The Relationships between Local Lesion, Local Colonization and Systemic Symptoms of Sorghum Downy Mildew on Sorghum after Inoculation with Conidia

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ABSTRACT

In this particular experiment the percent systemic infection from injection was higher than that from natural infection. The variety Q.L. 3 was free from downy mildew both artificial inoculation and field inoculation. There were relationships between local lesion, local colonization and systemic symptoms after artificial inoculation with conidia by the injection method and the rank value indicated the high relationship to exist between local colonization and systemic infection incidence.

Sorghum plants produce three types of symptom in response to conidial inoculations with sorghum downy mildew pathogen, *Sclerospora sorghi* Weston & Uppal. There are local lesions at the point of inoculum placement, local colonization of tissue around the point of inoculum placement and systemic infection via infection of the growing point. The objective of this experiment was to determine if there were any relationships between the development of these three symptom types on a range of sorghum lines.

The first successful inoculations with conidia were reported by Safeeulla (3). In their study conidia were produced in the laboratory in detached leaf cultures by floating pieces of freshly infected leaves on water surface in Petri dishes, and incubating them at 20 C and below. A thick felt of conidiophores bearing conidia, produced on the leaf surface by this method, was used to inoculate sorghum and maize seedling by brushing them on young leaves.

Jones (2) devised a method of conidial inoculation in which leaf sections were taken from infected plants with sorghum downy mildew and placed on the leaves of sorghum seedlings. When cold night temperature occured, the excised leaf section produced conidia that were deposited on the leaves of seedling.

Schmitt and Freytag (4) recently reported a technique for artificial inoculation of sorghum and corn by spraying with a water suspension of conidia.

Craig (1) examined the efficiency of inoculation methods in the identification of downy mildew resistance with five commercial sorghum hybrids in the greenhouse and in the field. He reported that the correlation between reaction of the resistance of hybrid to conidial inoculation in the greenhouse and field were good, but the less resistant hybrid exhibited much higher level of infection in response to artificial inoculation than those observed in the field. Some varieties resistant in the field were highly susceptible to artificial inoculation. This might indicate that certain type of resistance to downy mildew was circumvented by the artificial inoculation technique.

Materials and Methods

Twenty-five sorghum lines (including the susceptible checks) were planted in the field in a randomized complete block design, with two replications and 20 plants per plot after thinning. An insecticide, Furadan, was applied to the soil before planting and perfospray irrigation was applied daily at 1700 hr. for 30 min. throughout the experiment. In the field inoculation, the same varieties were planted in randomized complete block design, with two replications, and 50 plant per plot after thinning during the rainy season, 1977.

For the artificial inoculation, the inoculum

was prepared by incubating infected leaves at 20 C and harvesting the mature conidia after 8 $\frac{1}{2}$ hrs. A conidial suspension was made in tap water at 30 × 10^4 conidia per ml. Syringe inoculation was done on seedling 5 days after emergence during night from 2000 hr. until 0200 hr. Fresh inoculum was made up after each 30 minutes and needle of the syringe was injected very deep into the whorl of the seedlings.

Field inoculation, the epidermic developed both from overwintering oospores in the soil and from conidia produced on spreader rows which were inoculated by spraying with conidial suspension at the seedling stage. The local lesion incidence was observed 5-7 days after inoculation and the local colonization incidence was observed 10-14 days after inoculation. The systemic infection incidence was observed 14-21 days after inoculation. In the field inoculation, only the percent systemic infection was recorded which was two months after emergence.

Statistical analysis

The correlation among the % local lesion, % local colonization and % systemic infection were calculated all combinations by the formula as follows :

$$r = \frac{EXY}{\sqrt{(EX^2)\ (EY^2)}}$$

r = correlation coefficient
x = dependent variable
y = independent variable

The varieties were devided into three groups based on the percent systemic infection expressed under artificial inoculation. Those three groups are as follows :

Groups I : Resistance, 0 – 17 % systemic infection.

Groups II : Moderate susceptible, 18 – 49 % systemic infection.

Groups III : Highly susceptible, 50 – 8o % systemic infection.

The correlation coefficient was calculated separately in each group also. The relationships between the rank value of four susceptibility characters was calculated by Spearman's coefficient of rank correlation method as the following formula :

$$rs = \frac{1 - 6\ Ei\ di^2}{(n-1)\ (n+1)\ n} \quad \ldots\ldots\ldots 1$$

where rs is Spearman's rank correlation coefficient

n is the number of pairs

di is the difference for the i th pair.

and the significance of correlation were thus :

$$t = rs\sqrt{\frac{n-2}{1-rs^2}} \quad \ldots\ldots\ldots\ldots\ldots 2$$

Results and Discussion

With exception of QL. 3, (see Table 1) which had no local lesion development, all entries had high level of local lesion incidence (47.5-100 %). For 21 entries the incidence of local colonization was greater than the incidence of systemic symptoms and for 22 entries which the incidence of systemic infection from artificial inoculation was greater than the incidence of systemic infection from the natural inoculation. The lower of the

incidence of systemic infection than the incidence of local colonization indicated that one possibly the inoculum had not reached the growing points of some plants which would have developed systemic symptoms.

Table 1. Mean value of percent local lesion, local colonization, systemic infection from artificial inoculation and systemic infection from natural inoculation.

Varieties	% local lesion	% local colonization	% systemic infection	
			Artificial inoculation	Natural inoculation
QL – 3	0	0	0	0
CSV – 4	84.7	34.4	5	5.3
UCHV – 1	47.5	35	12.5	5.2
IS 5273	77.7	46.4	15.5	7.0
IS 173	77.2	51.6	25.8	2.3
IS 2042	92.4	73.0	25.8	2.4
SC – 239 – 14	75.5	56.9	26.9	18.8
UCHV – 2	76.9	55.7	28.2	8.9
SC – 108 – 14	84.7	79.5	28.2	5.4
CSV – 5	53.6	24.4	29.3	7.4
SC – 120 – 14	77.5	72.5	37.5	4.8
IS 2918	92.1	69.1	43.3	21.3
IS 3164	80.7	68.5	43.9	10.1
TAM – 428	100	97.2	45.9	26.2
IS 3799	74.8	64.4	47.2	8.7
TAM – 2566	97.5	92.5	55	14.7
SC – 175 – 14	94.7	84.2	55.3	25.1
SC – 120 – 6 – 88	78.4	62.5	59.0	30.9
SC – 110 – 14	80.5	68.3	60.8	10.4
SC – 414 – 12	87.5	67.5	65	17.3
SC – 173 – 12	97.5	97.5	66.3	20.6
CSV – 2	97.3	97.4	67.5	70.6
NSA – 440 – 12	100	94.3	68.1	44.8
SC – 1706 – 17	89.7	62.1	75.7	14.3
DMS – 652	92.5	75	80	100

Table 2. Correlation coefficient, mean, standard deviation, and significant of correlation coefficient among 25 varieties.

Characters	Local colonization	Systemic inf. (Artifi. Ino.)	Systemic inf. (Natural Ino.)	Mean	S.D.
Local lesion	0.868**	0.636**	0.402*	80.48	21.22
Local colonization	–	0.718**	0.460*	65.18	24.16
Systemic infection (Artificial ino.)	–	–	0.654**	42.70	22.44
Systemic infection (Natural ino.)	–	–	–	19.29	22.81

* Significant at 5% level of probability = 0.396
** significant at 1% level of probability = 0.505

Table 3. Analysis data for rank values using Spearman's coefficient of rank correlation.

Character	Local colonization		Systemic infection	
	rs	t – value	rs	t – value
Local lesion	0.8	7.6	0.6	3.9
Local colonization	–	–	0.9	0.3
Systemic infection	–	–	–	–

t (0.05) = 2.1

From the studying of relationships, (Table 2) the correlation coefficient indicated a high relationship existed between them. This mean we can use this relationship as an indication of the percent systemic infection after inoculation. And we can estimate that the actual percent systemic infection should be higher than percent systemic which expressed in the field condition.

When the rank values are analysed we see (Table 3) that there is a high correlation between rank value for systemic infection and local colonization and there was no consistent relationship to exist between local lesion incidence and incidence of other symptoms. From a study of the rank correlations, we concluded that percent local colonization should be used to a greater extent than local lesion for indicating the percent systemics infection. This is because we got a high correlation between the rank of local colonization and systemic infection from the injection method of inoculation. In addition, it is easier to observed local colonization than local lesion.

Literature Cited

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