Effect of Galactose on Polygalacturonase Production and Pathogenesis by Fusarium oxysporum f. sp. lycopersici

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ABSTRACT

Galactose repressed polygalacturonase synthesis by *Fusarium oxysporum* f. sp. *lycopersici* about 70-85% on a pectin-salts medium. Galactose reduced foliar symptoms of *Fusarium* wilt of tomato about 40% on plants treated 2-3 days after inoculation. Phytopathology 61:242-243.

Several reports suggest that induction or repression of polygalacturonase (PG) during pathogenesis may affect the amount of disease (1, 4, 7, 9). When *Fusarium oxysporum* f. sp. *lycopersici* (Sacc.) Snyd. & Hans. was grown on a pectin medium containing glucose, little or no PG was detected (5, 9, 10). Patil & Dimond (9) found that glucose repressed PG synthesis by *F. oxysporum* f. sp. *lycopersici,* and also reported that applications of glucose to inoculated tomato plants reduced *Fusarium* wilt symptoms. We have previously observed that galactose applied before inoculation reduced *Fusarium* wilt symptoms on tomato plants (Biehn & Dimond, *unpublished data*).

This paper reports the effect of galactose on the in-vitro production of PG by *F. oxysporum* f. sp. *lycopersici,* as well as the curative effect of galactose on *Fusarium* wilt of tomato.

The effect of galactose (0.06 M) on the production of PG by *F. oxysporum* f. sp. *lycopersici* was studied on a pectin (1%)-salts medium (9) adjusted to a pH of 5.0 with 0.1 M NaOH. Galactose was passed through a sterile Millipore filter (0.22 ± 0.02 μ) (Millipore Corp., Bedford, Mass.), then added to the autoclaved pectin-salts medium. Citrus pectin N.F. was purchased from Nutritional Biochemicals Corp., Cleveland, Ohio.

Inoculum was grown on a glucose casamino acids medium (9) and prepared according to the procedure of Patil & Dimond (9). A 1-ml aliquot of a spore suspension containing 5.6×10^6 cells/ml was added to 35 ml of medium in a 250-ml flask. The flasks were incubated on a Gyrotary (New Brunswick) shaker (212 cycles/min) at 22-24 C. Contents were centrifuged, and the solid material was rinsed with deionized water. The combined supernatants were dialyzed overnight against deionized water at about 5 C and assayed for PG activity by a standard viscometric assay (9).

Bonny Best tomato plants were grown and inoculated as previously outlined (2, 3). A galactose solution (5 g/l) containing 20 ppm streptomycin sulfate was applied by subirrigation to tomato plants 2-3 days after root inoculation, and the application continued daily for 6-11 days. Each plant received from 400-450 ml of the galactose solution. Control plants received an equal amount of a solution containing 20 ppm of streptomycin sulfate. Tomato plants were rated for foliar symptoms about 2-2.5 weeks after inoculation as described previously (3).

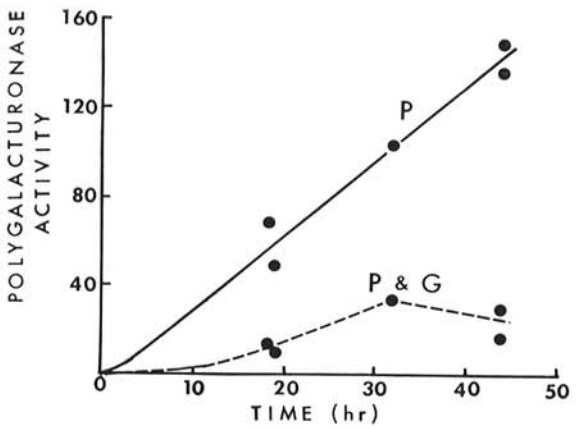

Fig. 1. Synthesis of polygalacturonase by *Fusarium oxysporum* f. sp. *lycopersici* in a pectin (1%)-salts medium in the presence of 0.06 M galactose (P & G) and in the absence of galactose (P) with time. Polygalacturonase activity is expressed as $\frac{1,000}{t}$, where t equals min required for the relative viscosity of the reaction mixture to be reduced by 50%/mg dry wt of mycelium.

We have not found any polygalacturonate *trans*-eliminase activity in culture filtrates of *F. oxysporum* f. sp. *lycopersici.* In addition, galacturonic acid was detected as a reaction product using the chromatographic assay of Page (8). This information confirms the studies of Waggoner & Dimond (10) showing that *F. oxysporum* f. sp. *lycopersici* produces a PG.

The production of PG by *F. oxysporum* f. sp. *lycopersici* was found to be subject to catabolic repression by galactose. PG production per unit mycelial dry wt was reduced about 70-85% when galactose (0.06 M) was present in the pectin (1%)-salts medium (Fig. 1). We also observed that galactose (0.03 M) in the presence of 0.3% pectin reduced PG production about 70-85%. Galactose incubated with the PG of *F. oxysporum* f. sp. *lycopersici* at a final concn of 0.06 M for 2 hr had no effect on its activity. Using an assay based on the loss of wt of cucumber pericarp sections as a measure of PG activity, Mussell (5) and Mussell & Green (6) reported that *F. oxysporum* f. sp. *lycopersici* produced less PG when grown on a modified Czapek-Dox medium plus galactose as compared to a modified Czapek-Dox medium plus polygalacturonic acid or galacturonic acid.

Root feeding of galactose to inoculated tomato plants reduced *Fusarium* wilt symptoms an average of 45% in two experiments. An average of seven replicate plants/treatment were used in each experiment. Control plants had about 85% disease. Tomato plants were also inoculated and supplied with galactose at 5,000 ppm through exposed stem bundles, using the

method of Patil & Dimond (9) except that a string wick was used. In this case, galactose also reduced *Fusarium* wilt symptoms about 40%.

In conclusion, our data suggest that galactose might be reducing the severity of *Fusarium* wilt of tomato by repressing PG synthesis by *F. oxysporum* f. sp. *lycopersici.*

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