

Light Intensity Effects on Lesion Size Caused by *Phytophthora infestans* on Potato Leaves

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ABSTRACT

Leaves of potato plants grown under different light intensities had significant variations in lesion size caused by *P. infestans*. Lesions were larger on plants grown at lower light intensities than on plants grown at higher light intensities.

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Breeding potatoes (*Solanum tuberosum* L.) for resistance to *Phytophthora infestans* (Mont.) de By. is

complicated by environmental factors that affect late blight disease development. There is considerable information on the effects of factors such as temp, moisture, nutrition, and day-length on late blight development in potatoes (3). Little is known about the effect of light intensity on resistance, although there is information on the effect of light on other host-parasite interactions (2, 4). Crosier (1) found plant reaction to infection by *P. infestans* was not altered by different light intensities. We report here the effect of light intensity on general resistance to *P. infestans* in the field and in controlled environment chambers.

MATERIALS AND METHODS.—Potato plants were grown in the field and in 15.2-cm (6-inch) diam pots in controlled environmental chambers. During the field experiment, temp varied from 14-26 C, relative humidity (RH) from 55-95% and day-length averaged 14.3 h. Different levels of light intensity were obtained in the field experiment by using Lumite woven saran shade fabrics (Fabric numbers: 5180102, 30% actual shade; 5180502, 55% actual shade; and 5181702, 80% actual shade, manufactured by Chicopee Manufacturing Co.,

TABLE 1. Size of lesions (mm)² on in situ leaves of potato clones (cultivars) grown in the field under four light intensities after inoculation with zoospores of *Phytophthora infestans*

Clones	0% shade	30% shade	55% shade	80% shade
	in situ leaves ^a	in situ leaves	in situ leaves	in situ leaves
*Ackersegen ^c	10.6 ^b	12.5	15.9	43.4
*Green Mountain ^c	46.8	58.8	64.6	122.4
*Kennebec ^d	1.0	9.4	15.8	25.4
*Katahdin ^c	33.7	101.4	97.5	108.8
*Maritta ^d	1.0	9.6	16.8	24.6
*Sebago ^c	13.0	14.3	14.8	40.7

^aTwenty-one leaflets per plant were inoculated.

^bAverage size of lesion from four plants; five readings taken on each plant on two consecutive days.

^cRace 0 of *P. infestans* was used.

^dRace 1, 4 of *P. infestans* was used.

TABLE 2. Size of lesions (mm²) caused by *Phytophthora infestans* on leaflets of potato clones (cultivars) grown under different light intensities in growth chambers

Clones	Light intensity (ft-c)		
	6,000 ^a	3,000 ^b	1,100 ^b
'Dorita' ^{cc}	4.9 ^d	7.1	23.8
'Elenita' ^{cc}	6.1	23.0	87.5
'Ackersegen' ^{cc}	29.3	60.1	67.9
'Kennebec' ^{cc}	38.9	55.6	65.4
'Katahdin' ^{cc}	70.3	119.5	156.4
'Sebago' ^{cc}	103.7	133.7	149.9

^aISCO plant growth environmental chamber Model E-A, Serial No. 5965.

^bEnvironmental Growth Chambers, Chargin Falls, Ohio.

^cRace 1, 2, 3, 4, of *P. infestans* was used.

^dAverage of five leaves and five leaflets per leaf on two consecutive days.

^eRace 0 of *P. infestans* was used.

Cornelia, Georgia). These fabrics were used on cages 3.8-m long, 2.44-m wide, and 1.5-m high to shade groups of plants. Control plants were not shaded. Environmental conditions in controlled environmental chambers were 21-23 C, 60-64% RH, and 13 h photoperiod of either 11,836, 32,280, or 64,560 lx (1,100, 3,000, or 6,000 ft-c).

Isolates of races 0; 1, 4; and 1, 2, 3, 4 of *P. infestans* were maintained on a susceptible potato cultivars such as 'Katahdin' (Ro) throughout all the experiments. Inoculum suspensions were obtained from infected leaflets previously incubated in petri dish moist chambers for 24 h. At the initiation of each experiment the identity of a race was checked by inoculating detached leaflets of differential clones.

For the field experiment 9- to 10-wk-old potato plants were inoculated by placing 5-mm diam filter paper disks, previously wetted in a suspension of 80,000 sporangia ml, on the under surface of detached leaves or on the upper surface of in situ leaves. Detached leaves from potato plants grown for 6 wk in the controlled climate chambers

were inoculated by applying a drop of inoculum containing 30,000 zoospores/ml on the under surface. Inoculated material was kept in a moist chamber at 20 C and 95-100% RH for 24-48 h.

Lesion size was determined by measuring the length and width measured at right angles on two consecutive days beginning the third day after inoculation. Averages of these measurements were used as an index of lesion size. An analysis of covariance of complete factorials was made in which lesion size was adjusted to leaflet dimensions (length and width).

RESULTS AND DISCUSSION.—The plants grown under the different light intensities differed significantly in many gross characteristics such as plant height, number of shoots, leaf size, etc. The statistical analysis of the light effects showed differences were significant ($P = 0.025$) in both the field and the controlled environment chamber inoculations. Lesions were larger on leaflets from plants grown under low light intensities than from plants grown under high light intensities in both field and controlled environment experiments, Tables 1 and 2. Results were similar on both in situ and detached leaves, however lesion size was larger on detached leaves.

These results indicate that light intensity should be considered when testing potato breeding lines for resistance to *P. infestans*. Plants tested under low light intensities may appear to be more susceptible than they would be in the field, and thus valuable resistant material might be discarded.

LITERATURE CITED

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