The latent period of Septoria nodorum in wheat.
1. The effect of temperature and moisture treatments under controlled conditions

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Abstract

The latent period of *S. nodorum* (Berk.) Berk. on seedlings of the wheat 'Felix' was determined in growth chambers under various temperature and moisture treatments, with two inoculum densities. In the wet treatment, where the inoculated plants were placed in continuously water-saturated air, the shortest latent period was 6 days at 23°C; in the alternate treatment, where 12 h saturated air alternated with 12 h at 85 to 90% r.h., maturity of pycnidia as indicated by extrusion of pycnidiospores was delayed by 5.6 days. In the dry treatment, continuously at 85 to 90% r.h., no sporulation occurred, though infection had taken place. On the average, sporulation at low inoculum density (5.10^4 pycnidiospores, ml^{-1}) was delayed by 2.4 days when compared to sporulation at high inoculum density (5.10^5 spores.ml^{-1}). From the data obtained, equations were derived to predict the latent period within the limits of the experiment. Eventually, these equations can be used in a computer simulator.

Introduction

Latent period, the period from inoculation to sporulation, is a determinant of the speed of an epidemic (Van der Plank, 1963). Latent periods of *S. nodorum* have been reported without specification of temperature and moisture conditions prevailing before and after inoculation, and reports on the factors affecting the latent period are vague. Therefore, experiments were conducted to determine the effect of temperature and moisture on the latent period of *S. nodorum* in leaf tissue.

Materials and methods

*Host.* In all experiments, the winter wheat 'Felix' was used (Sneep et al., 1969). This cultivar, which was also used in other epidemiological studies, was chosen because of the susceptible response of its leaves to *S. nodorum*. Plants were grown in sterilized sandy peat soil, in 7 cm diam. plastic pots, ten plants per pot. The plants were grown at 18 ± 1°C, and exposed to a light intensity of 11,500 lux from fluorescent tubes (Philips TLM 40W/33RS) during 16 hours per day. The plants were inoculated with *S. nodorum* at the three leaf stage.

*Pathogen.* The pathogen studied was *Septoria nodorum* (Berk.) Berk., the imperfect state of *Leptosphaeria nodorum* E. Müller. A well sporulating and virulent isolate was obtained from the Institute of Phytopathological Research (IPO) at Wageningen, by courtesy of E. Ubels.
**Experimental design.** There were three independent variables: temperature, moisture, and inoculum density. The dependent variable was latent period. Eight temperature treatments were applied in the range of 4 to 25°C (see below). There were three moisture treatments: wet, dry, and alternating (see below). Two inoculum densities were used: \(5 \times 10^4\) and \(5 \times 10^5\) spores.ml\(^{-1}\). Per treatment two pots with ten plants were available, each plant with three inoculated leaves: sixty leaves per treatment. Per treatment there were up to twelve sampling days, with five leaves per daily sample (see under latent period). Each sample of five leaves was chosen at random. At the lower temperature, sampling was begun only after the appearance of the first symptoms. The total number of leaves available for examination was \(8 \times 3 \times 2 \times 12 \times 5 = 2880\).

**Inoculum.** The surface of wheat meal agar plates (2% wheat meal + 2% agar; Shearer, 1967) was flooded with a pycnidiospore suspension in sterile deionized water. The plates were incubated at 15°C, and exposed to light from fluorescent tubes at an intensity of 22,000 lux during 16 hours per day. Within seven to ten days pycnidia, extruding spores in orange-pink cirri abounded. A pycnidiospore suspension was prepared by macerating agar and pycnidia from a number of plates in 100 ml deionized water, followed by filtration through one layer of muslin cloth. The spore suspension was diluted to the desired concentration, \(5 \times 10^4\) or \(5 \times 10^5\) spores.ml\(^{-1}\), with the aid of a haemocytometer.

**Inoculation.** The standardized spore suspension was sprayed onto the plants until run-off by means of a De Vilbiss No 15 adjustable tip atomizer, using compressed air. After inoculation, the plants were enclosed in clear polythene bags for 72 hours to provide a water-saturated atmosphere conducive to infection.

**Temperature treatments.** The inoculated plants were placed in growth chambers at various constant temperatures (Table 1). Because spores of *S. nodorum* germinate poorly at 5°C (Thomas, 1962), plants of the 5°C batch were incubated at 18°C for twelve hours prior to transfer to the 5°C environment.

**Moisture treatments.** In the dry treatments, the pots with plants were placed in the growth chambers at 85 to 90% r.h. in a metal tray containing water to a depth of 1 cm. The wet treatment was imposed with the aid of 15 × 15 × 39 cm metal frames covered with clear polythene. A water saturated atmosphere was maintained by placing the potted plants in a tray containing water to a depth of 1 cm, and by covering the plants with the polythene cage. The covered plants were placed in the growth chambers. The alternating treatment was obtained by covering and uncovering the plants every twelve hours.

The commencement of the moisture period coincided with the beginning of night in the light cycle. Prior to each covering, the plants were sprayed with deionized water to ensure leaf wetness. After the twelve hours wet period, the free water on the leaves was still visible, but it evaporated within two minutes after removal of the polythene cage.

As the air temperatures tended to rise in the enclosed space of the polythene cages,