

THE GROWTH OF STEREUM GAUSAPATUM FRIES IN RELATION TO TEMPERATURE AND ACIDITY¹

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The recent discovery of the importance of *Stereum gausapatum* Fries as a major cause of heartrot of oaks (Davidson, 1934) served as a stimulus for a study of its general biology. The writer has attempted such an investigation and this paper represents a portion of that study.²

TEMPERATURE

The relation of the growth of *S. gausapatum* to temperature has been previously investigated. Humphrey and Siggers (1933) using temperatures from 12° C. to 40° C., report 24° C. as the optimum temperature, and 38° C. as inhibiting growth. Considerable growth took place at 12° C. *S. spadiceum*, which Burt (1920) lists as a synonym of *S. gausapatum*, was studied by Cartwright and Findlay (1934). They grew the fungus at temperatures of 5° C. to 30° C. The optimum temperature employed was 25° C. Growth was not completely inhibited at either extreme.

In the present investigation the effect of temperature on growth rate was investigated by growing the fungus at various constant temperatures ranging from 5° C. to 35° C. with 5° intervals.

About 20 cc. of potato dextrose agar was poured into each of 70 Petri plates and inoculated at one edge with a small piece of mycelium taken from the edge of a vigorously growing cul-

¹This paper is a revision of a portion of a thesis submitted to the faculty of The Ohio State University as partial fulfillment of the requirements for the degree of Doctor of Philosophy. The temperature studies were carried on at The Ohio Agricultural Experiment Station and the acidity studies at The Ohio State University.

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²Two other portions of this study have recently been accepted for publication and should appear in the near future. The papers are as follows: (1) Growth and Variability of *Stereum gausapatum* Fries in Culture. To appear in *Phytopathology*. (2) A Microscopical Study of the Mycelium of *Stereum gausapatum* Fries. To appear in *Transactions of the American Microscopical Society*.

ture of a single spore isolate. In order to reduce evaporation each plate was sealed with nurseryman's tape. The cultures were kept at room temperature for 15 hours, and then ten cultures were placed in each of the various constant temperature chambers.

After six days the radius of the mycelial growth in each plate was measured in millimeters. The average growth of the ten mycelia grown at each temperature is shown in Table I.

The above experiment was repeated using malt agar with 28 cultures at each temperature and an incubation period of 10 days. The results of this experiment are also presented in Table I.

TABLE I

THE RELATION OF THE GROWTH RATE OF *Stereum gausapatum* TO TEMPERATURE AS DETERMINED BY RADIAL GROWTH OF MYCELIA AT VARIOUS CONSTANT TEMPERATURES

TEMPERATURE IN C.	5°	10°	15°	20°	25°	30°	35°
Average radial growth in mm. on potato dextrose agar in six days.....	1	3.2	5.3	27.3	44.2	32.7	2.8
Average radial growth in mm. on malt agar in ten days.....	2	10	14.4	46	73.5	66	6.5

Growth at 5° C. was very slight and probably would have been completely inhibited at some temperature between 0° C. and 5° C. The greatest growth occurred at 25° C. At 35° C. growth was very irregular and abnormal in appearance. If higher temperatures had been tried growth would probably have been inhibited at about 38° C., as reported by Humphrey and Siggers (1933).

ACIDITY

Various researches (Wolpert, 1924; Zeller, Schmitz and Duggar, 1919) have shown that many wood-destroying fungi grow best on an acid medium. Cartwright and Findlay (1934), Humphrey and Siggers (1933) and Bergenthal (1933) have all cultured this fungus on media which were acid in reaction, but there has been no work reported in which the relation of acidity to growth was investigated.

The relation of acidity to the growth rate of *S. gausapatum* has been studied by growing the fungus on potato dextrose agar having a series of pH values. One hundred fifty cc. of freshly

TABLE II
MYCELIAL GROWTH OF *Stereum gausapatum* ON POTATO DEXTROSE AGAR, HAVING DIFFERENT H-ION CONCENTRATIONS, AS DETERMINED BY RADIAL GROWTH OVER A PERIOD OF FIVE DAYS

pH Value	Number of Mycelia Measured	Minimum Radius in mm.	Maximum Radius in mm.	Average Radius in mm.
8.6	36	0	0	0.0
8.4	36	0	0	0.0
8.2	36	0	0	0.0
8.0	30	0	2	0.1
7.8	30	0	6	2.3
7.6	27	14	23	18.3
7.4	32	13	19	16.0
7.2	34	15	25	20.9
7.0	35	15	24	21.0
6.8	28	12	25	20.1
6.6	30	20	25	23.0
6.4	32	20	27	24.2
6.2	27	20	27	23.7
6.0	32	18	29	25.2
5.8	32	20	29	25.5
5.6	34	24	35	27.5
5.4	33	24	35	27.5
5.2	36	22	31	27.3
5.0	36	25	34	27.7
4.8	32	25	32	28.5
4.6	36	20	35	29.6
4.4	36	24	31	27.6
4.2	36	22	31	26.6
4.0	32	20	30	25.2
3.8	36	19	25	22.5
3.6	36	19	25	22.5
3.4	36	16	22	19.0
3.2	35	13	21	16.1
3.0	36	13	18	15.2
2.8	36	9	16	13.5
2.6	35	4	10	6.9
2.4	35	0.5	3	1.3
2.2	36	0	0	0.0
2.0	36	0	0	0.0
1.8	36	0	0	0.0

prepared potato dextrose agar was poured into each of several 250 cc. Erlenmeyer flasks. The flasks of agar were autoclaved at 15 lbs. pressure for 20 minutes, and stored for a few days. Upon remelting, the agar was found to have an acidity of pH 5.2. Suitable amounts of 5% or 20% HCl and of normal NaOH

were added to the various flasks so as to adjust the media to H-ion concentrations ranging from pH 1.8 to pH 8.6 with intervals of approximately 0.2 of a pH unit. The pH of the agar was determined by means of a Hellige comparator using color disks. Immediately after adjusting the acidity nine plates were poured from each flask. The plates were uniformly inoculated at four marginal points with a small piece of mycelium from a potato dextrose agar culture of a single spore isolate. They were allowed to incubate, in darkness, at room temperature, for a period of five days. On the fifth day the radii of the mycelia were measured in millimeters. The essential data of the experiment are presented in table form (Table II).

It may be seen from the data in this table that *S. gausapatum* will grow fairly well over a wide range of H-ion concentration. The optimum pH for growth appears to be about 4.6. As the acidity increases from the optimum, the rate of growth decreases rather uniformly. Growth is inhibited at pH 2.2. In certain preliminary experiments growth was sometimes observed to occur at pH 2.2, but never at pH 2.0. As the acidity decreases from the optimum to around pH 7.6 the growth rate gradually decreases, but a sudden drop takes place from this point to pH 8.0 or higher; beyond this point growth is inhibited. In the experiment here described almost no growth occurred at pH 8.0, but as was the case at the lower pH limit, in one of the preliminary experiments, a slight growth was observed at pH 8.0 but never at pH 8.2.

The data which are reported here for *S. gausapatum* compare favorably with such data for several other wood-rot fungi which have been previously studied (Wolpert, 1924). It is not possible to find any pH value which could justly be considered as the isoelectric point.

SUMMARY

The heartrot fungus, *Stereum gausapatum* Fries, has been grown on potato dextrose agar and on malt agar at various constant temperatures ranging from 5° C. to 35° C. Very little growth occurred at either extreme. The greatest growth occurred at 25° C.

The effect of acidity on rate of growth has been investigated by culturing the fungus on potato dextrose agar having a series of acidities. Considerable growth occurred from pH 2.8 to pH 7.6. The optimum pH for growth was found to be about 4.6.

Growth was inhibited at pH 2.2 and at pH 8.0. No indication of an isoelectric point was found.

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