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HOW TWO TYPES OF FLUCTUATING TEMPERATURE AFFECT THE GROWTH OF *FUSARIUM SOLANI*

Abstract.—Growth of six isolates of *Fusarium solani* on potato dextrose agar was determined with (1) continually changing temperature programs, (2) programs consisting of two alternating constant temperatures, and (3) a constant temperature program. All programs had a mean of 70° F. Growth increased with an increase in temperature fluctuation of 10 or 20° F., but decreased with a fluctuation of 40° F. Significant differences were found in the growth rates of the isolates.

The change in the growth rate of a fungus with a change from a constant temperature to a fluctuating temperature has been reported by several authors. Smith (4) and Burgess and Griffin (2) used programs that approximated daily temperature changes. Jensen (3) used a program of two constant temperatures, each alternately maintained for 12 hours.

This study was established to determine if six isolates of *Fusarium solani* (Mart.) App. & Wr. emend Synd. & Hans. differ in their response to these two types of fluctuating temperature programs.

Materials and Methods

The effect of the two types of temperature programs on the growth of *F. solani* was determined in an incubator controlled by a cam-type temperature programmer. For each program type, three fluctuating temperature regimes, each with a mean of 70° F., were established. The three temperature regimes had fluctuation ranges of 10° (65 to 75° F.), 20° (60 to 80° F.), and 40° F. (50 to 90° F.). The effect of a constant temperature regime of 70° F. was also determined.

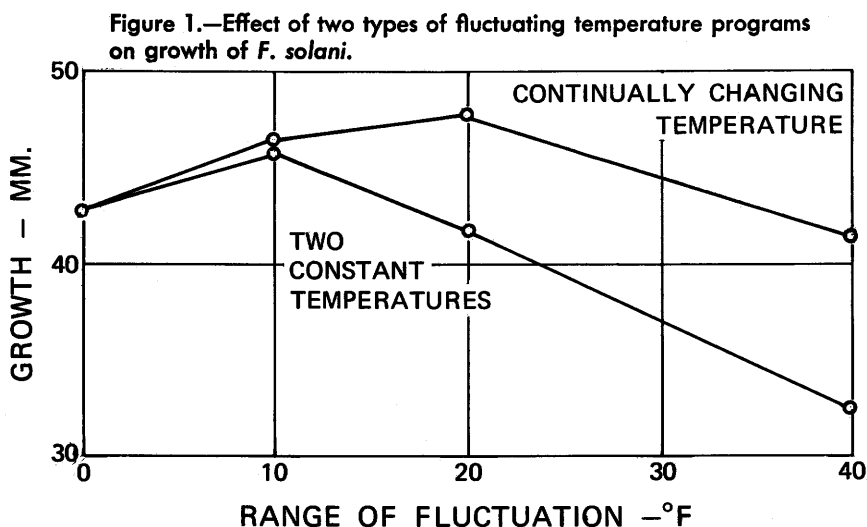
Six isolates of *F. solani* were grown with each temperature regime. Five of the isolates, F1M, F2P1, F3Y, F5P2, and F6P3, were isolated from cankers on hardwood trees. The sixth, F4S, was isolated from soil. All isolates were obtained from the U.S.D.A. Forest Service collection at Delaware, Ohio.

The fungi were grown on potato dextrose agar in disposable petri plates. The cultures were inoculated by cutting an agar plug from the edge of an actively growing culture with a No. 3 cork borer, and inverting the plug in the center of the petri plate. All isolates were placed in the incubator at the same time to insure uniform temperature treatment. After 5 days, the mean diameter of each culture was determined by measuring the culture diameter at two locations, at right angles to each other

The temperature regimes were replicated twice. Each replication contained four cultures of each isolate for each of the seven temperature regimes. The data were analyzed statistically in a split-plot design, and comparisons were made with Scheffé's test (1).

Results and Discussion

Growth of *F. solani* varied with the type of temperature program and with the temperature regime (fig. 1). Growth increased with an increase in the range of fluctuations up to 20° F. with the continually changing temperature program and decreased with a further increase in the range



of fluctuations to 40° F. With the program of two constant temperatures, growth increased with an increase in the range of fluctuation to 10° F. and decreased with an increase in the range of fluctuations to 20 or 40° F. Growth with the continually changing temperature program was greater than growth with the program of two constant temperatures, at all ranges of fluctuations tested.

The increased growth in the 65-75° F. regime suggests that the relationship between growth and temperature is not linear: that the increase in growth with an increase in temperature from 70 to 75° F. is greater than the decrease in growth with a decrease in temperature from 70 to 65° F.

At the upper and lower temperature extremes of the 60 to 80° F. and 50 to 90° F. regimes, growth was apparently slower than at temperatures nearer to 70° F. Hence, growth with the continually changing temperature program was greater because the environmental temperature was at the extreme temperatures only a very small part of the 24-hour period, whereas with the programs with two constant temperatures the temperature was at each extreme for 12 hours. Therefore, temperature programs that approximated the temperature variation in the natural environment caused the greatest changes in growth and probably most closely predict the response of the isolates studied to temperature in their natural environment.

Growth varied significantly among some of the isolates of *F. solani*: from 40.7 mm. for F5P2, a canker-causing isolate, to 44.7 mm. for F4S, the isolate from soil. However, growth of two of the canker-causing isolates was not significantly different from growth of the soil isolate.

The variation in growth between isolates of *F. solani* is probably due to genetic variation within the species and is not related to the source of the isolate. Even though the soil isolate grew significantly more than three of the canker-causing isolates, this relationship will have to be tested more thoroughly with many isolates before any conclusions can be made.



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