instar stage (54.3%) followed by first

Table-1: Effect of *F. subglutinans* on the mortality of various stages of scale insect (Mean of 3 observations)

Dosages (spores/ml)	% mortality					Mean of dosages
	I instar	II instar	III instar	IV instar	Adult	
10^3	36.7(36.6)	48.5(44.1)	16.0(23.5)	9.6(17.4)	10.1(18.4)	24.2(28.0)
10^4	46.8(43.2)	57.8(46.1)	16.8(22.7)	12.7(20.8)	11.5(19.8)	27.7(30.5)
10^5	49.2(46.5)	51.8(46.1)	19.7(26.3)	14.0(21.5)	17.0(24.3)	30.3(32.9)
10^6	53.7(47.2)	55.0(47.9)	21.0(27.1)	17.5(24.7)	15.2(22.8)	32.5(33.9)
10^7	59.2(50.3)	53.8(47.2)	22.2(27.9)	17.8(24.8)	24.4(29.5)	35.5(35.9)
10^8	59.3(50.5)	58.5(49.9)	21.7(27.6)	24.6(29.5)	34.6(36.0)	36.7(38.7)
10^9	59.4(50.6)	60 8(51.3)	31.5(34.0)	26.6(31.0)	37.2(37.6)	43.1(40.9)
Mean of stages	52.1(46.4)	54.3(47.5)	21.1(27.0)	17.5(24.2)	21.4(26.9)	33.3(34.4)

(Figures in parentheses are arc sine $\sqrt{\text{percentage}}$ values)

C.D. (P=0.05)

Stages	3.5
Dosages	4.1
Interaction	NS

instar (52.1%). However, the differences were not significant. When all the dosages were considered together, mortality of third and fourth instar nymphs and adults ranged from 17.5 to 21.4 per cent only.

Treatment differences were also found to be highly significant. The dosage with 10^9 spores/ml was found to be more effective and caused 43.1 per cent mortality followed by 10^8 spores/ml (39.7%) while 10^3 spores/ml was least effective.

This clearly shows that the rate of mortality was directly proportional to the dosage of the fungus and susceptibility of scale insect to the fungus decreased with increase in age of the pest. Earlier, Walstad and Anderson (1971) reported that mortality was a function of the quantity of inoculum applied. Kuruvilla and Jacob (1979) reported that first and second instar nymphs of brown plant hopper of rice, ***Nilaparvatha lugens*** (Stal.) were more susceptible to attack by ***Fusarium oxysporum*** than third, fourth and fifth instar nymphs and adults. Nagalingam (1983) reported that ***Fusarium semitectum*** was more effective at higher concentrations than at lower concentrations against green peach aphid, ***Myzuz persicae*** (Sulz.)

Significant differences in mortality of first instar nymph were observed when the nymphs were placed at varying levels of temperatures after fungus treatment. Among the incubation temperatures tested, mortality was found to be higher at low temperatures and it increased with increse in temperature (Table 2). The per cent mortality observed at 15°C was 71.5 compared to 18.7 at 35°C. Mortality of scale insect was more at higher concentration (10^8 spores/ml) at all the temperatures. However, the differences between the dosages were not significant at 15 and 20°C.

Table 2. Influence of incubation temperature on the pathogenicity of the fungus to the first instar nymphs (Mean of 3 observations)

Temperature (°C)	% mortality		Mean
	10^4 spores/ml	10^8 spores/ml	
15	67.6(58.0)	75.3(60.3)	71.4(59.6)
20	66.8(54.9)	71.4(57.7)	69.1(56.3)
25	47.4(43.5)	62.2(52.1)	54.8(47.8)
30	33.6(35.4)	49.5(44.7)	41.6(40.1)
35	13.8(21.2)	23.6(28.9)	18.7(25.1)
Mean	45.9(42.8)	56.4(48.7)	51.1(45.8)

	CD (P=0.05)
Temperatures	3.5
Dosages	2.7
Temperature x Dosage	6.1

Under different relative humidity levels tested, 90 per cent RH was more congenial to the fungus for inflicting high mortality of scale insect at both the dosages tested followed by 95 per cent. However, the differences between these two levels of RH were not significant (Table 3). Lower mortality of 47.0 and 55.3 per cent was observed at 80 per cent humidity level at low and high

Table 3. Influence of relative humidity (at 20°C) on the pathogenicity of the fungus to first instar nymphs (Mean of 3 observations)

Relative humidity (%)	% mortality		Mean
	10^4 spores/ml	10^8 spores/ml	
80	47.0(43.3)	55.3(40.2)	51.2(46.2)
85	55.2(48.0)	65.6(54.1)	60.4(51.1)
90	63.9(53.1)	70.5(57.1)	67.2(55.1)
95	55.8(48.3)	68.7(56.0)	62.3(52.2)
Mean	55.5(48.2)	65.0(51.9)	60.3(51.2)

	C.D. (P=0.05)
Relative humidity	2.6
Dosages	2.3
Humidity x Dosage	NS

concentrations of spores, respectively. Higher dosage of the fungus (10^8 spores/ml) was found to cause more mortality at all humidity levels compared to lower dosage. Low temperature and high atmospheric humidity are known to favour the development of epizootic mycosis in several fungi. The study clearly showed that temperature regimes of 15–20°C and relative humidity of 90-95 per cent appeared to be favourable for the fungus to cause high mortality.

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