Environmental Factors Influencing Basidiospore Discharge by

Polyporus tomentosus Fr.

by

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ABSTRACT

Basidiospore discharge rates by sporophores of *P. tomentosus* were studied in relation to the influences of light, relative humidity, and temperature in both the field and the laboratory. Discharge rates were reduced abruptly when relative humidity was reduced to approximately 75% under conditions of continuous darkness and constant temperature. Above 75 to 85% relative humidity, discharge rates were not affected by changes in relative humidity. In darkness and high relative humidity, discharge rates were highly correlated with temperature in the range of 35 to 75F. The introduction of light disrupted both these relationships and under natural conditions, the periodicity of discharge rates was not correlated with the periodicities of any of light, relative humidity, or temperature, but appeared, nevertheless, to be exogenous and modified by the interaction of the above three factors. Spore discharge rates were negatively correlated with light intensities above 190 ft-c; below this intensity light had no effect. *P. tomentosus* sporulated well on cloudy days when temperatures were moderate, however, its highest rates of discharge occurred in the evening hours due to rising relative humidity and declining light intensity. Discharge declined in the early morning hours due to falling temperatures. *P. tomentosus* is considered as chiefly a nocturnal sporulator.

Other factors such as sporophore size, growth rate, and moisture content, and soil moisture and nutrient content were examined in relation to basidiospore discharge. None of these factors were related to changes in spore discharge rates provided that all were at a level for basidiospore discharge to occur. Sporophores required at least 180% moisture content to discharge spores at optimal rates. Unexplained variability in spore discharge rates occurred in some sporophores.

An important phenomenon observed during this study was that the developmental rate of the hymenium was not uniform over the whole surface. This was supported by two observations; spores from two sides of the same sporophore were discharged at different rates, and spores from the same area of the hymenium were deposited in different patterns from hour to hour under uniform conditions of light, temperature, and relative humidity.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Figure Page

INTRODUCTION

Polyporus tomentosus Fr. is a major cause of a stand-opening disease in forests of white spruce (*Picea glauca* (Moench) Voss) in Saskatchewan and Manitoba (Whitney, 1962). This stand-opening disease is characterized by patches of dead or dying trees, some of which have been windthrown, and results in an open area in the usually dense spruce stand. The fungus grows in the roots and butts of the trees and advances slowly upwards causing a severe white-pocket rot. The importance of *P. tomentosus* as a causal agent in the stand-opening disease-complex and the pathogenicity of the organism has been thoroughly studied by Whitney (1962, 1963, 1964, and 1966b).

P. tomentosus produces annual sporophores which first appear near diseased trees in the stand-opening area about the third week of July at Candle Lake, Saskatchewan, where the present studies were undertaken. Sporophores continue to appear until late September or early October, depending upon climatic conditions. In the button stage, the sporophores are tan-colored, but become darker as they expand. A typical healthy, mature sporophore has a tomentose upper surface and a white hymenial surface. Whitney (1962) has suggested that the white color of the mature hymenial surface is probably due to the accumulation of basidiospores which are white in mass. Other characteristics of healthy sporophores include

a pore surface which has uniformly sized pores, a thick white pileus margin, and a high spore discharge rate under suitable environmental conditions. Mature sporophores are usually stipitate and are always attached by mycelial strands to a diseased root; these roots may be up to 15 cm. below the soil surface. The sporophore stipe is normally central, although it may be excentric or lateral when the sporophore grows adjacent to a tree, stump or log. In overmature sporophores, the hymenial surface becomes brown, the pores coalesce, and the sporophore is usually attacked by insects or other micro-organisms.

Sporophores have been observed growing directly from the trunk of a tree, or from exposed roots, and they frequently appear in soil which has been disturbed at least one year earlier. Diseased roots always occur nearby, providing a point from which the sporophores may develop. Patton and Myren (1970) used sporophores as boundary indicators of diseased areas in their studies on the development of root rot caused by P. tomentosus in pine and spruce plantations in Wisconsin. They found that root infections extended no further than three feet beyond the limit of the infected area as delineated by the occurrence of sporophores.

Whitney (1962) gave convincing evidence that root rot caused by P. tomentosus may be spread as a consequence of root contact between healthy and diseased trees. He found that the fungus does not grow in the soil and, from this locus, invade tree roots. Attempting to explain the role of basidiospores in the spread of the disease, he inoculated

basidiospore suspensions into small spruce roots, thereby successfully causing infection (Whitney, 1963). Only wounded roots became infected. The above facts suggest that roots must be exposed and wounded for basidiospore infection to occur or that basidiospores are washed through the soil to the wounded roots by rain. There is also the possibility that mice, squirrels, rabbits or other small animals carry basidiospores and thus serve as vectors of P. tomentosus. The growth habit of this organism at the ground level would be conducive to the various methods of dissemination outlined.

Since basidiospores of P. tomentosus are capable of initiating root infections in wounds (Whitney, 1963), they may be an important factor in the spread of the disease, since it would seem that any long-distance spread of the fungus would require the existence of an air-borne inoculum. Basidiospores of Fomes annosus (Fr.) Cke. have been shown to initiate infection of wounded pine roots and stumps (Rishbeth, 1951; Wallis, 1961) and, while few investigations have been completed, it may be that basidiospores are an important source of inoculum in diseases caused by root-rotting fungi.

This study was undertaken primarily to investigate the influence of relative humidity, temperature, and light on the rate of spore discharge from sporophores of P. tomentosus and, secondarily, to investigate those aspects of sporophore development which may be pertinent to spore discharge. Also, the effects of other factors such as rainfall, soil moisture, soil nutrients, as well as sporophore size, growth, and mois-