T H E S I S

on

A Pathological Survey of the Peavy Arboretum

Submitted to the

OREGON STATE AGRICULTURAL COLLEGE

In partial fulfillment of
the requirements for the
Degree of

MASTER OF SCIENCE

by

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May 1932

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A PATHOLOGICAL SURVEY OF THE PEAVY ARBORETUM

Part I

Decay of Felled Timber on Thinning Plots of the Peavy Arboretum

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MAP OF PEAVY ARBORETUM

1932

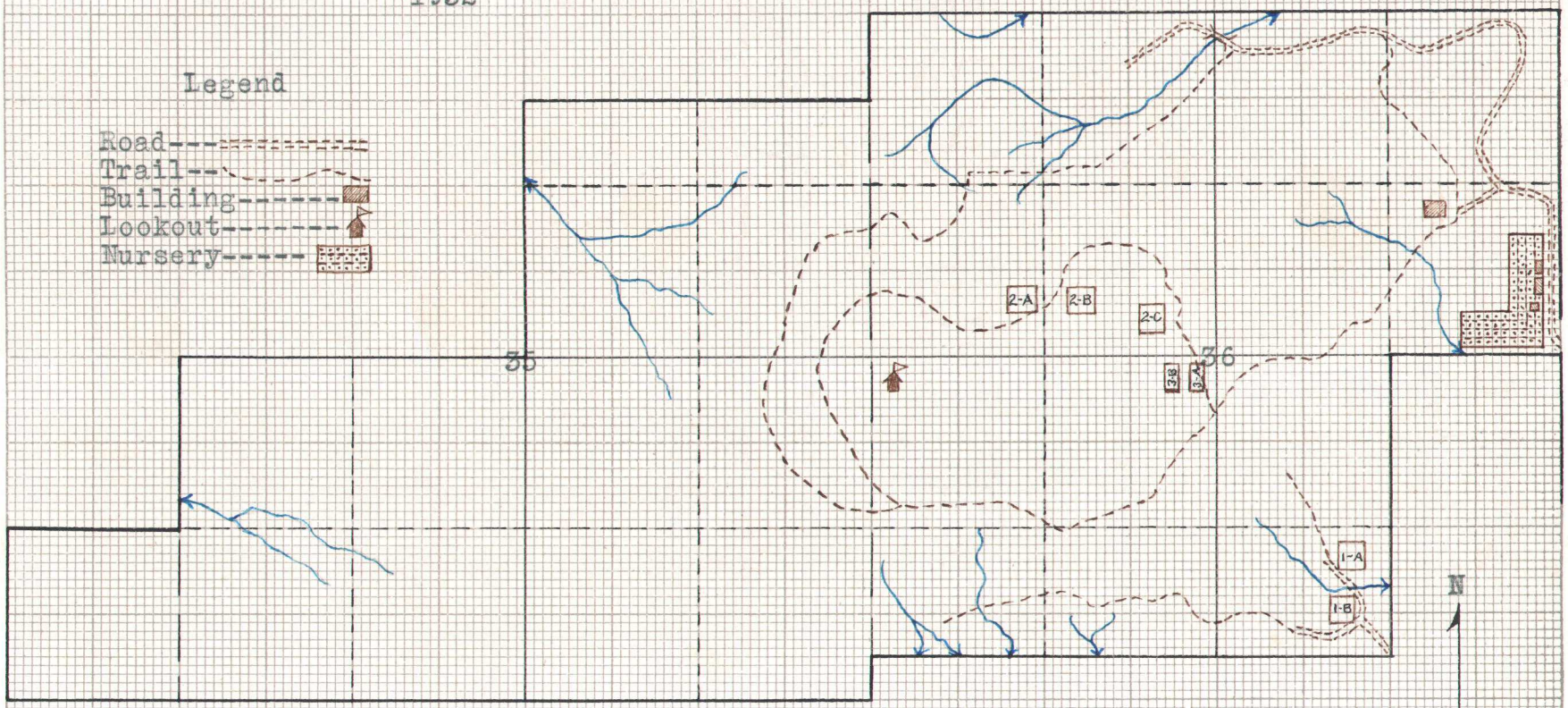


Plate I

Decay of Felled Timber on Thinning Plots of the Peavy Arboretum

Introduction

It was the wish of the Northwest Forest Experiment Station to have experimental thinning plots in the second-growth Douglas fir of the Peavy Arboretum. For this reason, in 1926, the school of forestry established under the supervision of Professor E. G. Mason, four thinning plots at different localities over the Arboretum. Three of the plots were one acre each and one was half an acre. Three check plots, two an acre in area, and one a half acre, were established near the thinning plots. Each tree in the seven plots was numbered and given a metal tag bearing its number. The trees were marked by Mason and felled during their dormant stage in the winter of 1926.

The slash was lopped and scattered on one plot and lopped on another, the other two were left as they were. On those two plots where slash disposal was practiced the felled trees were trimmed, all limbs being cut off next to the bole.

In the winter 1928 volume measurements were taken of all the felled trees of the plots. The data were recorded on form 558a and the volumes were plotted graphically. The stump height cut was 18 inches.

This work necessitated the chopping thru the bark at intervals along the trunks of the trees, thus exposing the sapwood to fungi infection.

Object of the Present Study

When these four plots were thinned in 1926 the question arose of how to dispose of or utilize the felled trees. Several things were considered, and it was finally decided to leave them and observe the rate of decay under the existing conditions.

The fellowship in forestry given by Mrs. Mary J. L. McDonald has afforded an opportunity to carry on this study. Under the direct supervision of Professor Earl G. Mason this study was carried on by the writer and an assistant, Mr. Herbert Willison.

The study as outlined will continue over a number of years with observations after each five year period. The present study is merely the first of the series of periodic observations. The object is to determine the extent of decay now present in the logs, and the comparative amounts of each species of decay, with an explanation of the probable cause of the entrance and development of each of the types of rot.

Existing Conditions

Weather Conditions Since the Plots were Started:
(Taken from the State Weather Records.)

November 1926 was mild and unusually wet. Much cloudiness, and frequent precipitation characterized the weather of December. There was cold weather and snow at high elevations during the first part of the month.

The year 1927 was generally cool with much more than the normal amount of cloudiness. It was nearly normal as to temperature, but the summer months were slightly warmer than normal. Heavy rains starting in September lasted until December when it turned to snow. It was a very good year for fungus growth.

The year 1928 was unusually mild and dry except the two months of March and April, which were unusually wet. Warm weather and drought prevailed thruout the remainder of the year. Precipitation became normal about December 23.

Two outstanding features of the weather for 1929 were the persistence of low temperature in January, February, and April, and the prolonged drought in the summer and fall. The year as a whole was the driest of record. In the five months July to November, inclusive, the precipitation amounted to 1.81 inches, which is one-fifth the normal. December was the wettest since 1896. The precipitation for that month was more than the total for the eight preceding months.

The year 1930 was the driest of record, having slightly less precipitation than 1929. The precipitation was more evenly distributed, starting in early September. December was the driest month of the name on record.

In 1931 the drought continued for the first two months with March breaking the dry conditions with more than normal precipitation. April and May were again very dry with high temperatures. June had some rains thruout the middle of the month. July and August were the driest months on record, with very little rain and exceptionally high temperatures. September had some rain and much cooler weather. October and November were nearly normal in precipitation and were colder than usual. December temperature was below normal and precipitation was greater than normal.

On the whole these five years seem about average for fungi development. The first two years were exceptionally favorable for spore production and germination, and the last three years dry and unfavorable for new infection. As infection probably takes place mostly during the first year or two that trees are down, this prolonged drought perhaps did not deviate the results to a great extent.

Description and Conditions of the Plots:

There were seven plots marked off, four of which were thinned and three were left as check plots. 1-A was a check plot for 1-B. 2-B was a check plot for 2-A and 2-C, and 3-B

Plate II

A check plot where no thinning was done. Second-growth Douglas fir.

was a check plot for 3-A. (See map, plate 1.)

Plot 1-B:

Plot 1-B has the lowest elevation and the moisture conditions are wettest of the four plots. A small creek passes within 200 feet of the North boundary of this plot. Before the plot was thinned there were many standing and down trees that were decayed or contained decay. Many of these decayed stubs or snags were left standing. On the whole the plot provided an abundance of inoculum for the felled trees, this together with the moist conditions afforded favorable infection conditions.

The plot is at an elevation of about 600 feet and located on a gentle North slope near a small creek. The trees are all second-growth Douglas fir. Five years after thinning the standing trees average 14 inches in diameter, and form a closed canopy. The under growth is sparse, with some hazel and evergreen ferns. The floor is covered by deep moss, under which is well drained humus soil. There was no slash disposal method used on this plot, and no volume measurements were taken in 1928 as were on the other three plots.

Plot 2-A:

Plot 2-A has the highest elevation of the four plots, and probably the driest moisture conditions. It is located at about 1050 feet elevation on a gentle East slope, becom-

Plate III

A thinning plot five years after being thinned. Douglas fir.

ing about 10% near the East side. The standing trees five years after thinning formed a nearly closed canopy and averaged 20 inches in diameter breast high.

There is no under brush and the floor is made up of shallow duff, with well drained deep soil covered by moss and herbaceous plants. There was no slash disposal method used on this plot.

All logs on this plot were measured in 1928 for volume and at that time notches were cut thru the bark at ten-foot intervals along the logs. This provided entrance courts for fungi.

Plot 2-C:

Plot 2-C, located at an elevation of about 850 feet and on an East slope of about 15%, consists of all second-growth Douglas fir trees, which form a nearly closed canopy five years after being thinned. There is no under brush except ferns, and the floor is a moss covered, well drained, deep humus soil. At the time of thinning the slash on this plot was lopped and left lie. lying

In 1928 notches were cut thru the bark along the logs at five and ten-foot intervals.

Plot 3-A:

Plot 3-A is the half acre plot. It is located on an East slope of approximately 18% at an elevation of about 750 feet. The canopy formed by the trees in 1931-32 was not

closed.

The floor of the plot is moss covered with a higher story of herbaceous plants and some hazel brush. When the plot was started the slash from the felled trees was lopped and scattered. And in 1928 the work done on the felled trees necessitated chopping thru the bark at intervals.

Method of Study

In the Field:

In October 1931 investigations began on the four thinning plots. General notes were taken on each plot, as to elevation, topography, aspect, type of timber, density of stand, type of soil and soil cover, drainage conditions, general humidity conditions, and method of slash disposal used at time of thinning.

Five representative felled trees were chosen on each plot. The following notes were taken on each tree: (1) General notes on forks, breaks, and other possible entry courts for fungi, and their locations on the tree. (2) Factors that might influence the rate of decay, such as direction felled; whether or not the tree was on the ground, and if off the ground, at what points and how far off the ground it rested; tightness of the bark; and at what points the sapwood was exposed. (3) Stump diameter inside and outside of the bark. (4) Diameter breast high inside and outside of the bark. (5) Notes on the shade conditions of the tree,

Plate IV

The end of a section showing the thickness of the decay.

Thinning Plot Decay Study

Tree No.- 56 Plot No. - 1-B

Date - 3/30/32
Notes - J.W.K.
Work - H.W. + J.W.K

General Tree Data

Breaks - No breaks or injuries.

Felled - S.E. on level ground.
Position - All on ground except from 20ft. mark to the 60ft. mark, which is off the ground .1 to 1 foot. - 1ft. at 40ft. mark.
Bark - Tight full length.

Shade - Some slash over log full length of the tree. No brush. Partial shade.

Sporophores - P. abietinus full length of tree. F. pinicola near 20ft. mark.

Length - 100ft.
Other Notes - Limbs left on the tree. No slash disposal.

Plate V

Page from field notebook showing general tree notes

that is at what points the tree was overgrown with vegetation or covered with slash. (6) The presence of sporophores, the species and the location on the tree. (7) The total length of the tree.

Diameter measurements were taken with steel diameter tapes and steel rulers. Length measurements were taken with a hundred-foot steel tape.

Each tree was then marked, and sawed into ten-foot lengths, to a six-inch top diameter. Notes were taken on each ten-foot section. At the small end of the section the diameters outside bark, inside bark, and inside rot, were measured to the nearest tenth of an inch. The ends of each section were examined to determine the kinds and amounts of each decay present. The amounts were estimated in percentage of the section occupied by each species of decay. In some cases it was necessary to split open the section or peel off the bark and chop thru the rot to determine this.

In the Laboratory:

Those species of decay which could not be determined from the former association of the writer with wood-rots, in school and in previous field experiences, were identified in the laboratory. Samples of the questionable rotten wood were collected and cultures were grown from them on prepared media. Three kinds of media were used: Potato-dextrose agar, rice agar, and plain agar without other nutrient. The

Thinning Plot Decay Study

Tree No.- 56 Plot No.- 1-B

Date - 3/30/32
Notes - J.W.K.
Work - H.W. & J.W.K.

Tree Data

	o.b.	i.b.
Stump Diameter (inches)	20	17
D.B.H. (inches)	17	15

Section Data

Section	D.O.B. inches	D.I.B. inches	D.I.R. inches	Decay —	Notes —
1	15.00	13.50	9.50	100% abiet.	
2	14.25	13.00	9.50	50% "	50% pinicola
3	13.75	12.75	9.50	100% "	
4	13.00	12.00	9.25	" "	
5	12.00	11.00	8.50	" "	
6	11.25	10.50	7.50	" "	
7	9.00	8.75	4.00	20% "	80% pinic.
8	7.50	7.00	4.00	60% "	40% "

Plate VI

A page from the field notebook showing tree and section data

rots were first planted, under sterile conditions, on potato-dextrose and on rice agars. If a contaminated culture resulted the fungus was separated by making transfers to plain agar medium. Rotten wood of known species were cultured in the same way. These known cultures were then compared with the known cultures to ascertain the species. In the case of Polystictus abietinus the known culture was prepared from spores taken from sporophores.

In the Office:

*Thickness of Rot

The average rot thickness was determined for each plot by adding the rot thickness of all samples on that plot, except those samples that were thrown out as doubtful data, and dividing by the number of samples used. The following table shows the number of samples and average thickness of rot for each thinning plot:

Plot Number	Samples Used	Average Thickness of Rot (Inches)
2-A	39	2.61
3-A	39	3.03
1-B	34	3.24
2-C	42	3.81
All plots	154	3.12

*The term "thickness of rot" as used in this report means the part of the diameter of the sample that contains decay, or double the depth of rot on the radius of the sample.

An average rot thickness for all plots was determined by using the 154 samples mentioned above. This average was 3.12 inches.

Correlations

An endeavor was made to correlate the thickness of rot with supposedly influencing factors.

The formula used in finding the coefficient of correlation was: $r = \frac{P_{xy}}{\sigma_x \sigma_y}$

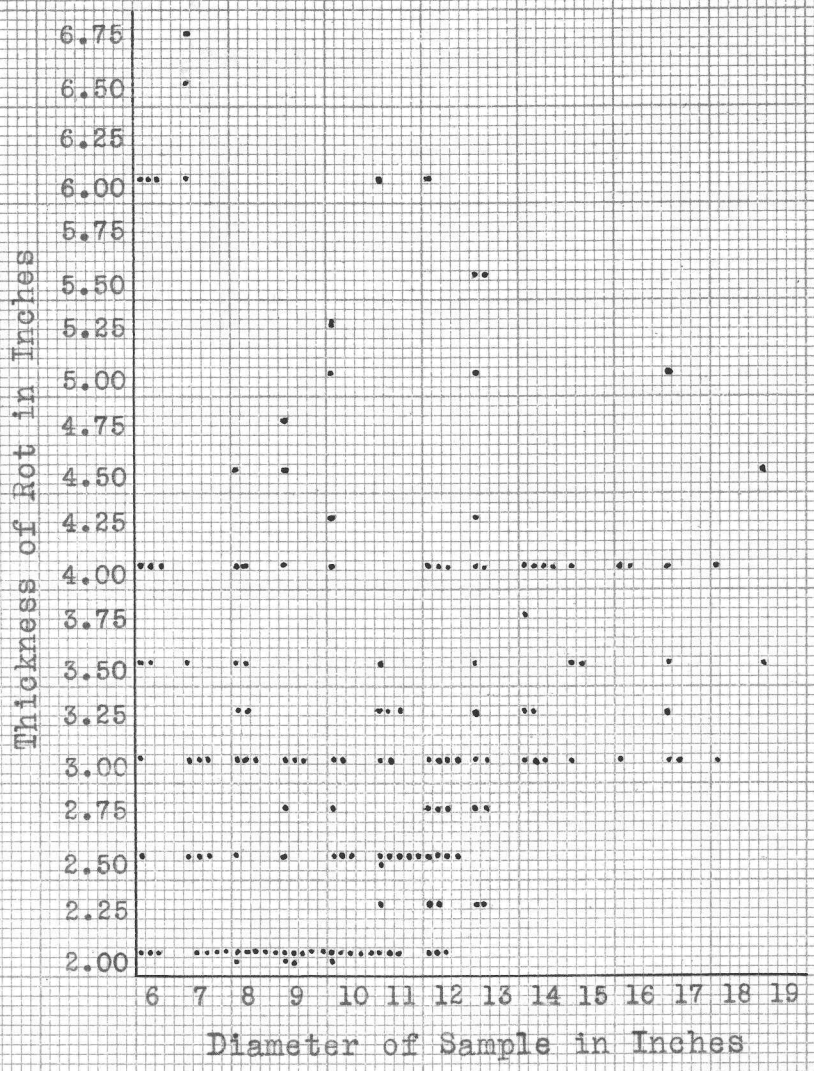
when σ = Standard deviation $= \sqrt{\frac{\Sigma \delta^2}{n}}$

and P_{xy} = First product moment of the table.

Plate VII is a chart showing the plotted points, of the 154 samples used on the four plots, in an attempt to correlate the thickness of rot with the diameter of the samples. The coefficient of correlation was .099. Since it is the common practice to call anything less than .4 no correlation, it is evident there is no correlation here.

Plate VIII is a chart showing an attempt at correlating the thickness of rot with the distance the sample was from the ground after the tree was felled. The coefficient of correlation here was-.017, which also shows no correlation.

Plate IX shows there is no correlation with thickness of rot and density of shade on the samples. The coefficient of correlation here was .169. This came nearer correlating with the thickness of rot than any of the other factors


Thickness of Rot in Inches
6.75
6.50
6.25
6.00
5.75
5.50
5.25
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
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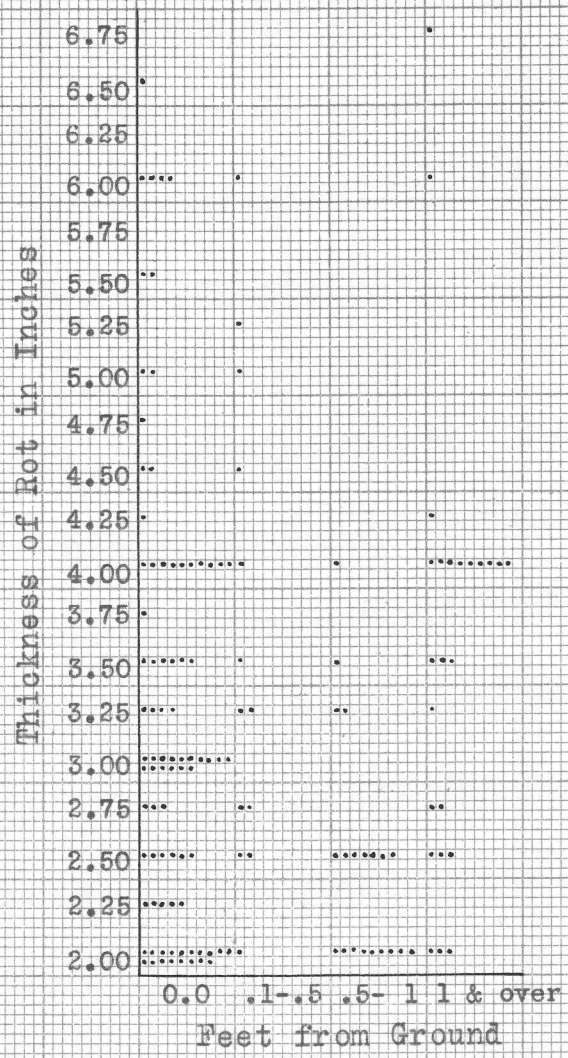
2.50
2.25
2.00
6 7 8 9 10 11 12 13 14 15 16 17 18 19
Diameter of Sample in Inches

Plate VII


Thickness of Rot in Inches
6.75
6.50
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4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
0.0
.1-.5
.5- 1
1 & over
Feet from Ground

Plate VIII

studied.

Plate X is an attempt at correlating the thickness of rot with the species of rot. This chart shows absolutely no correlation.

Other factors used in an attempt to find a correlation with the thickness of rot were: the thickness of the bark on the sample, the two factors combined of shade density and distance from the ground, and a combination of the two factors species of rot and size of sample. None of these factors or combination of factors showed any correlation.

The average thickness of rot for each plot did not correlate with the density of the remaining stand after thinning. The following chart shows a correlation except for Plot 2-A:

Plot Number	Rot Thickness (inches)	Density B. A. per acre (sq. ft.)
2-A	2.61	250.93
3-A	3.03	108.84
1-B	3.24	145.79
2-C	3.81	195.84

Species of Decay

The amount of each species of decay was calculated in the percentage of the total for all four plots, by taking the percentage of each species in each sample, adding them and then dividing by the total number of samples. The results were as follows:

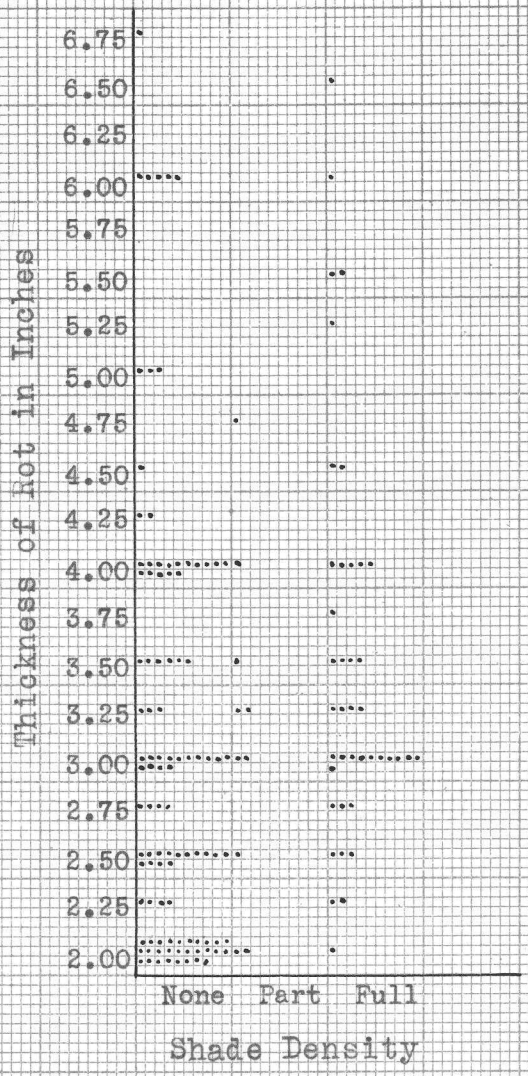

Thickness of Rot in Inches
6.75
6.50
6.25
6.00
5.75
5.50
5.25
5.00
4.75
4.50
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
None
Part
Full
Shade Density

Plate IX

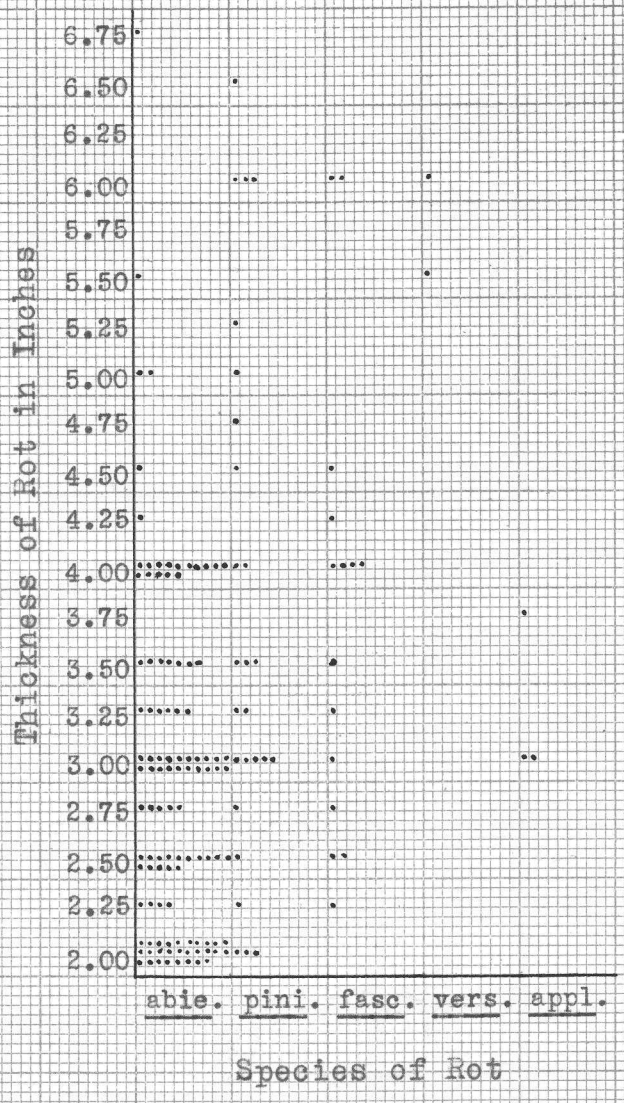
Polystictus abietinus 64%	Fomes pinicola 20%
Hypholoma fasciculare 12.4%	Fomes applanatus 2.1%
Polystictus versicolor .4%	Trametes subrosea .3%
All others .8%	

Conclusions

The only definite conclusions that may be stated are the average thicknesses of rot for each plot, and the average thickness of rot for all four plots. (See page nine.) All other conclusions are more or less indefinite or hypothetical.

The percentage of each species of rot found is as definite as could be determined on such a large scale study in the short length of time available.

The reasons accounting for the amount of decay as stated here are merely conjectural. If the thickness of sapwood of the samples at the time of felling could have been determined, it may have been possible to correlate the thickness of decay with this factor. From plate VII it may be seen that no sample over the diameter of thirteen inches had a rot thickness of less than three inches, while the greatest precentage of samples thirteen inches or less in diameter had a rot thickness of three inches or less. This would suggest that there is something common to all larger samples which cause the rot to be at least three inches


Thickness of Rot in Inches
6.75
6.50
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abie.
pini.
fasc.
vers.
appl.
Species of Rot

Plate X

thick. If it could be shown that the thickness of sapwood in these larger samples, at the time of felling, was consistently three inches or over in thickness, the theory, that sapwood and rot thickness correlate, could be proven. It appears that there is some correlation between this factor and the thickness of rot. Another observation that was made points to this same conclusion. In plot 2-A the average thickness of rot found was 2.61 inches, which was less than for the other three plots. The density of the stand on this plot was greater than on the other three plots before the thinning was made, and this dense stand would mean a slower growing stand and therefore a lesser thickness of sapwood. Then if the sapwood was not so thick it might account for the thickness of rot being less on this plot.

All species of decay found on these plots were sapwood rots, however, the two species, Fomes pinicola and F. applanatus also attack exposed heartwood, and F. applanatus seems to attack only under very moist conditions. Wherever the bark was tight, and no wounds or breaks occured the principal species found was Polystictus abietinus. Where the bark was off, or where it had been cut thru with an axe, the principal rot found was F. pinicola, and it was the only rot found where breaks or cracks exposed heartwood. From plate X it may be seen that P. abietinus is very consistent in the rot thickness, and because this is a sapwood rot, it would

indicate that sapwood thickness might correlate with rot thickness if this was the only rot present.

From observation in the field and from the notes in the office it appears that in the first five years F. pinicola will work only in the sapwood if heartwood is not exposed, and that exposed wood is necessary for its presence at all, while the other rots encountered in this study seem to be able to permeate the bark.

Another theoretical conclusion suggested by the data is that the volume of wood decayed the first five years is larger than that volume that will be decayed during the second five year period. This is shown by the consistent thickness of rot in all size diameters of the samples. The decay seems to be able to permeate only so far in the first five years, no matter what the diameter is, with the only deviation from this being that in the smaller samples it seems to permeate a little less. If the decay keeps growing at the same rate, which is doubtful because of the large percentage of sapwood rot, the thickness of rot-growth the second five years will be the same as the thickness of rot-growth the first five years. The diameter of sound wood in all samples is less, by the thickness of rot, after the first five years, therefore, the volume of wood decayed in the second five year period will be less than in the first.

Summary

Four thinning plots were established in the second-growth Douglas fir on the Peavy Arboretum in 1926, on which the felled trees were left lying on the ground. After a period of five years a study was carried on to determine the extent and species of decay present in the felled trees, and an attempt to offer some explanation for the conditions found was made.

It was found that during this five year period weather conditions favoring infection and decay were extremely good the first two years and relatively poor the last three.

At the end of this period the average thickness of rot in a cross section of a felled tree, determined from the measurement of 160 samples, taken to a six inch diameter minimum, was 3.12 inches. That means the rot had permeated the stem to a depth of 1.56 inches.

The two principal fungi found were Polystictus abietinus, which made up 64% of the total and Fomes pinicola, which made up 20%. The other species found were, in order of their abundance, Hypholoma fasciculare, Fomes applanatus, Polystictus versicolor, Trametes subrosea, Lenzites sepiaria, and Stereum spp.

No correlation could be made with the thickness of rot and the supposedly influencing factors. The thickness of the sapwood could not be determined from the samples, be-

cause the distinction between sapwood and heartwood could not be made after being down five years. The thickness of rot, therefore, could not be correlated with the thickness of sapwood, altho it is believed a correlation exists.

Borings on live trees

It was concluded that *F. pinicola*, which causes 20% of the decay, would probably not be present if wood was not exposed to start infection.

Hypothetically it was concluded that the volume of wood decayed the first five years is greater than the volume that will be decayed during the second five year period.

A PATHOLOGICAL SURVEY OF THE PEAVY ARBORETUM

Part II

The Forest Fungi of the Peavy Arboretum

The Forest Fungi Of The Peavy Arboretum

Purpose of the Study

This pathological survey of the Peavy Arboretum is the first of its kind to be made on this tract of land. Altho the survey is by no means complete, the purpose of ascertaining the more important forest fungi of the tract is fulfilled. The determining of the occurrence of each species of fungus is another item of the purpose that has been carried into more or less detail. It is known that hundreds of species of fungi of the perfect and imperfect forms may be found on such a large wooded tract in this humid coast country. Only the more conspicuous and abundant species of the higher forms, however, were studied.

Method of Research

Field Procedure:

The Peavy Arboretum consists of over a thousand acres of forest land, the major portion of which is second-growth Douglas fir type. To make observations and collections over such a large area at all times of the year is a problem itself. Systematic cruises of this tract were made periodically thruout the nine months from September, 1931, to May, 1932, inclusive. Collections were made of all fungus fruiting bodies of each species for each host plant. Each ten-

acre subdivision was cruised at each survey made. Each specimen was labelled in the field as to host, location of collection, and forest type, and notes were taken on the abundance of sporophores.

Preserving of Specimens:

Each specimen was taken to the laboratory where it was identified and then preserved and filed.

Specimens of fungi on leaves were pressed and dried. Collections of sporophores and other fruiting bodies were dried in racks over a steam radiator. All specimens were made small enough to file in paper packets 5½ by 8 inches, and preserved against insects by use of napthalene flakes in the packets. A card was pasted on the face of each packet, giving the collection number, species of fungus, species of host, collector's name, place of collection, type of forest where collected, elevation, and date of collection. The packets were filed in order of the collection numbers in boxes, and stored at the School of Forestry for future reference.

Identification of Specimens:

Specimens were identified while in the fresh condition when time was available. Assistance was received from Professor C. E. Owens and Dr. S. M. Zeller in the identification of some of the specimens, and various books and keys on fungi were used. The species of each fungus was deter-

mined except in a few cases where only the genera could be absolutely determined. Some of the Agaricaceae were not given a name because the dried specimens were insufficient to determine the genera.

Observations

General:

The Peavy Arboretum may be said to be clean and sanitary, as far as fungi are concerned. Altho there are hundreds of different forms of fungi on the tract, none of them are epiphytotic or doing any great damage. In fact, the fungi of this area do by far more good than harm in decaying of and dispensing with the waste materials of the forest. The decaying of standing timber, other than wolf trees, need be of no consequence in the practice of forestry on this area, because the pathological rotation for Douglas fir is about twice as long as the financial rotation of cutting which will be practiced here.

Abundant Species:

Some species occur in abundance on the arboretum. This is because of the favorable climatic conditions and the large percentage of certain preferred host plants for common fungi.

Fomes pinicola, the red-belt fungus, is probably the most abundant of the more conspicuous species found here.

It is found on Douglas fir and white fir, the most common trees of the arboretum. Altho exposed dead wood is necessary for the entrance of this disease, it grows very fast and soon decays the dead trees and slash of the forest.

Polystictus abietinus, the purple fungus, is one of the most abundant species found on this tract. It is the first fungus to attack the newly felled logs and slash of Douglas fir, and it grows nearly as rapidly as the red-belt fungus. This fungus confines its action exclusively to the sapwood.

Hypholoma fasciculare, a sap rot on Douglas fir logs and slash, is abundant. The sporophores are numerous during November, and they may be found as late as February and early March.

Fomes ferruginosus, a brown poria-like sporophore, is abundant thruout the year on dead wood of hazel, cherry, alder, and especially on oak. This sporophore is generally resupinate and may cover the entire side of a log or standing oak snag.

Lepiota naucina, an edible mushroom, is abundant in the nursery in early November.

Rhytisma punctatum, tar spot on broadleaf maple, is abundant in the fall until the leaves decay.

Other species are abundant wherever their host is found and are limited only by the abundance of the host.

Lophodermium pinastri, a needle spot on planted Norway pine, is abundant on the needles of dead trees on the arbor-

etum. Only a few acres of these trees, however, are planted on the tract.

Common Species:

Many species are common, among which are Armillaria mellea; Polystictus versicolor; Stereum hirsutum; Lenzites sepiaria; Polyporus picipes; Trametes subrosea; and Fomes applanatus among the wood rots. Common mushrooms are Amanitopsis vaginata; Stropharia ambigua; Lepiota clypeolaria, and species of Russula. Several leaf diseases are common--Phyllactinia corylea, Uncinula salicis, and Microsphaera alni are among the more common species of powdery mildews.

Rare Species:

A few species are rarely found on the arboretum, among which are: Poria obliqua, found on one occasion on the inside of a hollow maple tree; Polyporus guttulatus, found but once during the year; Polyporus caesius, of which only two specimens were found, one on Douglas fir and one on oak; two Pleurotus species - algidus and sapidus on alder; and a mushroom, Tricholma amarum, of each of which only one collection was made.

Other Notes:

Certain wood rots which are generally common in older Douglas fir stands are uncommon on the arboretum. Among those species conspicuous by their scarcity are: Trametes

pini, Polyporus sulphureus, Polyporus schweinitzii, and Fomes officinalis. Altho these species occur they are not abundant or even common. Polyporus sulphureus is not uncommon on oak but was not collected on Douglas fir on the tract. There are a few concentrations of Trametes pini on the tract, but in small quantities on small, dead, standing Douglas fir trees. Some ~~is~~ are found on wolf trees scattered over the arboretum.

Ganoderma oregonense and Fomes applanatus are found almost exclusively along creeks and in moist localities. Fomes applanatus was found on five different host plants.

The Phycomycetes were not collected because of the difficulty of preserving the specimens and the relative unimportance of this group of fungi.

Collection

The collection of 101 specimens, made during the year, is classified and each specimen is recorded in order of classification.

ASCOMYCETES

In this group of fungi many leaf spots and leaf diseases were collected.

A. Plectomycetes:

1. Erysiphales:

a. Erysiphaceae:

The three leaf diseases found under this family are:

Microsphaera alni (D. C.) Wint.

No. 3 - Collected on Alnus rubra Bongard, October 9, 1931.

Notes: Common on alder leaves along creeks. Found in the fall as long as the leaves last.

Phyllactinia corylea (Pers.) Karst.

Nos. 5, and 8 - Collected on Corylus californica (A. DC.) Rose, and Cornus nuttallii Audubon, October 9, 1931.

Notes: Common on leaves of hazel and dogwood. Remaining on the leaves until they decay in the winter.

Uncinula salicis (D. C.) Wint.

No. 26 - Collected on Salix sp., November 4, 1931.

Notes: Common on willow along creeks and on moist slopes over the arboretum. Found until leaves decay.

B. Discomycetes:

1. Pezizales:

a. Mollisiaceae:

Four collections were made under this family.

Dasyscypha bicolor (Bull. ex Fr.) Fckl.

No. 13 - Collected on Rubus parviflorus Nutt., October 23, and December 21, 1931.

Notes: Common on dead stalks of thimleberry. Found thruout the year.

Dasyscypha sp.

Nos. 34, and 100 - Collected on Pseudotsuga taxifolia Britton, November 4, 1931, and March 5, 1932.

Notes: Uncommon on canker-like wounds on young trees and on small twigs of slash.

Lachnellula sp.

No. 11 - Collected on Ribes sanguineum Pursh, October 23, 1931.

Notes: Not uncommon on dead stems of this wild currant.

2. Helvellales:

a. Helvellaceae:

Helvella crispa (Scop.) Fries

No. 23 - Collected on Duff of forest floor, November 3, 1931.

Notes: Not uncommon for a short time in late October and early November.

3. Phacidiales:

a. Phacidiaceae:

Rhytisma arbuti Phill.

No. 71 - Collected on Arbutus menziesii Pursh, December 21, 1931.

Notes: Uncommon on leaves of madrone. Found until late spring.

Rhytisma punctatum (Pers.) Fries

No. 4 - Collected on Acer macrophyllum Pursh, October 9, 1931.

Notes: Abundant. Found on leaves of broadleaf maple wherever the trees are found. Remains until leaves are decayed.

4. Hysteriales:

a. Hysteriaceae:

Lophodermium pinastri (Schrod. ex Fr.) Chev.

No. 35 - Collected on Pinus resinosa Aiton, November 4, 1931.

Notes: Abundant on dead needles of young pines planted Southwest of the cabin.

C. Pyrenomycetes:

1. Hypocreales:

a. Gnomoniaceae:

Gnomonia coryli (Batsch. ex Fries) Awd.

No. 9 - Collected on Corylus californica (A. DC.) Rose, October 10, 1931.

Notes: Uncommon on leaves of hazel just before they drop in the fall.

b. Nectriaceae:

Nectriella sp.

No. 95 - Collected on Acer circinatum Pursh, February 7, 1932.

Notes: Not uncommon on bark of vine-maple wherever this tree species occurs on the arboretum.

BASIDIOMYCETES

The most specimens were collected under this group of fungi.

A. Autobasidiomycetes:

1. Hymenomycetales:

a. Thelephoraceae:

Corticium vagum Berk. and Curt.

No. 25 - Collected on Pinus resinosa Aiton, November 4, 1931.

Notes: Common on root-collar of dead transplanted

pines of this particular species.

Peniophora sanguinea Fr.

No. 48 - Collected on Pseudotsuga taxifolia Britton, November 27, 1931.

Notes: Uncommon on bark of Douglas fir slash and logs. Found in November and December.

Stereum hirsutum (Willd.) Fr.

Nos. 6, 62, and 63 - Collected on Corylus californica (A. DC.) Rose, Arbutus menziesii Pursh, and Acer macrophyllum Pursh, October 9, and December 21, 1931.

Notes: Common on deciduous host plants. Fruiting-bodies are plentiful wherever the disease is found.

Stereum rameale Schw., Natur.

No. 17 - Collected on Pseudotsuga taxifolia Britton, October 24, 1931.

Notes: Uncommon on dead Douglas fir slash and logs.

Stereum sp.

No. 61 - Collected on Corylus californica (A. DC.) Rose, December 21, 1931.

Notes: Not uncommon on dead hazel branches.

Stereum velleneum Berk.

Nos. 14, and 15 - Collected on Quercus garryana Douglas, and Acer macrophyllum Pursh, October 23, 1931.

Notes: Common on these two host species. Found mostly on twigs and limbs.

Thelephora sp.

No. 66 - Collected on Duff of forest floor, December 21, 1931.

Notes: Uncommon, found along roads where duff is shallow. Very disagreable odor.

b. Clavariaceae:

Clavaria cristata (Holmsk.) Fries

No. 65 - Collected on Moist forest floor, December 21, 1931.

Notes: Common in moist places. Found thruout the winter. Edible.

c. Hydnaceae:

Hydnum erinaceus (Bull.) Fries

No. 80 - Collected on Quercus garryana Douglas, December 23, 1931.

Notes: Rare. Found on dead down oak tree. Sporophores last only a short time. Edible.

Irpex deformis Fr.

No. 96 - Collected on Quercus garryana Douglas, March 5, 1932.

Notes: Uncommon on dead oak limbs and slash. Found only in early spring.

d. Agaricaceae:

Practically all specimens of this family were collected on the duff of the forest floor.

Amanitopsis vaginata (Bull.) Roze.

No. 42 - Collected on Duff of forest floor, November 20, 1931.

Notes: Common. Found thruout the fall until early December. Edible.

Armillaria mellea (Fries) Quelet.

No. 37 - Collected on Quercus garryana Douglas, November 7, 1931.

Notes: Common on stumps of oak and around bases of dead oak trees. The sporophores were gone by the latter part of November.

Clitocybe ochropurpureum Berk.

No. 52 - Collected on Duff of forest floor, November 30, 1931.

Notes: Uncommon. Occurs in small areas under dense shade.

Hypholoma fasciculare (Huds.) Fr.

No. 19 - Collected on Pseudotsuga taxifolia Britton, October 24, 1931.

Notes: Abundant on down Douglas fir logs over the tract. Sporophores most abundant in November.

Hypholoma sp.

No. 59 - Collected on Duff of forest floor, December 15, 1931.

Notes: Uncommon and inconspicuous. Bitter.

Lactarius sp.

No. 60 - Collected on Duff of forest floor, December 15, 1931.

Notes: Not uncommon. Occurs in November and December. Acrid.

Lenzites sepiaria Fries

No. 28 - Collected on Pseudotsuga taxifolia Britton, November 4, 1931.

Notes: Common on burned logs and stumps of Douglas fir. Sporophores found thruout the year.

Lepiota clypeolaria (Bull.) Fries

No. 54 - Collected on Duff of forest floor, December 5, 1931.

Notes: Common. Abundant in restricted areas under Douglas fir canopy. Edible.

Lepiota naucina Fries

No. 38 - Collected on Mineral soil in forest nursery, November 10, 1931.

Notes: Abundant in the nursery for about a week in early November. Edible.

Pleurotus algidus Fr.

No. 10 - Collected on Alnus rubra Bongard, October 15, 1931.

Notes: Rare. The only collection made was this one specimen.

Pleurotus sapidus Kalch.

No. 74 - Collected on Alnus rubra Bongard, December 22, 1931.

Notes: Rare. Only this one collection was made during the entire year.

Pleurotus sp.

No. 44 - Collected on Quercus garryana Douglas, November 21, 1931.

Notes: Uncommon on oak logs and stumps. This sporophore is found only in late November and early December.

Russula spp.

Nos. 36, and 57 - Collected on Duff of forest floor, November 5, and December 10, 1931.

Notes: Common along trails where moles have exposed mineral soil. Not poisonous but unpleasant. Species of collection No. 57 is rare.

Schizophyllum commune Fries

No. 81 - Collected on Alnus rubra Bongard,

February 7, 1932.

Notes: Not uncommon on deciduous species along creek bottoms and in moist places.

Stropharia ambigua (Peck) Zeller

No. 45 - Collected on Duff of forest floor, November 25, 1931.

Notes: Common. Occurs in large numbers over small areas, in dense shade.

Tricholma amarum (A. & S.) Quel.

No. 43 - Collected on Duff of forest floor, November 20, 1931.

Notes: Rare. Found only in November on the arboretum. Very bitter.

e. Polyporaceae:

This family contains the bulk of the collection.

Fomes applanatus (Pers.) Fries

Nos. 47,72,85,88, and 89 - Collected on Quercus garryana Douglas, Pseudotsuga taxifolia Britton, Alnus rubra Bongard, Abies grandis Lindley, and Acer macrophyllum Pursh, November 27, and December 22, 1931, and February 7, 1932.

Notes: Common on oak stumps and logs. Found occasionally on other hosts along creeks and in moist places. Sporophores found thruout the year. Forms a white rot.

Fomes ferruginosus (Schrod.) Massee.

Nos. 39, 77, 86, and 87 - Collected on Corylus californica (A. DC.) Rose, Prunus emarginata (Doug.) Walp., Alnus rubra Bongard, and Quercus garryana Douglas, November 12, and December 23, 1931, and February 7, 1932.

Notes: Abundant on dead oak, and common on hazel. Not uncommon on alder and cherry. Found thruout the year wherever dead oak is found.

Fomes officinalis Fries (F. larigis Murrill)

No. 75 - Collected on Pseudotsuga taxifolia, Britton, December 23, 1931.

Notes: Uncommon on the arboretum. Found only on wolf-trees of Douglas fir.

Fomes pinicola Fries

Nos. 33, and 92 - Collected on Pseudotsuga taxifolia, and Abies grandis Lindley, November 4, 1931, and February 7, 1932.

Notes: Abundant on the arboretum. Found on Douglas fir trees, logs, stumps and slash. Found thruout the year. Forms a cubical brown rot.

Ganoderma oregonense Murrill

Nos. 7, and 78 - Collected on Pseudotsuga taxifolia Britton, and Duff of forest floor near base of a Douglas fir tree, October 9, and December 23, 1931.

Notes: Uncommon on slash and down timber. Found in moist localities. Sporophores from September to January.

Merulius corium Fr.

Nos. 94, and 99 - Collected on Acer macrophyllum Pursh, February 7, and March 5, 1932.

Notes: Uncommon on dead limbs of bigleaf maple. Found from February to May.

Polyporus caesius Schroder ex Fries

Nos. 22, and 83 - Collected on Pseudotsuga taxifolia Britton, and Quercus garryana Douglas, October 24, 1931, and February 7, 1932.

Notes: Rare. These were the only collections, of this species, made on the arboretum in this study. Found on dead and decayed oak and Douglas fir.

Polyporus fragilis Fries

No. 82 - Collected on Pseudotsuga taxifolia Britton, February 7, 1932.

Notes: Uncommon on logs of Douglas fir, along creeks and other moist places. Found in February and March.

Polyporus guttulatus Peck.

No. 70 - Collected on Pseudotsuga taxifolia Britton, December 21, 1931.

Notes: Rare. But one collection of this fungus was made.

Polyporus osseus Kalchbreuner

No. 69 - Collected on Pseudotsuga taxifolia Britton, December 21, 1931.

Notes: Not uncommon on sawed ends of Douglas fir logs. Found in November and December.

Polyporus picipes Fries

No. 20 - Collected on Quercus garryana Douglas, October 24, 1931.

Notes: Common on dead oak stumps and logs, found on duff, and on alder. Sporophores found from September to May.

Polyporus schweinitzii Fries

No. 64 - Collected on Pseudotsuga taxifolia Britton, December 21, 1931.

Notes: Not uncommon around bases of old snags and wolf-trees of Douglas fir. Sporophores occur in the summer and early fall.

Polyporus sulphureus Bulliard ex Fries

Nos. 1, and 49 - Collected on Quercus garryana Douglas, October 9, and November 27, 1931.

Notes: Not uncommon on dead oak trees, logs, and stumps. Sporophores are in their prime in October. Specimens collected in late November were decayed.

Polyporus volvatus Pk.

No. 97 - Collected on Pseudotsuga taxifolia Britton, March 5, 1932.

Notes: Uncommon on logs of Douglas fir. Found only in the spring.

Polystictus abietinus (Dicks.) Fries

No. 21 - Collected on Pseudotsuga taxifolia Britton, October 24, 1931.

Notes: Abundant on logs of Douglas fir. Found thruout the year.

Polystictus hirsutus (Wulf.) Fries

Nos. 79, and 93 - Collected on Prunus emarginata Walpers, and Alnus rubra Bongard, December 23, 1931, and February 7, 1932.

Notes: Uncommon on the arboretum, usually found on deciduous hosts along creek bottoms. Forms a white rot.

Polystictus versicolor (L.) Fries

Nos. 2, 18, 32, 84, and 101 - Collected on Quercus garryana Douglas, Pseudotsuga taxifolia Britton, Fraxinus oregona Nuttall, and Crataegus douglasii Lindley, October 9, and 24, and November 4, 1931, and February 7, and March 30, 1932.

Notes: Common on dead oak and Douglas fir. Sporophores are plentiful thruout the entire year.

Poria obliqua (Pers.) Quel.

No. 90 - Collected on Acer macrophyllum Pursh, February 7, 1932.

Notes: Rare on bigleaf maple. Found on one tree only, on the arboretum. Persistant thruout the year.

Poria subacida (Pk.) Sacc.

No. 91 - Collected on Pseudotsuga taxifolia Britton, February 7, 1932.

Notes: Uncommon on very rotten Douglas fir logs along creeks and in moist places.

Trametes heteromorpha (Fr.) Lloyd.

No. 98 - Collected on Pseudotsuga taxifolia Britton, March 5, 1932.

Notes: Uncommon on dead Douglas fir logs and slash. Found in early spring only.

Trametes pini (Thore.) Fries

No. 24 - Collected on Pseudotsuga taxifolia Britton, November 4, 1931.

Notes: Not uncommon. Found in three restricted areas in old trees and dead second-growth Douglas fir. Sporophores found thruout the year.

Trametes subrosea Weir

No. 16 - Collected on Pseudotsuga taxifolia Britton, October 24, 1931.

Notes: Common over the arboretum on dead Douglas fir wood. Found in living trees wherever broken tops and forked tops are found, also common on stumps and broken logs of Douglas fir.

2. Gasteromycetales:

a. Lycoperdaceae:

Geaster hygrometricus (Pers.) Morgan

No. 67 - Collected on Mineral soil on grass land, December 21, 1931.

Notes: Uncommon. Found on mineral soil in grassy glades and open grass knolls. Sporophores found thruout the year.

b. Nidulariaceae:

Crucibulum vulgare Tul.

No. 76 - Collected on Quercus garryana Douglas, December 23, 1931.

Notes: Common on various dead material on the ground and in moist places.

FUNGI IMPERFECTI

The only specimens collected in this group were three leaf diseases.

A. Hyphomycetales:

1. Dematiaceae:

Virgaria sp.

No. 68 - Collected on *Abies grandis* Lindley, December 21, 1931.

Notes: Not uncommon on needles of white fir all-over the arboretum.

B. Sphaeropsidales:

1. Sphaerioidaceae:

Phyllosticta spp.

Nos. 12, and 73 - Collected on *Fraxinus oregona* Nuttall, and *Taxus brevifolia* Nuttall, October 23, and December 22, 1931.

Notes: Common on leaves of ash. Persisting until leaves decay. Common on leaves of yew, causing considerable defoliation.

Unidentified Fungi

Thirteen specimens collected in the fall could not be identified. Nine belonged to the Agaricaceae and four to other groups.

The Host Plants

The host plants are alphabetically arranged with the fungi, found on them, arranged alphabetically for each host.

Abies grandis

- *Fomes applanatus*
- *Fomes pinicola*
- *Virgaria* sp.

Acer circinatum

- *Nectriella* sp.

Acer macrophyllum

- *Fomes applanatus*
- *Merulius corium*
- *Poria obliqua*
- *Rhytisma punctatum*
- *Stereum hirsutum*
- *Stereum velleneum*

Alnus rubra

- *Fomes applanatus*
- *Fomes ferruginosus*
- *Microsphaera alni*
- *Pleurotus algidus*
- *Pleurotus sapidus*

Polystictus hirsutus

Schizophyllum commune

Arbutus menziesii

Rhytisma arbuti

Stereum hirsutum

Cornus nuttallii

Phyllactinia corylea

Corylus californica

Fomes ferruginosus

Gnomonia coryli

Phyllactinia corylea

Stereum hirsutum

Stereum sp.

Crataegus douglasii

Polystictus versicolor

Duff of forest floor

Amanitopsis vaginata

Clitocybe ochropurpureum

Ganoderma oregonense

Helvella crispa

Hypholoma sp.

Lactarius sp.

Lepiota clypeolaria

Russula spp.

Stropharia ambigua

Thelephora sp.

Tricholma amarum

Fraxinus oregona

Phyllosticta sp.

Polystictus versicolor

Mineral soil

Geaster hygrometricus

Lepiota naucina

Moist forest floor

Clavaria cristata

Pinus resinosa

Corticium vagum

Lophodermium pinastri

Prunus emarginata

Fomes ferruginosus

Polystictus hirsutus

Pseudotsuga taxifolia

Dasyscypha sp.

Fomes applanatus

Fomes officinalis

Fomes pinicola

Ganoderma oregonense

Hypholoma fasciculare

Lenzites sepiaria

Peniophora sanguinea

Polyporus caesius

Polyporus fragilis

Polyporus guttulatus

Polyporus osseus

Polyporus schweinitzii

Polyporus volvatus

Polystictus abietinus

Polystictus versicolor

Poria subacida

Stereum rameale

Trametes heteromorpha

Trametes pini

Trametes subrosea

Quercus garryana

Armillaria mellea

Crucibulum vulgare

Fomes applanatus

Fomes ferruginosus

Hydnum erinaceus

Irpex deformis

Pleurotus sp.

Polyporus caesius

Polyporus picipes

Polyporus sulphureus

Polystictus versicolor

Stereum velleneum

Ribes sanguineum

Lachnellula sp.

Rubus parviflorus

Dasyscypha bicolor

Salix sp.

Uncinula salicis

Taxus brevifolia

Phyllosticta sp.

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