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A COMPARISON OF A SCLEROTINA FOUND ATTACKING
APRICOT FRUITS IN CALIFORNIA WITH VARIOUS
AMERICAN AND EUROPEAN FRUIT SCLEROTINIAS

EDITH M. PHILLIPS

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dissect

study in



painted 1/2/15
canker of Barthelet Pear

x1

from material brought
into lab. 12/19/14
& kept in water

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**A COMPARISON OF A SCLEROTINA FOUND ATTACKING
APRICOT FRUITS IN CALIFORNIA WITH VARIOUS
AMERICAN AND EUROPEAN FRUIT SCLEROTINIANS.**

By

Edith H. Phillips

April, 1918
Berkeley, California

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A COMMITTEE OF AGRICULTURAL EXPERTS
HAS BEEN APPOINTED TO INVESTIGATE THE
PROBLEM OF THE AGRICULTURAL SECTOR
AND TO REPORT TO THE GOVERNMENT.

WALTER H. BRIDGES

1911
Bureau of Agriculture

SB 733
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I. The Problem.

During the past few years the brown rot fungus, a species of *Sclerotinia*, has grown increasingly important in the central coast regions of California largely because of its parasitic attacks upon apricot trees and blossoms. The ripening fruit is likewise often attacked. This fungus occurring in California is locally called *Sclerotinia fructigena*, but should it be called by this name or by a different name? It was to find definitely if possible the answer to the above question that I undertook the experimental work later described.

II. History of species and present status of the species question.

a. In Europe.

Persoon (1) in 1796 gives the following description of a fruit rot fungus:

Torula fructigena: cinero-albida, subrotunda, filorum articulis ovatis.

Hab. in variis fructibus putridis Pruni domesticae Amygd. Persicae, autumnno praecipue frequens in piris putridis, caespitulos crassos subrotundus efficiens. Obs. Fila in novo hocce genere nec in capitula stipitata colliguntur, qualia exhibent Moniliae negue digitiformia trunco imposita, uti in genere Aspergillo locum obtinet, and articulata; articulis deciduis, and glabra simplicissima sunt, quae in Dematio non observantur.

The above may be translated:

Torula fructigena: grayish-white, nearly round, egg-shaped united in chains.

Habitat: in various fruits of the domestic plum when decaying, peach, in autumn especially frequent in decaying pears, producing nearly round thick knobs.

Observation. There are chains in this new kind and they are not collected into crowded heads in like manner to the Monilia, and not like finger-like forms imposed on a trunk, as takes place in the Aspergillus form, and they are articulated: the articulations separate and are smooth and very simple, which are not observed in Dematium.

His color term cinero-albida seems to refer to the color of the spores under the microscope, and not to the color of the fungus on the fruit as seen by the unaided eye. "Nearly round thick knobs" is his most definite morphological description. When he says, "There are chains in this new kind and they are not collected into crowded heads, etc." he seems to be referring again to the appearance of the fungus under the microscope. His description of his group Monilia is not very enlightening.

Monilia. Erecta, filis moniliformibus capitulum constituentibus.

His description of Torula is just as vague.

Torula. Acaulis, fila moniliformia intricata, indeterminata effusa.

Persoon changed the name of this fungus from Torula to Monilia and Monilia it remained for 100 years, or until the Monilia form was found to be an imperfect stage of a Sclerotinia.

Female Insects: Group - Ants, mostly found, and -

found in...

...in various parts of the country from the mountains, beach,

in various especially frequent in the mountains, producing mostly

found with...

...Ants are found in this...

collected into the...

the...

...Ants are found in...

Ehrenberg (2) in 1818 gives the following:

Moniliae

Oideum Lk.

laxum mihi 4) inpruno armeniaco putrido

4) OIDEUM laxum: floccis erectis divergentibus pallido cinereis; articulis rarius confluentibus pellucidis magnis. Habitu et colore ab *O. fructigena* Schmidt valde differt, cujus specimina, in herbario nostro servata, ab ipso amico Dr. Schmidt examinata sunt. Noster fungus Sporotrichum fere refert

Ehrenberg's description may be translated:

Moniliae

Oideum Lk.

laxum mine 4, in decaying apricots

4) OIDEUM laxum: tufts erect diverging pale ashen; spores large, pellucid, rarely holding together. Habit and color which differs exceedingly from *O. fructigena* Schmidt, whose specimens, which have been preserved in our herbarium, have been examined by Dr. Schmidt himself. Our fungus is closely related to Sporotrichum.

The first part of this description seems to be the only part of much value. Ehrenberg seems to describe a fungus different from the one Persoon describes, the difference apparently lying in the morphological appearance of the conidial pustules.

According to Aderhold and Ruhland (3) the name *Oideum laxum* was changed to *Oospora laxa* by Wallroth in 1833, and was later determined by Saccardo and Voglina as *Monilia*.

... in 1818 gives the following

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Bonorden (4) in 1851 claims to have found another fruit rot fungus which he calls Monilia cinerea and describes it as follows:

Monilia cinerea N; Kommt auf faulenden Früchten vor und hat graue Hyphen und unregelmässig - elliptische Sporen. Bildet kleine graue, etwas bräunliche Büschel oder Häufchen deren Mycelium in den Früchten (Kirschen) sehr leicht beobachtet werden kann, wenn man seine perpendikuläre Schnitte davon unter das Mikroskop bringt. Das Mycelium besteht aus artikulirten Fäden, welche sich Ästig in den Zellen der Frucht verbreiten und mit spitzen, nicht septirten, im Inneren Körnigen, frei in die Zellen hineinragenden Faden endigen.

The above may be translated as follows:

Monilia cinerea Mine; habitat on decaying fruits. Hyphae gray; spores irregularly elliptical; sporodochia small, gray, somewhat brownish; mycelium from which sporodochia are produced is readily seen in vertical sections of the fruit (cherries). Mycelium of septate filaments which spread, branching in the cells of the fruit, and end in free filaments containing granular contents within the cells.

Saccardo (5) in 1886 mentions the three species of Monilia, fructigena, laxa and cinerea and besides these gives two varieties of M. fructigena, var. syconophila and var. candida.

Monilia fructigena Pers. Oidium fructigenum Link, Torula fructigena Pers. caespitulis compactiusculis, pulvinatis, saepe circinantibus confluentibusque, tomentosis, albidis dein carneo-ochraceis, hyphis fasciculatis breve ramosis; conidiis longe ramoso-catenulatis, ovoidis v. oblongis 25 10-2 e hyalino carneolis.

Hab. in fructibus Piri, Mali, Persicae. Armeniacae in Germania, Gallia, Italia, Britannia, Belgio, Austria, America bor.

Var. syconophila. Cfs. Rabenh. Flora 1850 p. 632

conidiis acutionibus; caespitulis subaurantiacis. In fructibus Fici sicciae Casamicciola Ital. austri.

Var. candida Walk (sub Oospora): caespitulis candidis. Ad poma sub die putrescentia in Thuringia. An haec var. mera typi forma junior? Sporotrichum fructigenum Link. videtur quoque status infans.

Monilia cinerea Bon. caespitulis minutis, cinereis compactiusculis; hyphis cinereis ramulosis septatis; conidiis irregulare ellipsoideis v. saepius limoniiformibus, 15-17- 10-12, e concreto hyalinis, longe concatenatis.

Hab. in fructibus putrescentibus Pruni Cerasi in Germania et Italia.

Monilia laxa Walk Sacc. et Vogl., Oospora laxa Walk., Oidium laxum Ehrenb., Acrosporium laxum Pers., conidiis catenatis, erectiusculis, divergenti-ramosis, dense aggregatis, griseis in articulos (conidia) singulos, ovaes secedentibus.

Hab. in fructibus putridis Pruni Armeniacae in Germania (Ehrenberg)

"An diversa a M. cinerea Bon?"

The foregoing descriptions by Saccardo may be translated thus:

Monilia fructigena Pers. Oidium fructigenum Link, Torula fructigena Pers. spore masses more or less compact, cushion-shaped, often rounding and confluent, hairy, whitish then flesh color with ochre yellow, hyphae bunched, with short branches; conidia in long branching chains, egg-shaped or oblong 25 x 10 -12 microns, from transparent to flesh color (carneolis).

Habitat. in the fruit of pears, apples, peaches and apricots in

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Germany, France, Italy, England, Belgium, Austria and North America.

Var. syconophila. Cfr. Rabenh. Flora 1850 p. 632:

with rather pointed conidia; spore masses shading into orange.

On the dried fruits of the fig in Casamicciola, southern Italy.

Var. candida Walk (sub Oospora): spore masses white. In fruit (apple) rotting in the open in Thuringia. "Is this variety an early form of the genus? - one will recall that Sporotrichum fructigenum Link seems also an undeveloped form."

Monilia cinerea Bon. minute tufts, ashy (colored) more or less compacted; hyphae ashy (colored), branching, septate; conidia irregularly ellipsoidal or more frequently lemon-shaped, 15-17 x 10-12 microns, from ashy to transparent, in long connected chains.

Hab. in rotting cherry fruits in Germany and Italy.

Monilia laxa (Walk) Sacc. et Vogl., Oospora laxa Walk. Oidium laxum Ehrenb. Acrosporium laxum Pers. with conidia in chains, more or less erect, branching divergently, thickly clustered, ashy (colored) separating into single oval spores.

Hab. in rotten fruit of the apricot in Germany (Ehrenberg) "Is this Monilia different from M. cinerea?"

In general Saccardo's descriptions, with their names, agree with the descriptions of the three forms already given.

Woronin (6) in 1900 definitely establishes two species of Sclerotinia, which he calls Sclerotinia fructigena and Sclerotinia cinerea. At that time none of the apothecia of any of the fruit rot Monilias had been found and described, but Woronin was so sure that the forms he was

Germany, France, Italy, England, Belgium, Austria and North America
The following are the names of the countries mentioned in the text:

Germany, France, Italy, England, Belgium, Austria and North America
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working with were really the imperfect stages of a Sclerotinia that he called the two forms Sclerotinia fructigena and Sclerotinia cinerea instead of Monilia fructigena and Monilia cinerea.

He gives for the average size of the conidia of Sclerotinia fructigena taken from the surface of naturally infected pears and apples, which have fallen to the ground, as 20.9 x 12.1 microns. The maximum measurements for conidia produced in the open he gives as 24.5 x 13.2 microns. In cultures on different favorable media the size of the conidia increases still more, reaching 20.7 - 30.8 x 14.9 - 16.5 microns.

Spores of Sclerotinia cinerea taken from leafy shoots of cherry and peduncles of cherry blossoms and from the surfaces of different stone fruits average 12.1 x 8.8 microns. He says however, that the size is not constant. The largest spores of Sclerotinia cinerea collected by him in the open measure 13.2 x 9.9 microns. Spores in cultures on different favorable media are larger, and measure usually 17.5 x 11.2 microns. Single spores he adds in the favorable culture media may reach even 24.2 x 13.2 microns.

Woronin found the most striking difference between these two forms to lie in the general form and color of the conidial pustules. Sclerotinia fructigena produced the compact knob-like yellowish pustules, while Sclerotinia cinerea produced the grayish more powdery pustules. See Plate 28 for copies of the color blocks appearing with Woronin's work.

Aderhold and Ruhland (3) in 1905 claim the distinction of rediscovering the species laxa. In their work they compare the apothecial stage of the species they call laxa with the apothecial stage

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of S. fructigena, and compare the conidial stage of their species with the conidial stage they call cinerea. The species they call laxa is quite distinct from S. fructigena, but in the final analysis about the only distinction between their S. cinerea and S. laxa is the fact that S. laxa occurs naturally on apricots, and S. cinerea on other stone fruits, especially cherries, although S. laxa is supposed to have somewhat larger conidia than their S. cinerea.

They also decide that the form attacking peaches and plums in North America is S. cinerea and not S. fructigena, as Norton calls it, for the following reasons:

1. Preserved asci and ascospores they obtained from Norton are somewhat smaller than the asci and ascospores of their above Sclerotinia laxa.

2. Because Smith, E.F. describes conidia occurring on the peach in the Eastern United States as ashen-gray.

The first reason they think bars Norton's species from laxa, the second reason from fructigena.

Following are the principal distinguishing characteristics of Sclerotinia fructigena as given by Aderhold and Ruhland (3):

of B. flavipes, and compare the combined range of B. flavipes with the combined range they call B. flavipes.

B. flavipes is quite distinct from B. flavipes, but in the final analysis about the only distinction between them is that B. flavipes is the form that B. flavipes occurs naturally as a species, and B. flavipes on other forms, especially B. flavipes, although B. flavipes is supposed to have somewhat larger numbers than their B. flavipes.

They also decide that the form B. flavipes is also in North America is B. flavipes and not B. flavipes, as B. flavipes is for the following reasons:

1. Preserved cast and neotype they obtained from B. flavipes somewhat smaller than the cast and neotype of their above B. flavipes.

2. B. flavipes Smith, 1875, described B. flavipes occurring in the West in the Western United States as B. flavipes. The first reason they think B. flavipes is a species from B. flavipes, the second reason from B. flavipes.

Following are the principal distinguishing characteristics of B. flavipes as given by B. flavipes and B. flavipes (3):

Table I. Showing principal distinguishing characteristics of Sclerotinia fructigena, Sclerotinia laxa, and Sclerotinia cinerea as given by Aderhold and Ruhland.

Species	Ascospores (microns)	Conidial tufts	Asci (microns)	Habitat
<u>S. fructigena</u>	11-12.5 x 5.6 -6.8 pointed, without oil drops	yellow, larger	120-180 x 9x12	pomes
<u>S. laxa</u>	11.5-13.5 x 5.2-6.9 blunt, often with small oil drops	gray smaller	121.5-149.9x8.5- 11.8	apricot
<u>S. cinerea</u>	6.2 -9.3 x 3.1 - 4.6 blunt	gray smaller	8.9-107.6 x 5.9- 6.8	stone fruits

The foregoing measurements for Sclerotinia cinerea were made from apothecia on a peach mummy sent to Aderhold and Ruhland by Norton, the measurements for Sclerotinia fructigena and Sclerotinia laxa were made from material obtained in their own country.

Masse (7) 1910 gives only one name, and that Sclerotinia fructigena, to the form that attacks apples, cherries, plums and peaches in England. He says that the fungus fruits are grayish-white or whitish. He describes the Monilia stage as follows:

"tufts consisting of simple or branched chains of ovoid or lemon-shaped hyaline spores, 21-25 x 10-12 microns."

The sizes of the spores here given correspond more nearly to the

Table 1. Chemical analysis of the residues of Polystyrene and Polystyrene with styrene copolymer by means of gas chromatography and mass spectrometry.

Sample	Residue	Retention Time (min)	Mass Spectrum
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104
Polystyrene	Styrene	11.2-12.2 x 0.2-0.3	Styrene, m/e 104

The following measurements for Polystyrene and Polystyrene with styrene copolymer were made from the data on a gas chromatograph and mass spectrometer. The measurements for Polystyrene and Polystyrene with styrene copolymer were made from the data obtained in their own runs. Source (1) lists only one peak, and the Polystyrene and Polystyrene with styrene copolymer to the fact that the other, smaller, peak was not detected. He says that the larger peak was probably due to styrene. He describes the results as follows:

"Data consisting of single or grouped peaks of single or double peaked peaks are shown in Table 1. The size of the peaks and their retention times are given in the following table."

sizes given by Saccardo for fructigena than for cinerea, but the color of the spores corresponds more nearly to cinerea than fructigena.

Wormald (8) 1917 in studying the classification of Monilias distinguishes four types of Monilia as found on cultivated fruit trees of the genera Pyrus and Prunus. He used prune juice agar plate cultures, and cultures on steamed potato in Roux' tubes as a basis for his classification, which is given below.

Prune juice agar
plate cultures

Cultures on steamed
potato in Roux tubes

<p>(1) <u>Monilia fructigena</u> occurring commonly on apples and plums and frequently on sweet cherries</p>	<p>Margin almost entire or lacinate; no known coloration; conidia absent</p>	<p>Conidial tufts yellow, well-developed at upper end of potato, forming raised zones</p>
<p>(2) Blossom wilt <u>Monilia</u> of the apple, also occurring occasionally on plums</p>	<p>Margin with deltoid or flabelli form lobes, growth usually arrested about midway between center and side of plate, and new outgrowths as flabelli-form lobes develop usually from the sinuses; olive green to brown zones appear, the first usually at 0.5 to 1 cm. from the center; conidia absent</p>	
<p>(3) A grey <u>Monilia</u> frequent on plums and sweet cherries</p>	<p>As above but no brown zones appear</p>	<p>conidial tufts grey more numerous than in (2) often appearing in concentric circles around point of inoculation.</p>
<p>(4). American form of <u>Monilia</u>.</p>	<p>Margin entire or crenate; conidial tufts numerous, usually in concentric circles; brown coloration of the agar absent or appears as a peripheral band near the edge of the plate; growth generally more rapid than in (2) or (3) and more uniform</p>	<p>Conidial tufts grey, almost covering the whole surface in a continuous layer.</p>

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Sclerotina fructigena is the only form to which he gives a specific name. In his summary however he says in part:

"The causal organism is a grey Monilia easily distinguished from M. fructigena; at present it is to be referred to Monilia cinerea Bon.

On culture media the habit of the fungus is different from that of the grey Monilia (also referred to M. cinerea by American workers) which is commonly found in North America."

b. In the United States

Smith (9) in 1889 states that Monilia fructigena causes a destructive rot of peach fruit and blight of young peach branches in the orchards of Delaware and Maryland. He says,

"In the fungus the common mode of propagation from peach to peach, and the only known one, is by means of ash-gray conidia, which are produced in great numbers on the brown surface of the affected parts. These spores generally occur in little hemispherical tufts or confluent masses on bundles of hyphal threads which have burst through the skin of the peach."

Smith says that he first discovered the blight in the summer of 1887 in Delaware. He also says that this fungus occurs destructively on peaches, apricots, plums and cherries, and to some extent also on apples, pears, and quinces.

Cordley (10) in 1899 gives the name Monilia fructigena to the form occurring on prunes, cherries, peaches, apples, pears and quinces in Oregon. As to color he says:

"In passing through almost any of our prune orchards when the green fruit is being picked, or even earlier, one may see here and there a

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prune that is partly or wholly covered with this ash-grey or blue-gray 'mold' On cherries and peaches As the disease spreads the surface of the diseased tissues becomes covered with the characteristic ash-grey conidial tufts. In apples, pears, and quinces the disease spreads in much the same way but more slowly, and usually with a less abundant spore formation."

He says that the name of this fungus was determined in 1895 by means of prune specimens.

Norton (11) in 1902 changes the name of the form found in Maryland peach and plum orchards from Monilia fructigena to Sclerotinia fructigena, after definitely connecting the Monilia stage with a perfect stage. Norton says that the asci and paraphyses are of the usual form of the Pezizaceae and of the genus, and that the asci are 45-60 microns long and 3-4 microns wide with 8 spores in the apical half. He also says that cultures obtained from the ascospores produced the characteristic yellowish gray conidia of Monilia fructigena.

The question of the identification of species has interested several workers in this country, they no doubt being stimulated by the work of Worozin, Aderhold and Ruhland and other European workers. But our workers seem to have given little consideration to the possible Sclerotinia laxa, or, disregarding the specific names, to the fact that there may be more than two specific, economic fruit rot Sclerotinias. It will be remembered that Norton called the form he studied fructigena.

Read (12) in 1908 calls the form he has collected on various hosts fructigena. The measurements of the asci he gives as 125-215 x 7-10 microns.

... that is partly or wholly covered with the same grey or blue-grey
 ... on the surface and ... as the ...
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The spores he says are ellipsoid, ends round or less pointed, hyaline, often containing refractive granules, and measure 10-15 x 5-8 microns. The measurements of chlamydospores, conidia, he gives as 10-28 x 7-17 microns, mostly 7 x 11 microns. He gives the color of the pustules as at first cinereous, later on cherries and plums becoming ochraceous-buff to Isabella color (R), on peaches even drab to Isabella color (R), on pears and apples acquiring a blackish tinge. He says also they are lemon-shaped, continuous, hyaline, inarticulate di - or trichotomously branched chains without disjunctors.

Reade's description seems to fit better into Aderhold and Ruhland's description of S. laxa than their description of S. fructigena. S. fructigena is supposed to have ascospores pointed at both ends, which do not contain granules or oil drop.

Mathney (13) in 1913 decides that the American brown-rot fungus is Sclerotinia cinerea and not Sclerotinia fructigena. He knows of Aderhold and Ruhland's work dealing with the three species, fructigena, laxa and cinerea but he evidently does not consider laxa very seriously.

Mathney's general averages of ascospore measurements taken from Connecticut, Massachusetts, Maryland, New York, Indiana, and Wisconsin follow:

Host	Asci Microns	Ascospores Microns
Peach	135-190 x 6.9-10.5 mostly 163 x 8.9	10.5 -14.5 x 5.2-7.5 mostly 12.5 x 6
Plum	135-173 x 6.8-10.8 mostly 151x9.4	9.3-14.2 x 5-7.4 mostly 11.8 x 6.3

The average measurements for the American brown-rot conidia he gives as 14.7 x 9.9 microns. Conidia from California, Indiana, and New Hampshire and local conidia were used in getting these measurements. These measurements

The average of the measurements of the specimens of *Chrysomelids*, *Chrysomelids*, and *Chrysomelids*, as given in 10-22 x 7-17
 often containing reticulate granules, and measure 10-15 x 5-8 microns.
 The average of the measurements of the specimens of *Chrysomelids*, *Chrysomelids*, and *Chrysomelids*, as given in 10-22 x 7-17
 microns, mostly 7 x 11 microns. He gives the color of the granules as of
 first appearance, later on granules and gives becoming conspicuous until in
 granules color (B), on granules even dark to testaceous color (B), on granules
 granules appearing a pinkish tinge. He says also that they are in granules,
 granules, granules, granules, granules, granules, granules, granules, granules,
 without granules.

granules' granules granules to the granules that granules and granules
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 granules is suggested to have granules pointed at both ends, which do not
 contain granules or air granules.

granules (18) in 1892 granules that the granules granules granules in
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 granules' general averages of granules granules granules granules granules
 Connecticut, Massachusetts, Maryland, New York, Indiana, and Wisconsin

follow:

Length	Breadth	Weight
10.5-14.5 x 5.5-7.5	10.5-14.5 x 5.5-7.5	mostly 12.5 x 5
9.5-12.5 x 5-7.5	9.5-12.5 x 5-7.5	mostly 11.8 x 5.5

The average measurements for the granules granules granules he gives
 as 14.5 x 9.5 granules. Granules from granules, Indiana, and the granules
 and local granules granules in granules granules granules. These granules

might find a place either under Scleritinia cinerea or Sclerotinia laxa as given by Aderhold and Ruhland.

Mathney gives the color of the conidia of Sclerotinia fructigena as yellowish; of Sclerotinia cinerea as ash-gray.

c. In California

In California the brown rot fungus is called Sclerotinia fructigena. A strain, which is apparently typical of the California form is discussed more in detail under Experimental.

d. General Summary

I. There are three early virginal descriptions of fungi, all of which have finally been put into the genus Sclerotinia, which attack the common domesticated fruits. Vague though these descriptions be, Persoon, describing Torula fructigena in 1796, Ehrenberg describing Oideum laxum in 1818, and Bonorden describing Monilia cinerea in 1851 all seem to be describing different fungi.

II. That there are more than three forms of Sclerotinia, or Monilia as he calls them, that attack the common domesticated fruits is demonstrated by Wermald. He distinguishes four kinds. The only form he calls definitely by name is Sclerotinia fructigena.

III. There is great need for exact systematic work with standardized methods in order to determine the number of species of fruit rot Sclerotinias.

III. Experimental

a. Introductory - Obtaining of the various strains used in culture and inoculation work.

... of the ...

As apothecia¹ have never been reported in California and as they are often difficult to get in other places, the cultural work has been confined to the Monilia stage.

1. I searched in the spring of 1917 during the blossoming period of the apricot trees for apothecia of our fruit rot, Sclerotinia, and for apothecia of Sclerotinia libertiana. I brought to the laboratory from one orchard several of what I supposed to be Sclerotinia libertiana apothecia. These were all taken from the soil and none had any evident connection with a "mummy". Miss Smith (assistant professor of Plant Pathology at the University of California) placed these apothecia in a moist chamber with the adhering soil and considerable water. In a short time three apothecia showed to be slightly different from the typical Sclerotinia libertiana apothecia. They were somewhat darker and redder, a little coarser and tougher and more cup-shaped. Miss Smith used two of these apothecia to make rough cultures, first rinsing off the apothecium with distilled water and then planting a piece of it in a flask of bread and prune juice. From four flasks three apparently pure cultures of Monilia were obtained. Examination of the asci and ascospores of the other apothecium revealed a great ~~great~~ similarity to Sclerotinia libertiana asci and ascospores. The spores were somewhat larger than the spores of Sclerotinia libertiana and were inclined to be egg shaped, and possessed a ready ability to form a cross wall, and produce sterigmata and gonidia without first producing mycelium. Gonidia were sometimes produced directly by an ascospore without the interposition of a typical sterigma. The spores of Sclerotinia libertiana do not act this way, as far as I know. The above facts are extremely suggestive.

Other persons have searched for the apothecia of our fruit rot, Sclerotinia, but have not found them to their knowledge, apparently three of those mentioned above were apothecia of our fruit rot Sclerotinia. There seems to be some chance of confusing them with the often abundant apothecia of Sclerotinia libertiana.

In all I possessed sixteen strains of Sclerotinias. The word "strain" is here used for want of a better word.

In no case am I responsible for any of the following specific names. The cultures were so labeled before they were sent to me. Where a strain is not given a specific name, no name came with the culture. In the case of strains 1,7 and 8, the California strains, the specific names are not known.

Sclerotinia sp. designated as strain 1 was obtained in the following manner:

A ripe but undried French prune was inoculated without sterilizing with spores and probably mycelium from the surface of a naturally infected apricot. The spores which formed on the French prune were used to make three poured plates of standard nutrient agar. From one of these plates a pure single spore culture was obtained by constant watching under the microscope and transferring to fresh culture medium. This is the strain the name of which I desire to determine.

Westerdijk's Sclerotinia cinerea designated as strain 2 was obtained either from cherry or plum in Holland and forwarded to me by Dr. Johanna Westerdijk. In her letter accompanying this culture she says that this form was obtained from cherry, but the label on the culture says it was obtained from plum.

Westerdijk's Sclerotinia fructigena designated as strain 3 was obtained from apple in Holland and forwarded by Dr. Westerdijk along with strain 2.

English Sclerotinia fructigena designated as strain 4 was obtained at the Oregon Agricultural Experiment Station from a pear fruit sent to them by Dr. Salmon from Kent in England, and forwarded from Oregon here.

Oregon Sclerotinia cinerea designated as strain 5 was isolated at Corvallis, Oregon from an apple fruit.

Michigan Sclerotinia cinerea designated as strain 6 was obtained from an apothecium on a peach "mummy" Hart, Michigan. It was received through the Wisconsin Agricultural Experiment Station.

Apricot twig Sclerotinia designated as strain 7 was obtained in California during May from a small twig that had evidently been killed back during the previous blossoming period of the tree. It was not a single spore strain.

Apricot leaf Sclerotinia designated as strain 8 was obtained from a dead leaf at the time strain 7 was obtained. It was not a single spore strain.

Westerdijk's apricot Sclerotinia designated as strain 9 was isolated from conidia on apricot obtained in Germany, and sent here by Dr. Westerdijk.

Westerdijk's plum Sclerotinia designated as strain 10 was isolated from conidia on plum obtained in Holland and sent here by Dr. Westerdijk.

Westerdijk's cherry Sclerotinia designated as strain 11 was isolated and sent here by Dr. Westerdijk.

Westerdijk's apple Sclerotinia designated as strain 12 was isolated from conidia on apple obtained in Holland and sent him by Dr. Westerdijk.

Isolated *Escherichia coli* serotype 0157:H7

was obtained at the Oregon Agricultural Experiment Station from a pasteurized milk sample by Dr. Salmon from the Oregon Agricultural Experiment Station, and forwarded to the Oregon Agricultural Experiment Station for further study.

Isolated *Escherichia coli* serotype 0157:H7 was isolated at Corvallis, Oregon from an adult milk sample by Dr. Salmon from the Oregon Agricultural Experiment Station.

Isolated *Escherichia coli* serotype 0157:H7 was isolated from an investigation on a dairy farm, Milwaukie, Oregon. It was received from the Oregon Agricultural Experiment Station.

Isolated *Escherichia coli* serotype 0157:H7 was obtained from a dairy farm near Corvallis, Oregon. It was received from the Oregon Agricultural Experiment Station.

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Isolated *Escherichia coli* serotype 0157:H7 was isolated from a dairy farm near Corvallis, Oregon. It was received from the Oregon Agricultural Experiment Station.

Strains 9, 10, 11, 12 were not given a specific name by Dr. Westerdijk.

Washington prune blossom Sclerotinia designated as strain 13 was isolated from prune blossoms obtained in Clarke County, Washington and forwarded here by Dr. F. D. Heald.

Washington prune Sclerotinia designated as strain 14 was isolated from prune mummies obtained in Clarke County, Washington and forwarded here by Dr. F. D. Heald.

Prunus demissa Sclerotinia designated as strain 15 was obtained from Washington through Dr. Heald, where it causes a common blight and rot of the fruit of Prunus demissa.

Amelanchier Sclerotinia designated as strain 16 is a Sclerotinia that is found on the Amelanchier in the Palouse Country, Washington. It was sent here by Dr. Heald.

The best plan for studying these different strains and for arriving at some solution of the problem, namely the identification of our species, seemed to be to grow the strains on fresh fruits, as well as on prepared media, and to observe the type and color of growth, size and shape of spores, and other noticeable features. In the first series of inoculations ripe apricots were used.

b. Apricot inoculations to obtain rate of growth, type of growth, color of conidia, and approximate sizes of conidia.

The first twelve strains were used to inoculate fresh ripe apricots. Attempts to sterilize the apricots before inoculating injured the fruit so much, that the apricots were finally inoculated just as they were

Strains 9, 10, 11, 12 were not given a specific name by Dr.

Westerhoff.

Strain 13 was isolated from a patient in Oregon County, Washington

and forwarded here by Dr. W. A. Hensle.

Strain 14 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 15 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 16 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 17 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 18 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 19 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 20 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 21 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 22 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 23 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

Strain 24 was isolated from a patient in Oregon County, Washington and forwarded

here by Dr. W. A. Hensle.

picked from the tree after being placed in covered glass dishes.

Two fruits were inoculated with each strain and two fruits were used

as checks for each strain. All strains had been growing the same

length of time on identical media at the time they were used for

inoculating the apricots. The fruits were picked July 19, 1916 and were

inoculated July 21, 1916. Table 2 gives rate of growth, type of

growth, and color of conidia.

No.	Strain	Rate of growth	Type of growth	Color of conidia
1	Strain 1	1.5 mm	Spreading	White
2	Strain 2	1.5 mm	Spreading	White
3	Strain 3	1.5 mm	Spreading	White
4	Strain 4	1.5 mm	Spreading	White
5	Strain 5	1.5 mm	Spreading	White
6	Strain 6	1.5 mm	Spreading	White
7	Strain 7	1.5 mm	Spreading	White
8	Strain 8	1.5 mm	Spreading	White
9	Strain 9	1.5 mm	Spreading	White
10	Strain 10	1.5 mm	Spreading	White
11	Strain 11	1.5 mm	Spreading	White
12	Strain 12	1.5 mm	Spreading	White
13	Strain 13	1.5 mm	Spreading	White
14	Strain 14	1.5 mm	Spreading	White
15	Strain 15	1.5 mm	Spreading	White
16	Strain 16	1.5 mm	Spreading	White
17	Strain 17	1.5 mm	Spreading	White
18	Strain 18	1.5 mm	Spreading	White
19	Strain 19	1.5 mm	Spreading	White
20	Strain 20	1.5 mm	Spreading	White

placed from the first class to the second class.

The first class was made up of the first and second class.

no change for each year. All students had been given the same

length of time to finish the work at the time they were sent for

the first class. The first class was given July 19, 1910 and was

in the first class, 1911. The first class was given July 19, 1910

and the first class was given July 19, 1910.

Table 2. Giving rate of growth, type of growth and color of conidia of the first twelve strains on ripe apricots

Strain	Rate of Growth 5 days old	Type of growth	Color	Remarks 5 days old
1	1st 1/3 brown 2nd brown 3 cm. diameter	Profuse spore production typical	A little lighter than Saccardo's ¹	Cks. normal Growth and color typical for strain
2	1st normal 2nd brown 1.5 cm. diam. to one side of pt.	Scant spore production Tendency of fruit to wrinkle as fungus ad- vances decided	Seems to be like <u>1</u> very few spores for deter- mining	Cks. normal
3	1st-3/4 brown 2nd brown 3 cm. diam.	Profuse spore production Similar to <u>1</u>	See <u>1</u>	Cks. normal
4	1st normal 2nd 1/3 brown	Profuse spore production Compact felty looking pus- tules	Cartridge buff (R) ²	cks. normal
5	Very much ad- vanced in decay Skins blackening progressively	Profuse low growing spores similar to <u>1</u>	See <u>1</u>	Cks. normal
6	Both 1/2 brown	See <u>1</u>	See <u>1</u>	Cks. normal
7	1st 1/2 brown 2nd brown 3 cm. diam.	Well developed Barely showing	Grayish olive (R)	Cks. normal
	1st normal 2nd 1/3 brown	In one week first growth overgrown with secondary whitish mycelium	do.?	Cks. normal

Table 2, continued

Strain	Rate of growth 5 days old	Type of growth	Color	Remarks 5 days old
9	1st normal 2nd nearly 1/2 brown	Spores barely showing on brown fruit	Grayish olive (R)	1 ck. normal other contaminated in 3 days
10	1st normal 2nd brown 1 1/2-2 cm. diam.		See 1	Cks. normal
11	1st normal 2nd 1/3 brown	Similar to <u>1</u>	Grayish olive (R)	1 ck. normal other contaminated in 4 days.
12	1st normal 2nd 1/3 brown	Similar to <u>4</u>	Cartridge buff (R)	cks. normal

1. Saccardo, P.A. Chromotaxia seu Nomenclator Colorum 1894
2. Ridgeway, Robert Color standards and Nomenclature 1912

Table 2, continued

Number	Color	Type of growth	Date of growth	Remarks
1	Green	Spores rarely observed on crown olive (a)	1st normal 2nd nearly 1/2 green	1 ex. normal other contaminated in 3 days
10	Green		1st normal 2nd brown 3rd 1/2 green 4th black	1st normal
11	Green	Similar to 1	1st normal 2nd 1/2 green	1 ex. normal other contaminated in 4 days
12	Green	Similar to 2	1st normal 2nd 1/2 green	one normal

1. ...
2. ...

To obtain the color of the spore masses, a small mass of them was placed in the bottom of the dish, so that the spores could be placed over and near the color blocks to get the colors. Thus the light was partially transmitted, partially reflected.

All the strains were similar in that they readily induced a rotten condition of the apricot fruits. Some however did this much more rapidly than others. Strain 2, Westerdijk's Sclerotinia cinerea, progressed very slowly, in fact it was the slowest growing of all. Strain 5, Oregon Sclerotinia cinerea, became established first and grew most rapidly of all the strains. The other strains lay between these two extremes with a tendency to approach 5 rather than 2, 2 remaining distinctly in a class by itself as regarded the rate of growth.

In the matter of type of growth there seemed to be four different forms.

- (1) Profuse somewhat loose spore pustules. Strain 1 typical.
- (2) Profuse, compact, felty-looking spore pustules. Strain 4 typical.
- (3) Abundant surface mycelium with very few spores. Strain 8 the only strain with this characteristic.
- (4) Scant surface mycelium with very few spores. Strain 2 the only strain with this characteristic.

Nearly all the forms resembled the first above. The second had only two representatives, the third and fourth one representative each.

There seemed to be three different spore colors:

- (1) Cartridge buff (R)
- (2) Grayish olive (R)
- (3) Drab - a little lighter than Saccardo's drab.

To obtain the color of the spots masses, a small mass of them was placed in the bottom of the dish, so that the spots could be placed over and near the color blocks to get the colors. Thus the light was partially transmitted, partially reflected.

All the spots were similar in that they readily induced a certain condition of the animal's brain. Some however did not work rapidly than others. Strain 2, the variety's laboratory strain, worked very slowly, in fact it was the slowest growing of all. Strain 3 became established first and grew most rapidly of all the strains. The other strains lay between these two extremes with a tendency to approach 2 rather than 3, a tendency distinctly in a class by itself as compared with the rest of the group.

In the matter of type of growth there seemed to be four distinct

types.

- (1) Pattern somewhat loose more particles. Strain 1 typical.
- (2) Pattern compact, tight-looking spots. Strain 4 typical.

- (3) Spots of various sizes with very few spores. Strain 5 typical.

The only strain with this characteristic.

- (4) Spots surface medium with very few spores. Strain 3 the only strain with this characteristic.

Nearly all the forms resembled the first above. The second and only two representative, the third and fourth and representative each. There seemed to be three distinct types below.

- (1) Carriage path (-)
- (2) Strain 1 (-)
- (3) Path - a little lighter than Strain 1's dark.

The two strains, 4 and 12, that had the profuse, compact, felty-looking spore pustules were the two that had the cartridge buff spores. The strain that had abundant surface mycelium with very few spores, strain 8, seemed to have grayish olive (R) spores, while the strain that had scant surface Mycelium with few spores, strain 2, seemed to have the drab-colored spores. All the other forms had either the drab-colored or grayish-olive spores.

If color must be considered as an important factor we would have five different types.

	Drab	Cartridge buff	grayish olive
Growth form 1	_____	_____	_____
Growth " 2	_____	_____	_____
Growth " 3	_____	_____	_____
Growth " 4	_____	_____	_____

Diagram 1, showing possible types if color must be considered an important factor. Combination shown where solid lines cross.

The colors of all these forms did not remain constant as will be brought out later.

In getting the dimensions of the conidia they were mounted in ethyl alcohol (about 50%). The oil immersion lens was used. The values of the spaces of the ocular micrometer were calculated by means of comparing with a corrected stage micrometer. The value of the smallest spaces of the ocular micrometer was 1.9 microns, and, in measuring the spores, only the lines and an imaginary line half way between the lines were considered. That is if a spore, in length, covered 9 spaces and a

The two strains, 7 and 12, that had the greatest amount of leaf-feeding spots produced were the two that had the greatest leaf damage. The strain that had the greatest amount of leaf damage, strain 7, seemed to have the greatest amount of leaf damage. All the other strains had either the same amount of leaf damage or less than strain 7.

It is interesting to note that the amount of leaf damage is not directly proportional to the amount of leaf-feeding spots. This is probably due to the fact that the amount of leaf damage is also affected by the amount of leaf-feeding spots.

Strain	Leaf-feeding spots	Leaf damage
Strain 7	100	100
Strain 12	80	80
Strain 13	60	60
Strain 14	40	40
Strain 15	20	20

It is interesting to note that the amount of leaf damage is not directly proportional to the amount of leaf-feeding spots. This is probably due to the fact that the amount of leaf damage is also affected by the amount of leaf-feeding spots.

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The amount of leaf damage is also affected by the amount of leaf-feeding spots. This is probably due to the fact that the amount of leaf damage is also affected by the amount of leaf-feeding spots.

little over ~~over~~ but was nearer 9 than 9.5 spaces it was considered as 9 spaces, or 17.1 microns long. Unconscious selection was eliminated as far as possible by taking the spores as they came in crossing the field, but often masses of spores had to be skipped. 100 spores of each strain, as grown on the spricot fruits, were measured in this way. Plates 1-12 show graphical representations of the results.

The curves for spore width, with one notable and one minor exception, have a single peak. The curves for spore length all have more than one peak. That is there was more variation in the lengths of a set of spores than there was in the widths of the same set of spores.

A study of the curves revealed the following facts:

Strain 12, Westerdijk's apple Sclerotinia had the widest spores and the longest spores of all the strains. They were also longer in proportion to their width than in any other strain. Strain 4, English Sclerotinia fructigena had the next widest and longest spores, and the spores that stood next in their excess of length over width.

Aside from these general conclusions nothing more definite could be hazarded. Thus spore size differences, in this case at least, did not offer a very hopeful basis for differentiation. For this reason no more measurements were taken. Other workers have laid considerable stress on conidia dimensions.

The next series of cultures was grown on steamed rice.¹

-
1. 10 grams of rice and 50 cc of water placed in a flask and sterilized in the autoclave for 30 minutes at about 15 pounds pressure.

little over two feet and the number 3 has been placed at
 the bottom of the page. The photograph is attached
 to the envelope by taking the paper as they come in crossing the
 field, but other means of paper will be required. The paper is
 each side, as shown on the right side, was measured in this way.
 The paper is a standard rectangular paper of the weight
 The paper for each side, with one detail and one minor correction,
 have a single page. The paper for each side is the same, but one
 page. This is the way we were written in the length of a set of papers
 from their own to the right of the page set of papers.
 A photograph of the paper revealed the following facts:
 Details of the paper's weight, thickness, and the other paper was
 the largest source of all the paper. They were also taken in proportion
 to their weight and in the same way. Details of the paper's weight
 thickness and the other paper and paper weight, and the other paper
 from each in both sides of the paper weight.
 The paper from the other paper weight and paper weight should be
 provided. The paper's weight, thickness, in this case at least, did not
 offer a very detailed paper for the paper's weight. For the paper to have
 measurements were taken. The paper's weight and paper weight's weight in
 detail is provided.

The paper was an of course and given in standard size.

1. To make it clear and to avoid any doubt in a case
 which is in the subject for the paper's weight in detail
 and the other paper.

Table 3. Steamed rice cultures of conidia of the first twelve

c. Steamed rice cultures to obtain the color of the conidia of the first twelve strains.

Flasks of steamed rice were inoculated with the first twelve strains, the ones used in the apricot inoculations. These cultures, as before, had been grown on the same medium the same length of time before using for inoculating. The colors were obtained by viewing the less dense masses of conidia through the flasks. All these cultures were planted November 23, 1916. Table 3 gives the colors on rice and the date the colors were determined, together with the colors as found on the apricot fruits.

	See 1 on apricot	12/2/16
4	Cartridge buff (R) Cartridge buff (R)	12/1/16
5	Light grayish olive (R) See 1 on apricot	12/2/16
6	Do. See 1 on apricot	12/2/16
7	Do. Grayish olive (R)	12/2/16
8	Light mineral gray (R) Do.	12/2/16
9	Light grayish olive (R) Grayish olive (R)	12/2/16
10	Do. See 1 on apricot	12/2/16
11	Do. Grayish olive (R)	12/2/16
12	Cartridge buff (R) Cartridge buff (R)	12/2/16

to obtain the color of the control of the

first twelve weeks.

Flasks of steamed rice were inoculated with the first twelve strains, the ones used in the present investigation. These cultures, as before, had been grown on the same medium for some length of time before

being first inoculated. The colors were obtained by viewing the flask

through a mass of cobalt through the flask. All these cultures were

planted November 22, 1918. Table 3 gives the colors on rice and the

data for the colors were determined, together with the colors as found

on the various flasks.

Table 3. Giving colors of conidia of the first twelve strains when grown on steamed rice as compared with the colors of the conidia on apricot fruits.

Strain	Color of Conidia on rice	Color of Conidia on apricot	Date Color on Rice
1	Light grayish olive (R)	A little lighter than Saccardo's drab	12/1/16
2	Do.	Seems to be like 1 on apricot	12/2/16
3	Do.	See <u>1</u> on apricot	12/2/16
4	Cartridge buff (R)	Cartridge buff (R)	12/1/16
5	Light grayish olive (R)	See 1 on apricot	12/2/16
6	Do.	See <u>1</u> on apricot	12/2/16
7	Do.	Grayish olive (R)	12/2/16
8	Light mineral gray (R)	Do?	12/2/16
9.	Light grayish olive (R)	Grayish olive (R)	12/2/16
10.	Do.	See <u>1</u> on apricot	12/2/16
11.	Do.	Grayish olive (R)	12/2/16
12	Cartridge buff (R)	Cartridge buff (R)	12/2/16

temperatures recorded by means of a thermometer which lay on the table with
the cultures were as follows:

Table 2. Giving colors of dominia of the first twelve strains when grown on standard rice as compared with the colors of the dominia on upland's growth.

Strain	Color of dominia on rice	Color of dominia on upland	Date
1	Light grayish olive (R)	A little darker than standard's group	12/2/18
2	Do.	Same as no. 1 on upland	12/2/18
3	Do.	See 1 on upland	12/2/18
4	Cartridge butt (R)	Cartridge butt (R)	12/2/18
5	Light grayish olive (R) See 1 on upland		12/2/18
6	Do.	See 1 on upland	12/2/18
7	Do.	Grayish olive (R)	12/2/18
8	Light mineral gray (R)	Do.	12/2/18
9	Light grayish olive (R) (R)		12/2/18
10	Do.	See 1 on upland	12/2/18
11	Do.	Grayish olive (R)	12/2/18
12	Cartridge butt (R)	Cartridge butt (R)	12/2/18

On examining mounts from the culture of strain 8 no typical conidia could be found, only a mass of mycelium, irregular and spore-like at times.

Comparing Table 3 with Table 2, it was found that strains 4 and 12 were the only strains that had the same color of conidia when grown on rice that they had when grown on the apricot fruits. Three of the strains, 7, 9 and 11 were very nearly the same color on rice that they were on the apricot fruits, all of these being light grayish olive (R) on rice and grayish olive (R) on apricot.

These rice cultures apparently offered little as a basis for differentiating the strains.

The next set of cultures was made on ripe Royal Anne cherries, all sixteen strains being used this time.

d. Cherry inoculations to obtain color of conidia and general appearance of fungi on the fruits for all of the sixteen strains.

Ripe Royal Anne cherries were picked from one tree June 29, 1917. June 30th the cherries were inoculated. Five cherries were used for each strain. The cherries were placed on 5 x 7 inch glass plates in position for photographing, with their appropriate numbers. The three outside cherries of each lot were used for inoculating, the two inside cherries being saved for checks. Two strains were present on each plate. plates 13-20. Glass dishes were placed on the fruit, which was kept on top of a laboratory table where there was a strong north light. Some temperatures secured by means of a thermometer which lay on the table with the cultures were as follows:

On examining samples from the culture of strain 3 no typical
colonies could be found, only a mass of granular, irregular and spore-like
at times.

Comparing Table 3 with Table 2, it was found that strains 4 and 13
were the only strains that had the same color of colonies when grown on
rice that had been grown on the synthetic medium. In general the strains
7, 8 and 11 were very nearly the same color on rice that they were on the
synthetic media, all of these being light grayish olive (R) on rice and
grayish olive (R) on synthetic.

These rice cultures apparently offered little or no basis for differen-
tiating the strains.

The next test of culture was made on rice from Anna's character, all
sixteen strains being used this time.

Twenty inoculations to obtain color of colonies and general
appearance of fungi on the fungus for all of the sixteen strains.

Also special care was taken from one rice plant (R) 13119.
Five dishes were inoculated. Five dishes were used for

each strain. The character was placed on a 1 inch glass plate in
position for photographing, at the left of the inoculation. The three

outside character of each lot were used for inoculating, the two inside
character being saved for analysis. Two strains were present on each plate.

Glass dishes were placed on the table, which was kept on
top of a laboratory table where there was a strong north light. Some

specimens stored by means of a refrigerator which lay on the table with
the cultures were as follows:

Date	Hour P.M.	Temp. °C
June 30	5:30	23.5
July 2	6:00	20.5
" 3	5:00	20.5
" 5	5:00	21.4
" 6	4:00	20.6
" 7	1:00	22.6
" 9	5:00	20.7
" 11	1:00	21.0

The photographs, taken July 7, 1917, show the results of inoculating the cherries with the different strains. Strains 2, 15 and 16 failed absolutely to develop. The other strains showed varying degrees of development. The colors were taken by approaching the fruits as closely as possible with the color chart without touching them. Masses of the pores were not removed to the glasses as was done when getting the color of the spores on the apricots. The fruit was inoculated on the 30th of June and the colors were obtained on the 14th of July or two weeks after inoculating. Following is the list of colors obtained.

Strain	Color
1	Drab(S)
2	No fungus developed
3	Very slightly grayer than drab (S), but so close to it that the difference would ordinarily be overlooked.
4	Drab (S)
5	"
6	"

Temp. °C	Hum. %	Date
20.5	85.0	June 30
20.5	81.0	July 1
20.5	81.0	" 2
21.5	81.0	" 3
20.5	81.0	" 4
20.5	81.0	" 5
20.7	81.0	" 6
21.0	81.0	" 7

The observations, taken July 7, 1917, show the results of inoculating the
 cultures with the different strains. Strains 2, 3, 4, 5 and 6 failed
 absolutely to develop. The other strains showed varying degrees of
 development. The culture was taken by aspirating the fluid in
 a sterile syringe with the color chart without touching the base
 of the petri dish and removed to the plates as was done with the other
 color of the species on the petri dish. The fluid was inoculated on the 20th
 of June and the strains were obtained on the 10th of July on two plates
 also inoculated. Following is the list of colors obtained:

Strain	Color
1	(white)
2	No development
3	Very slightly yellow (2)
4	Very slightly yellow (2)
5	Very slightly yellow (2)
6	Very slightly yellow (2)

- | | |
|----|---|
| 7 | Drab (S) |
| 8 | Whitish mycelium but there seem to be no spores |
| 9 | Drab (S) |
| 10 | " |
| 11 | " |
| 12 | Cream (S) |
| 13 | Drab (S) |
| 14 | " |
| 15 | No fungus developed |
| 16 | " |

Strain 1 showed itself in a typical manner on the cherry fruit.

Strain 2 failed to develop. Strain 3 was typical. But what happened to strain 4? Instead of appearing as formerly with the smooth, felty-looking, cartridge buff pustules, it appeared in a form so closely resembling strains 1 and 3 that the three strains could not be distinguished. Up to this time strains 4 and 12 were alike as far as external appearances were concerned. There was a slight indication of a difference between 4 and 12 when the different strains were grown on the apricot fruits the previous year. When grown on the apricot fruits the spores of 12 were the longest of any with no exception. See graphs, plates 1-12. The easiest way to explain the situation would be to say that the cultures were probably mixed. I will not agree to such an explanation. We must leave the problem without a solution remembering the following:

Strain 4 which originally had the smooth, felty-looking, cartridge buff pustules, and which was called Sclerotinia fructigena, at the Oregon

Agricultural Experiment Station, resembled strain 3, which strain typically has had, ever since I have possessed it, dusty-looking drab-colored pustules, and which was called by Dr. Westerdijk Sclerotinia fructigena and that this strain 3 so closely resembled strain 1, or the California fruit rot form, that they could not be distinguished. These three strains were similar to several others, namely 5, Oregon Sclerotinia cinerea, 6, Michigan Sclerotinia cinerea, 7, Apricot twig Sclerotinia (California), 9, Westerdijk's apricot Sclerotinia, 10, Westerdijk's plum Sclerotinia, 11, Westerdijk's cherry Sclerotinia, 13, Washington prune blossom Sclerotinia, and 14, Washington prune Sclerotinia.

Strain 5 as it appeared on the cherries was characteristic for this strain, that is it was similar to strain 1. Strains 6 and 7 acted in a typical manner. Strain 8 which habitually produced abundant mycelium acted in a characteristic manner. No spores could be detected on the fruit. Strains 9, 10 and 11 were all characteristic and similar to strain 1. Strain 12 appeared as formerly with compact, felty-looking cream colored pustules. Strains 13 and 14 showed to be similar to strain 1, while strains 15 and 16 failed to develop.

As far as macroscopic characteristics go there were three different types that developed on the cherries.

- (1) Profuse somewhat loose spore pustules drab (S) in color.

Strain 1 typical.

- (2) Profuse, compact, felty-looking spore pustules cream (S) in color. Strain 12 the only strain.

agricultural Experiment Station, assembled strain 3, which strain

typically has had, ever since I have possessed it, bushy-leaving

dark-colored ovaries, and which was called by Dr. Kosterlik Belarotina

lyophilis and that this strain 3 is closely resembling strain 1, or the

California fruit fly form, that they could not be distinguished. These

three strains were eligible for several others, namely 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

Belarotina cinerea, 6, Belarotina californica cinerea, 7, Belarotina

californica (California), 8, Belarotina's earliest Belarotina, 9,

Belarotina's pink Belarotina, 11, Belarotina's heavy Belarotina,

12, Belarotina from Belarotina Belarotina, 13, Belarotina from

Belarotina.

Strain 3 was it appeared on the screen was characterized for this

strain, that is to say strain 3, strain 1. Strain 3 and 1 added in

a typical manner. Strain 3 which normally produced offspring

known in a characteristic manner. Its eggs could be detected on the

fruit. Strain 2, 10 and 11 were all characterized by the addition of

strain 1. Strain 12 appeared as the only strain, bushy-leaving

ovary colored ovaries. Strain 13 and 14 showed no difference to strain

1, which strain 15 and 16 failed to develop.

As far as morphological characters are concerned there were three distinct

groups that developed on the screen.

(1) Belarotina common form more bushy than strain 13 in color.

Strain 1 (typical).

(2) Belarotina, bushy, bushy-leaving ovary colored strain (2) in

color. Strain 12 the only strain.

(3) Abundant surface mycelium with apparently no spores.

Strain 8 the only strain.

Strain 2, which had always remained in a class by itself, failed to develop.

All the forms, that developed, with the exception of 8 and 12 resembled strain 1, or the California fruit rot strain.

In this lot of inoculations there were only two colors represented, drab(S) and cream(S). Strain 12 had the cream-colored pustules, and all the others had drab-colored pustules with the exception of 8 which apparently had no spores.

After the experimental work which has been described above had been completed it was decided that there were four possible forms among the cultures, 1, 2, 8 and 12 being the typical forms. Strain 8, the California strain obtained from an apricot leaf, was discarded at this stage of the work. Single spore strains of 2 and 12 were obtained in the conventional manner. Strain 1 was already a single spore strain. Because of the peculiar behavior of strain 4 a single spore culture of it was also obtained, and likewise a single spore strain of 3. These single spore strains were used to make planted plate cultures on Czapeck's agar.¹

1. Czapeck's agar

Distilled water.....	1000.00	cc
Magnesium sulfate.....	.50	grams
Dipotassium hydrogen phosphate.....	1.00	"
Potassium chloride.....	.50	"
Ferrous sulphate01	"
Sodium nitrate	2.00	"
Cane sugar	30.00	"
Agar agar.....	15.00	"

e. Czapeck's agar cultures to obtain general types of growth of strains 1, 2, 3, 5 and 12.

This formula was chosen because it was a complete nutrient medium, because it could be readily duplicated by other workers, and because due to its lack of color, and because of its transparent qualities it was considered a desirable medium to use in photographing the cultures.

Poured plates were made in the usual way and were inoculated with the five strains, 1, 2, 3, 4 and 12, August 16, 1917. The photographs of these five strains were taken August 28, 1918 or twelve days after the plates were inoculated. Plates 21-25. These are typical photographs of the different cultures.

Strain 1 produced spores abundantly. In obtaining the color of the pustules the petri dish was placed over the color chart, the lid of the dish having first been removed. The spore pustules of this strain were very close in color to pale olive-buff (R). The general outline and appearance of the culture may be seen from the photograph of this strain. Plate 21.

Strain 2 produced a compact, somewhat moist looking culture that was barely raised above the surface of the agar, and to the unaided eye there seemed to be no spores present. An examination of material from the culture under the microscope revealed some spore-like pieces of mycelium, but no typical spores. Plate 22.

Strain 3, called by Dr. Westerdijk Sclerotinia fructigena produced spores abundantly and was so similar to strain 1 that the two could not be distinguished. Plate 23.

The same was true of strain 4, which to begin with had the felty-looking, cartridge buff pustules. Plate 24.

General's most cultures in which general types of growth

of strains 1, 2, 3 and 4.

This formula was chosen because it was a complete nutrient medium, because it could be readily duplicated by other workers, and because due to its lack of color, and because of its transparent qualities it was considered a desirable medium to use in photographing the cultures.

Ported plates were made in the usual way and were inoculated with

the five strains, 1, 2, 3, 4 and 5, August 16, 1917. The photographs

of these five strains were taken August 23, 1918 or twelve days after

the plates were inoculated. (Figures 11-15). These are typical photographs

of the different cultures.

Strain 1 produced sparse growth. In obtaining the color of the

medium the part that is black over the color shift, the tip of the

tip being first been removed. The sparse growth of this strain was

very close in color to pale olive-buff (R). The characteristic

appearance of the culture may be seen from the photograph of this strain.

Figure 11.

Strain 2 produced a compact, somewhat colorless culture that was

directly related above the surface of the agar, and to the vertical eye

there seemed to be an opaque growth. An examination of several from

the culture under the microscope revealed some warty-like pieces of

material, but no typical spores. (Figure 12).

Strain 3, called by Dr. Westerman's *Micrococcus leucogriseus*

produced sparse growth and was so similar to strain 1 that the two

could not be distinguished. (Figure 13).

The same was true of strain 4, which in fact with the latter

looking exactly like the latter. (Figure 14).

Strain 12 remained distinct. On this agar it was the most rapid grower of any of the strains. Pustules were not produced, and a microscopic examination was necessary to find if there were any spores present. A few typical conidia were found. Plate 25.

These cultures were kept on the same table as the cherry cultures where some of the temperatures were:

Date	Hour P.M.	Temp. ° C.
August 16	3:30	18.5
" 17	3:30	18.5
" 18	1:00	18.4
" 20	4:30	20.5
" 21	3:00	18.5
" 22	4:30	19.5
" 23	1:30	18.5
" 24	12:30	20:0
" 25	4:30	21.7
" 27	4:00	21:3

To further test the individualities of these five selected strains it was decided to grow them all together on one medium. A Seek-no-further apple was chosen for this inoculation work.

f. Inoculations of the five strains, 1, 2, 3, 4 and 12 into one apple to further test their individuality.

For this experiment a nearly ripe Seek-no-further apple was carefully picked from the tree, placed in a moist chamber and inoculated

with the five strains used for the Czapeck's agar cultures, 1, 2, 3, 4 and 12. This was done on August 17, 1917. Five check punctures were made, one below each inoculation point, and these remained unchanged until overgrown by the fungus from above. The photograph was taken August 27th, 1917, or ten days after inoculation. Plate 26. In it the five letters, A, B, C, D, E represent the strains 1, 2, 3, 12 and 4 respectively.

A, C, E or strains 1, 3, 4 again could not be distinguished. They produced spores abundantly, especially A and E. The pustules were a little lighter than drab (S). B, or strain 2, grew so slowly that it was soon surrounded by A and C. Strain 2 produced a circular brown decayed spot, with a crack in the epidermis of the apple running through the point of inoculation. Microscopic examination revealed the fact that there were typical conidia present in the crack.

D, or strain 12, produced its most characteristic pustules. immediately around the letter. These were typically compact, felty-looking, and were cartridge buff(R) in color.

Thus again there were what seemed to be three distinct strains.

The inoculation of this apple terminated the experimental work.

G. Summary and conclusions.

I. The Sclerotinia found attacking apricot fruits in California (strain 1 is typical) produces conidia abundantly on many artificial and natural media. The pustules are rather loose and powdery, the color of these pustules being typically a drab, a little lighter than Saccardo's drab. These pustules may appear scattered or in more or less concentric zones.

II. This strain is similar to, and seems to be identical with, the following forms.

A strain attacking apple in Holland and called by Dr. Westerdijk Sclerotinia fructigena. This strain never has produced, while in my possession, the yellowish pustules supposed to be typical for

Sclerotinia fructigena.

A strain attacking apples in Oregon, and called Sclerotinia cinerea at the Oregon Agricultural Experiment Station.

A strain attacking peaches in Michigan and called by the Wisconsin Agricultural Experiment Station Sclerotinia cinerea

A strain attacking apricot twigs in California.

A strain attacking apricot fruits in Germany.

A strain attacking plum in Holland

A strain attacking cherry in Holland

A strain attacking prune blossoms in Clarke County, Washington.

A strain attacking prune fruits in Clarke County, Washington.

III. The strain mentioned under I of this summary is distinct from two other Sclerotinias which produce fruit rots, and which in turn are distinct from one another.

II. Summary and conclusions.

I. The Helicoverpa found attacking cotton fruits in California (species I is typical) produces certain characters on very artificial and natural media. The pupae are rather loose and gummy, the color of these cocoons being typically a deep, a little lighter than Helicoverpa's deep. These cocoons may appear scattered or in rows or loose concentric rows.

II. This species is similar to, and seems to be identical with, the following ones.

A strain attacking pupae in Holland and Belgium (Dr. Westerhoff) Helicoverpa sp. This strain never attacked, while in my possession, the yellowish pupae reported to be typical for

Helicoverpa sp.

A strain attacking pupae in France, and called Helicoverpa sp. at the Orger Station Experiment Station.

A strain attacking pupae in Belgium and called by the Belgians

Helicoverpa sp.

A strain attacking pupae in California.

A strain attacking pupae in Germany.

A strain attacking pupae in Holland.

A strain attacking pupae in Holland.

A strain attacking pupae in Orger Station, Belgium.

A strain attacking pupae in Orger Station, Belgium.

III. The strain mentioned under I of this summary is identical from the other Helicoverpa which produce fruit cocoons, and which in turn are identical from one another.

One is typically slow growing and produces very few conidia, which seem to be typically the same color as the conidia of the California fruit rot Sclerotinia, that is a light drab, and sometimes more grayish. This form, called Sclerotinia cinerea by Dr. Westerdijk, was obtained from cherry or plum in Holland.

The other form produces typically felty-looking cartridge-buff (R) pustules. It was isolated from conidia on apple in Holland.

IV. These three distinct forms seem to correspond to the three original descriptions of Persoon, Ehrenberg and Bonorden.

The commonest form, of which the California apricot rot Sclerotinia is typical, seems to correspond in general to Ehrenberg's description.

I suggest that it be called Sclerotinia laxa.

The form with the cartridge-buff pustules seems to correspond to Persoon's description. I think it should be called Sclerotinia fructigena.

The third form, called by Dr. Westerdijk Sclerotinia cineres I think should retain that name.

One is typically slow growing and produces very few cisterns,

which seem to be typical of the same color as the contents of the

Cellulose from the Belgian, and sometimes

more typical. This form, called Belgian by Dr. Westoby,

was obtained from sheep or pigs in Holland.

The other form, which is typically leafy-looking, is called (B)

and is obtained from cisterns on soils in Holland.

17. These forms, which have been reported to be more

typical descriptions of Belgian, Belgian and Belgian.

The common form, of which the Belgian is a

is typical, seems to correspond in general to Belgian's description.

I suggest that it be called Belgian.

The typical Belgian is called Belgian in

to Belgian's description. I think it should be called Belgian.

Belgian

The third form, called by Dr. Westoby Belgian

I think should be called Belgian.

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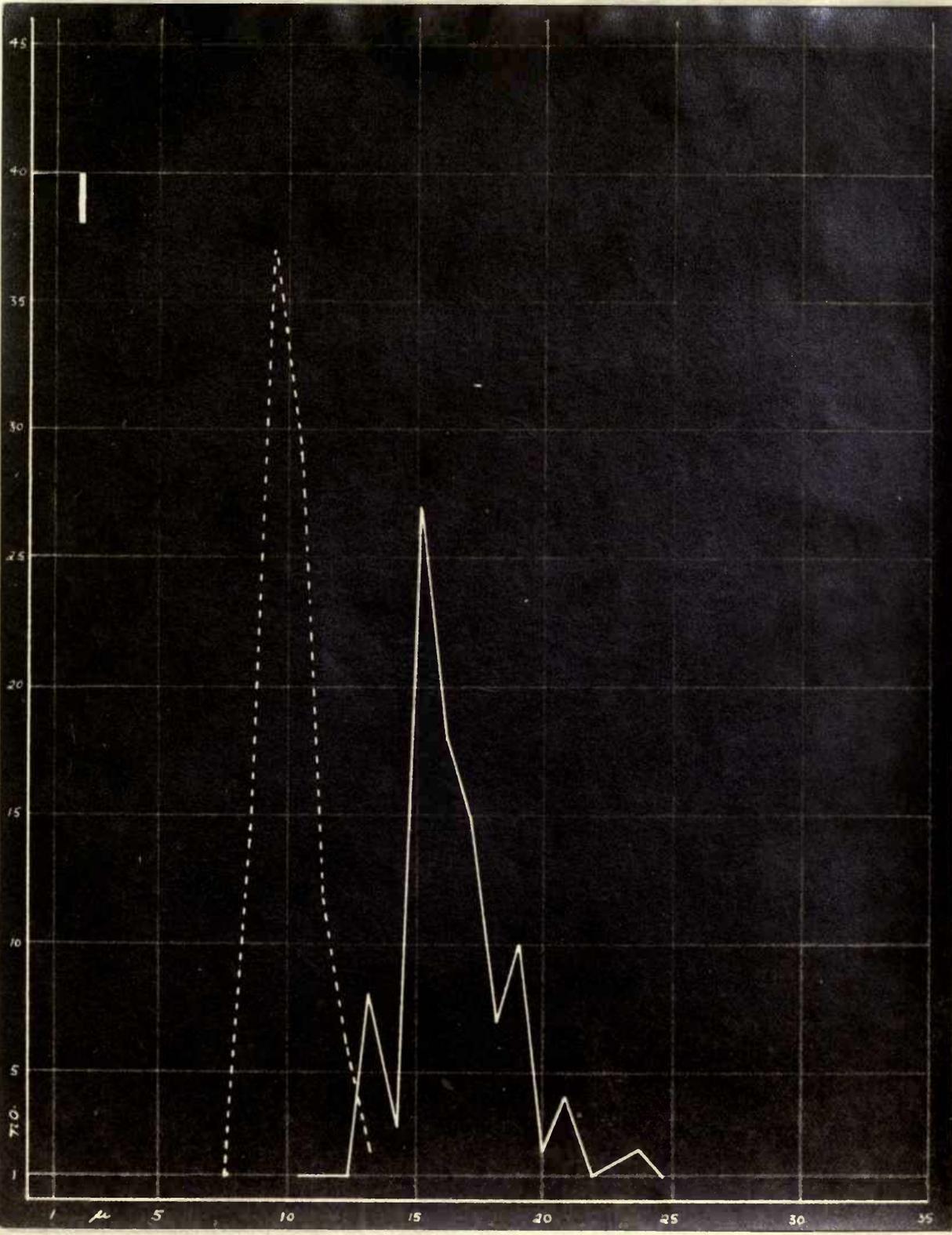
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ILLUSTRATIONS

Plate 1-12. Graphical representations of the lengths and widths of 100 spores of each strain from strains 1-12 inclusive as grown on ripe apricot fruits. The dotted lines representing widths and the solid lines lengths.

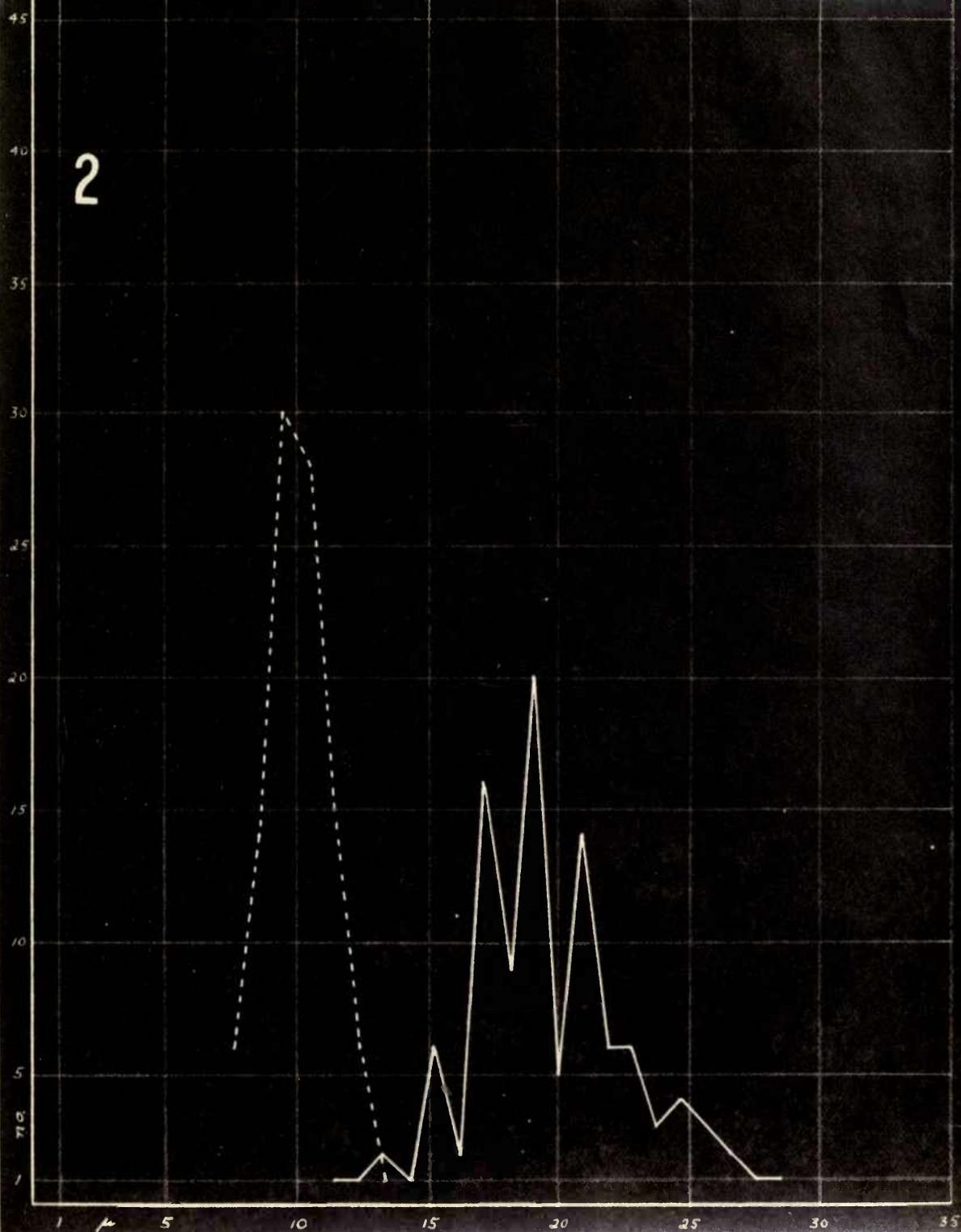
Plates 1-12. Graphical representations of the lengths and widths of 100 spores of each strain from strains 1-12 inclusive as grown on ripe apricot fruits. The dotted line representing widths and the solid line lengths.

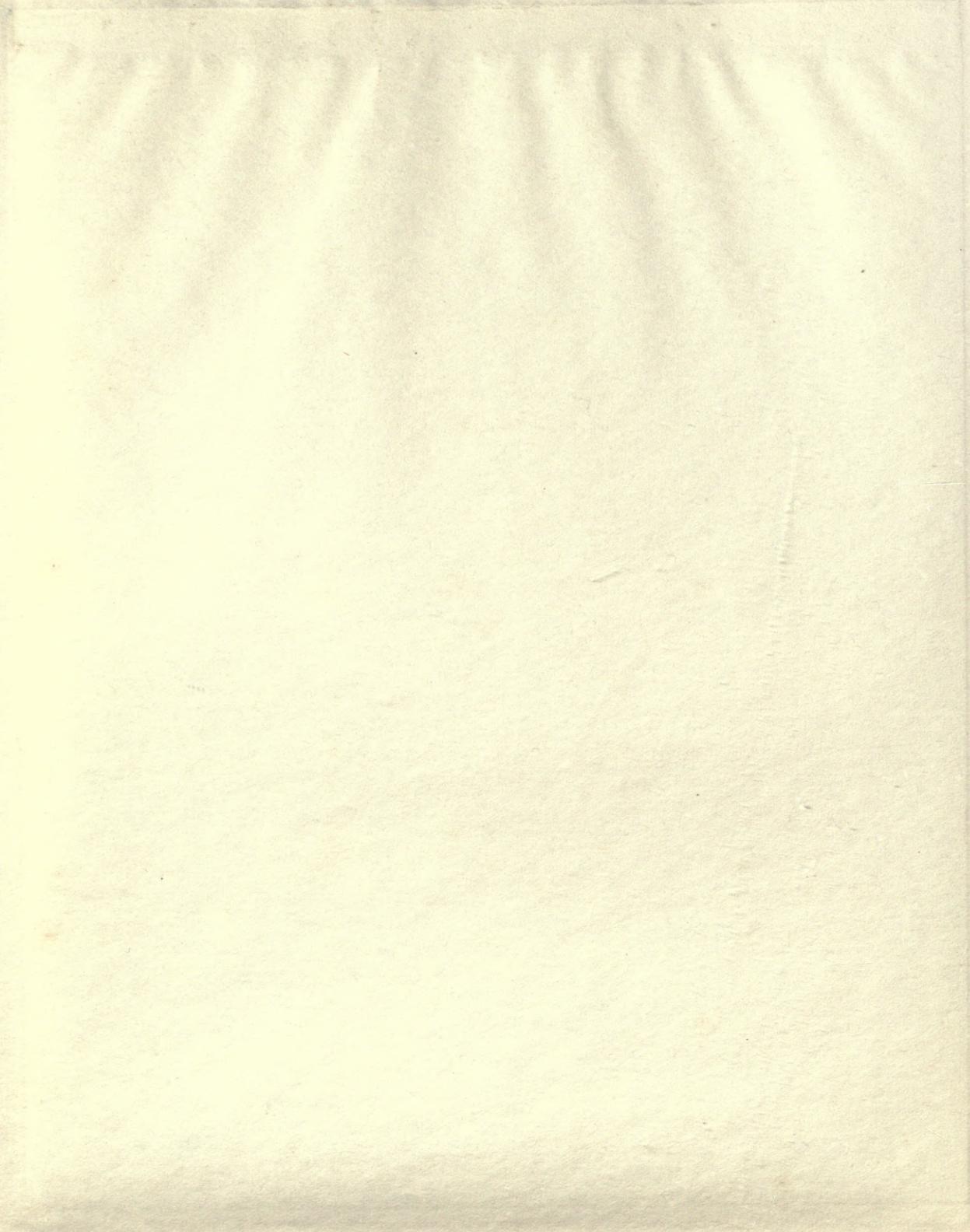
Plates I-12. Geometrical representations of the lengths and widths of 100 spores of each strain from strains I-12 inclusive as grown on the agaric fruit. The dotted line representing width and the solid line length.

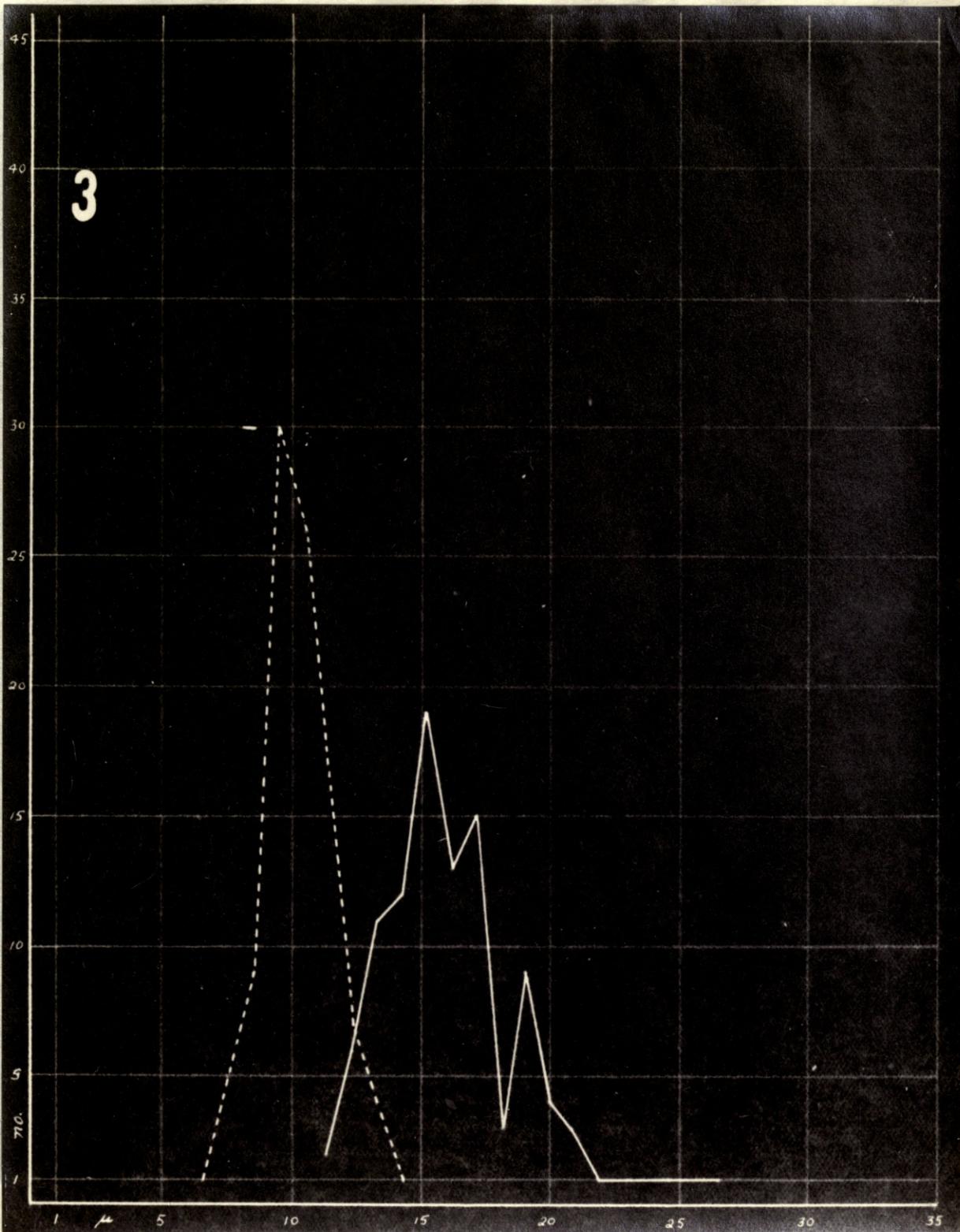


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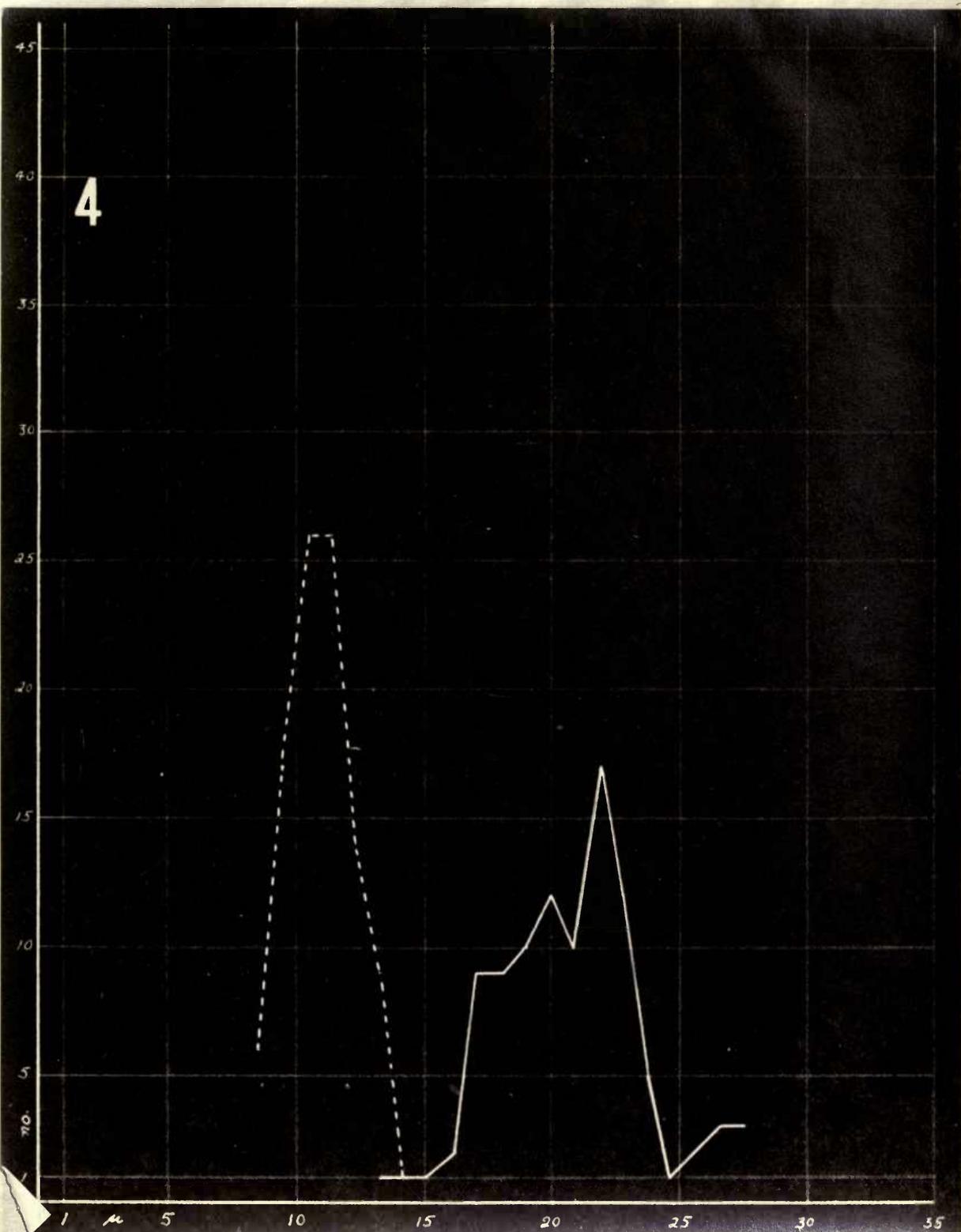
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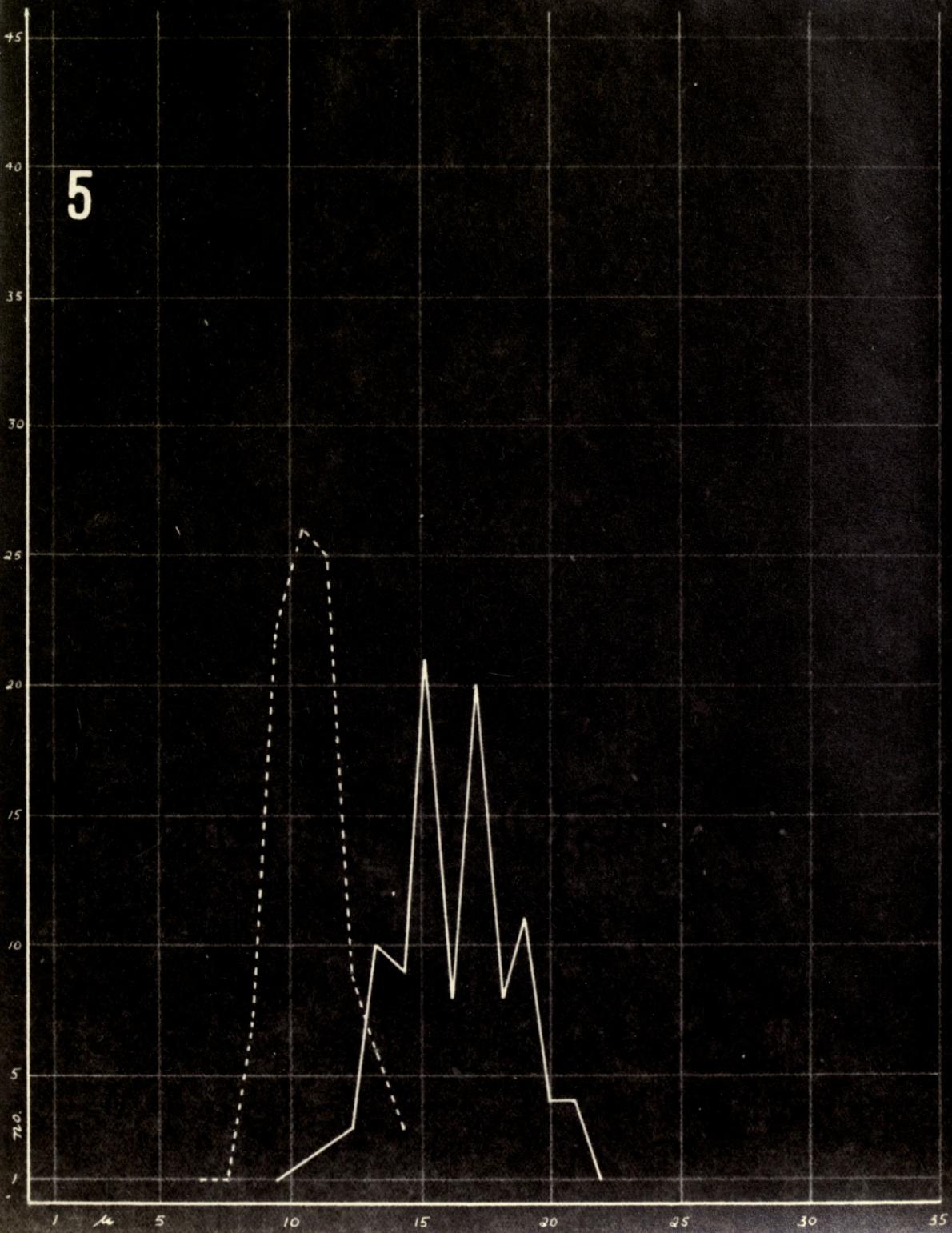






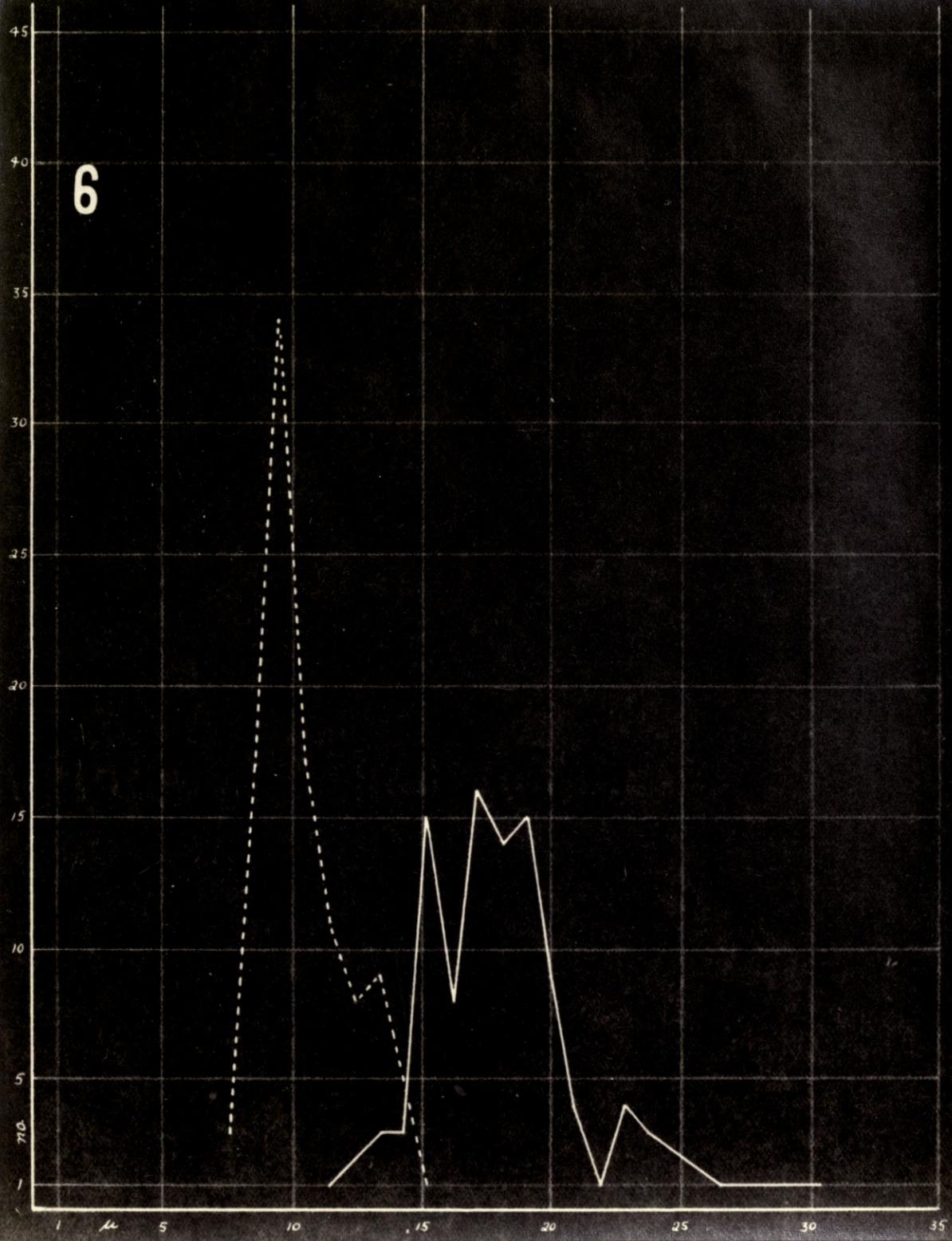


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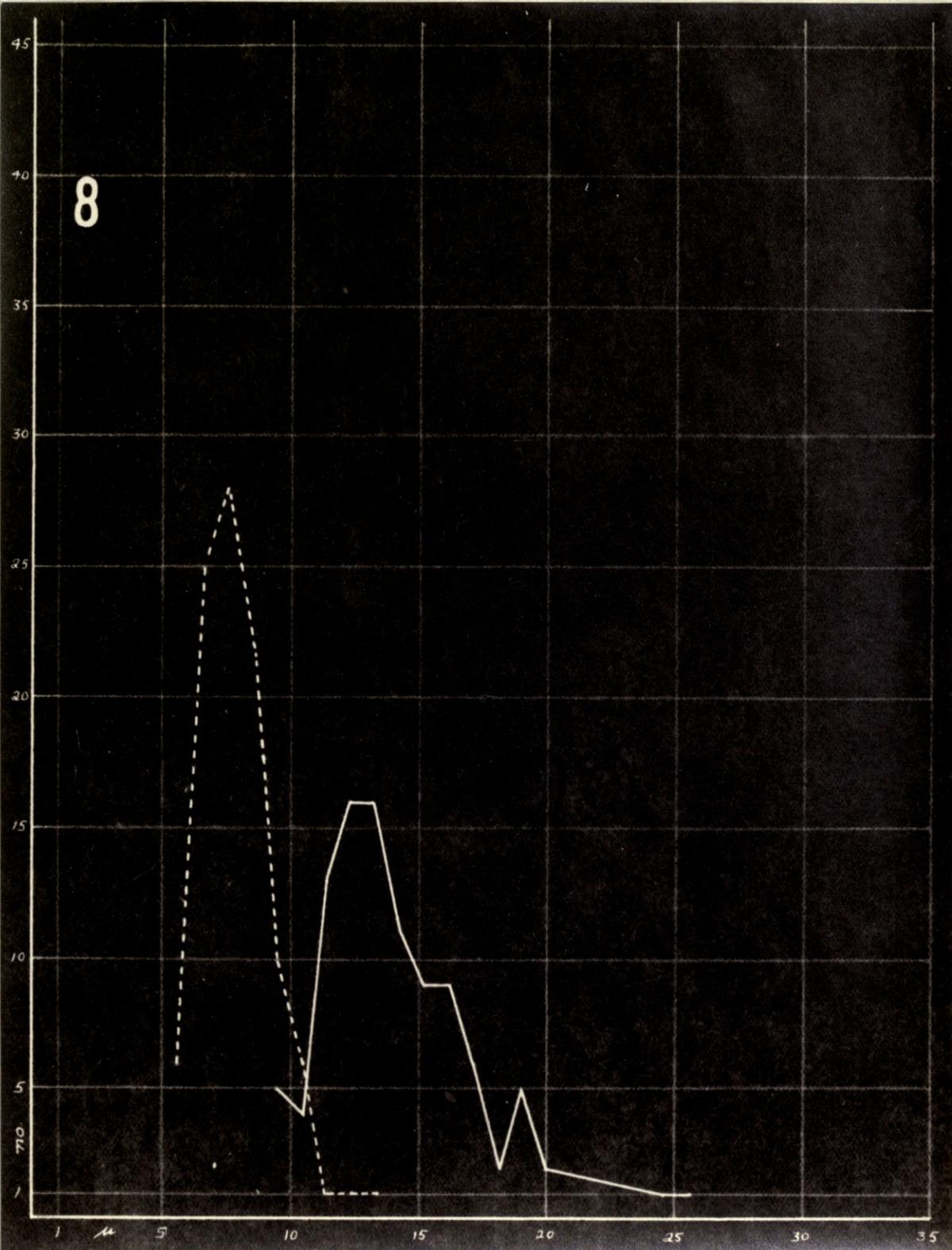


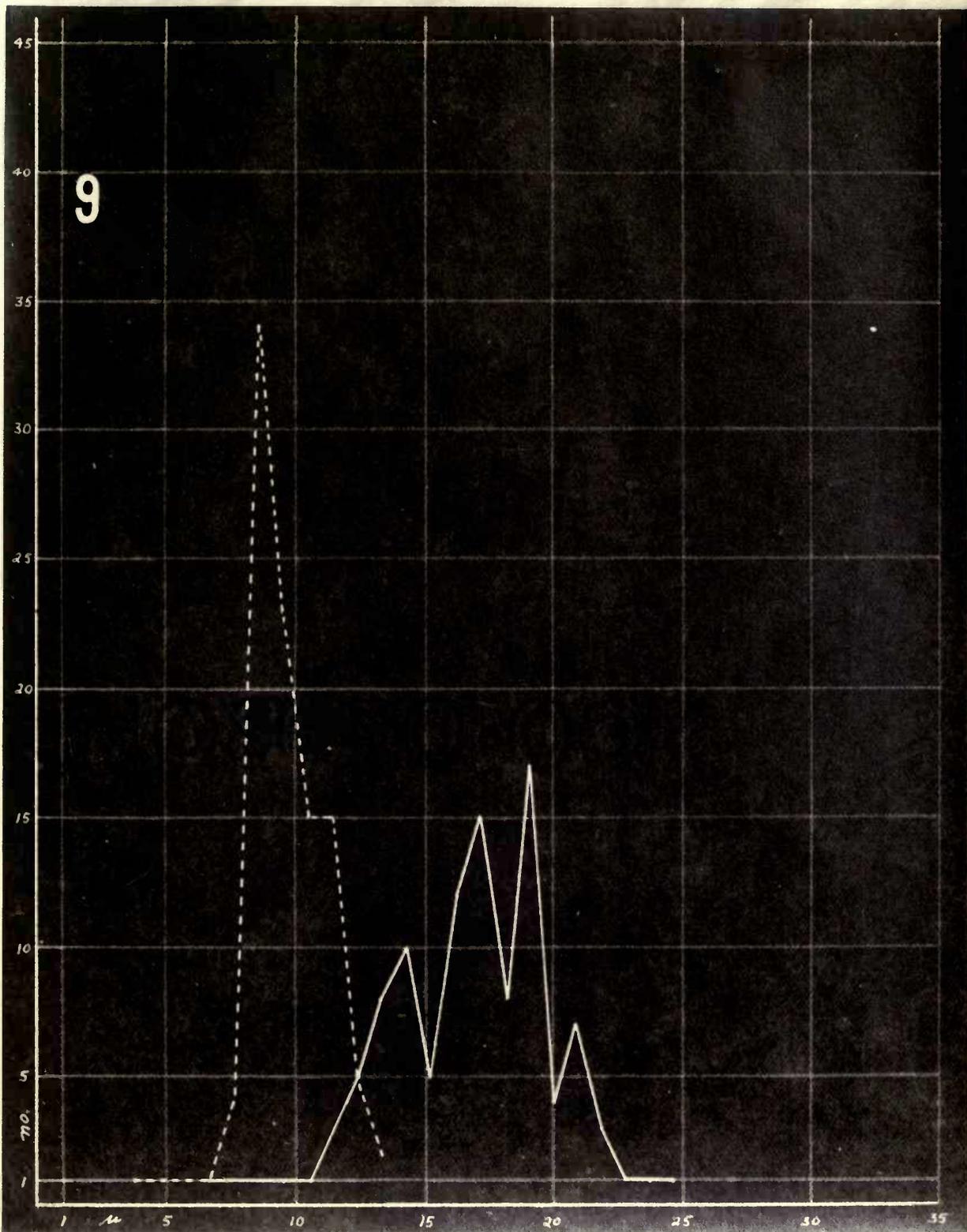


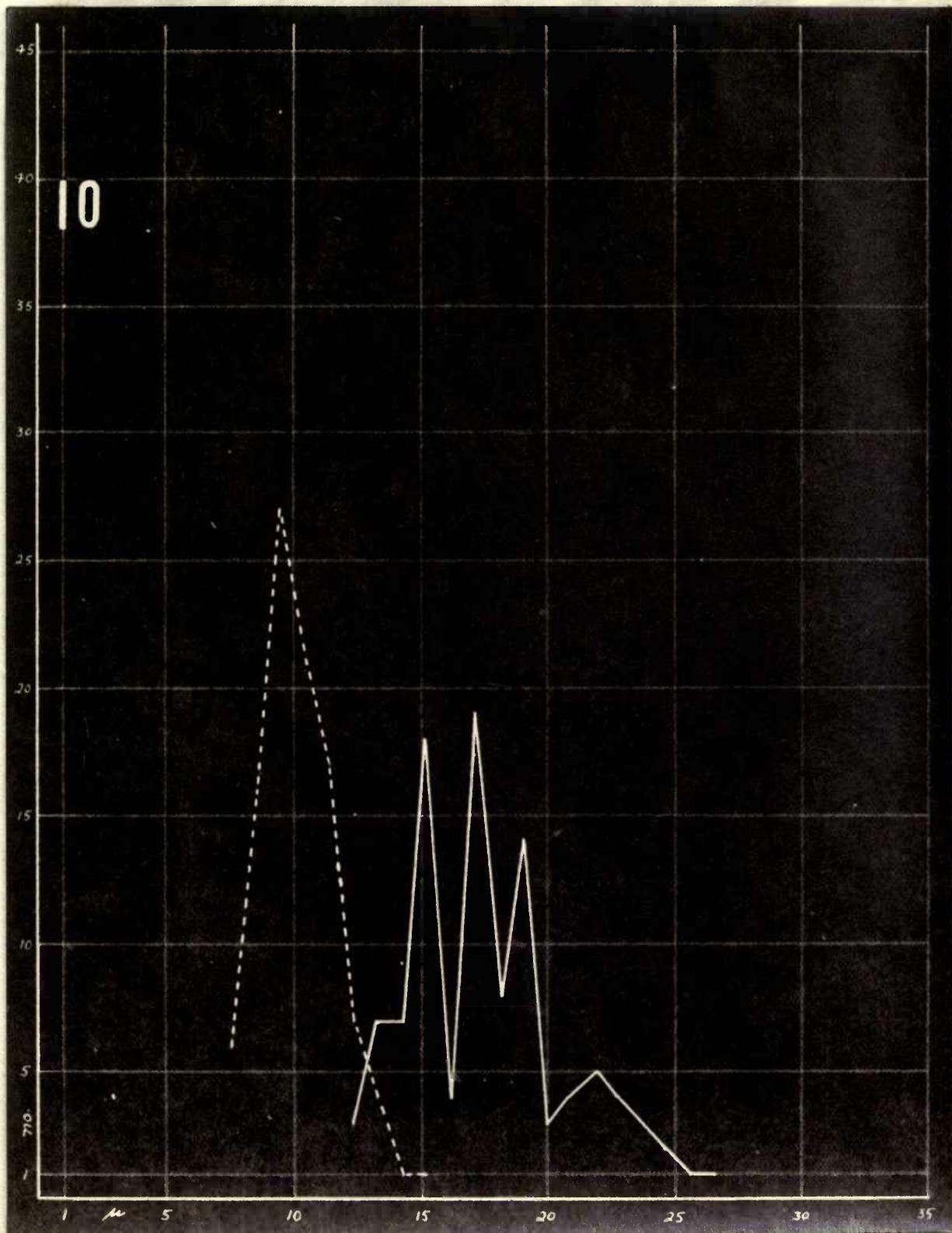
7

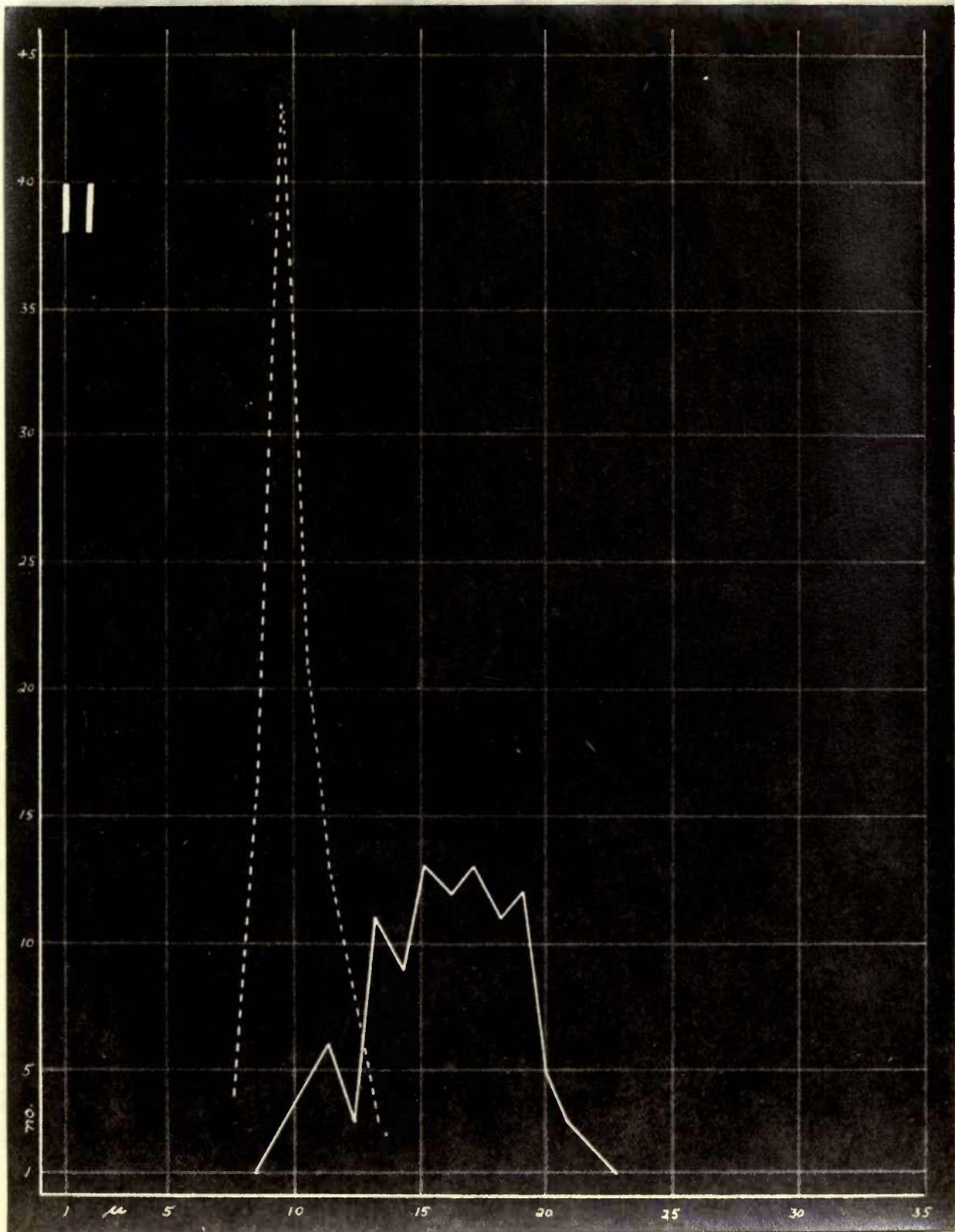


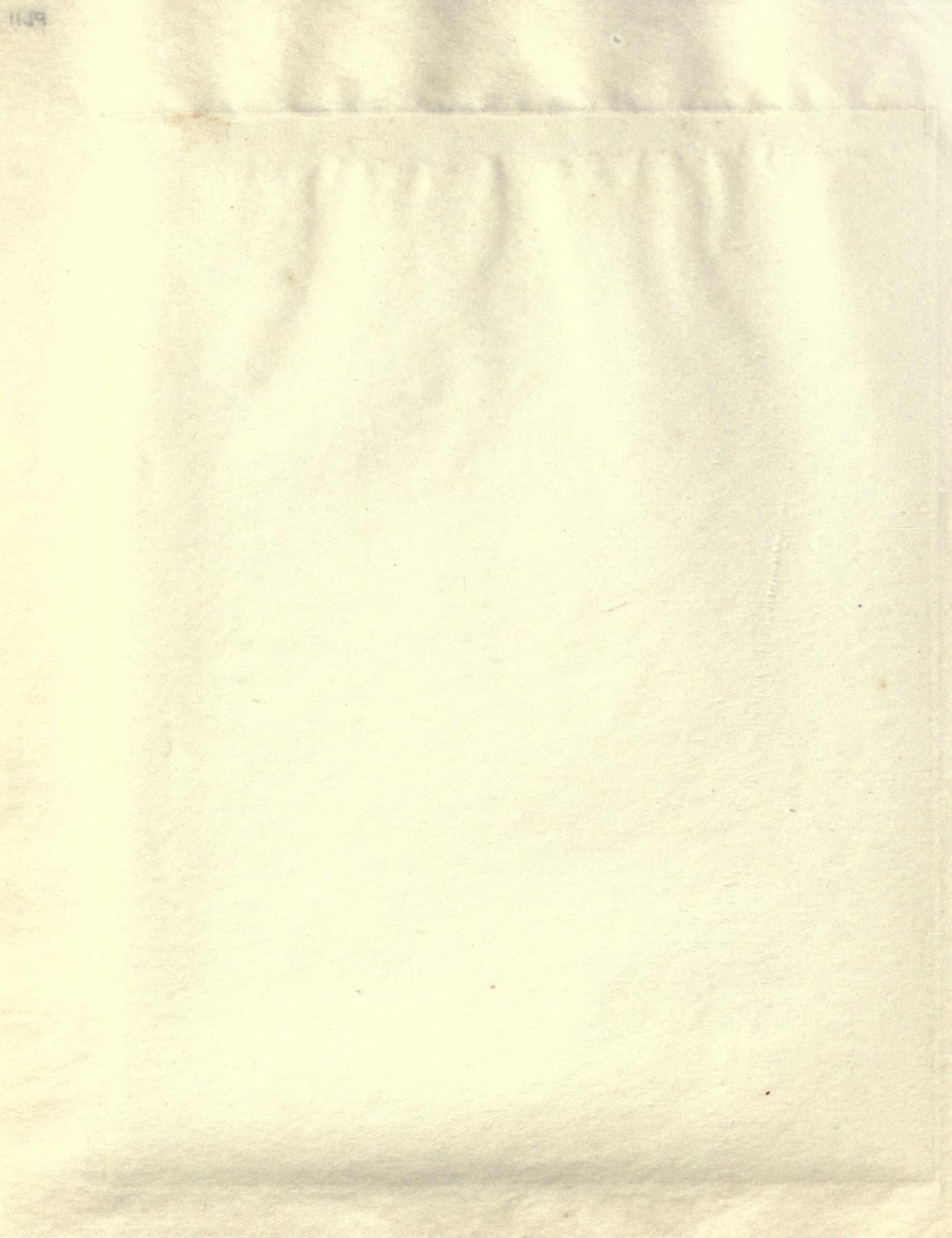
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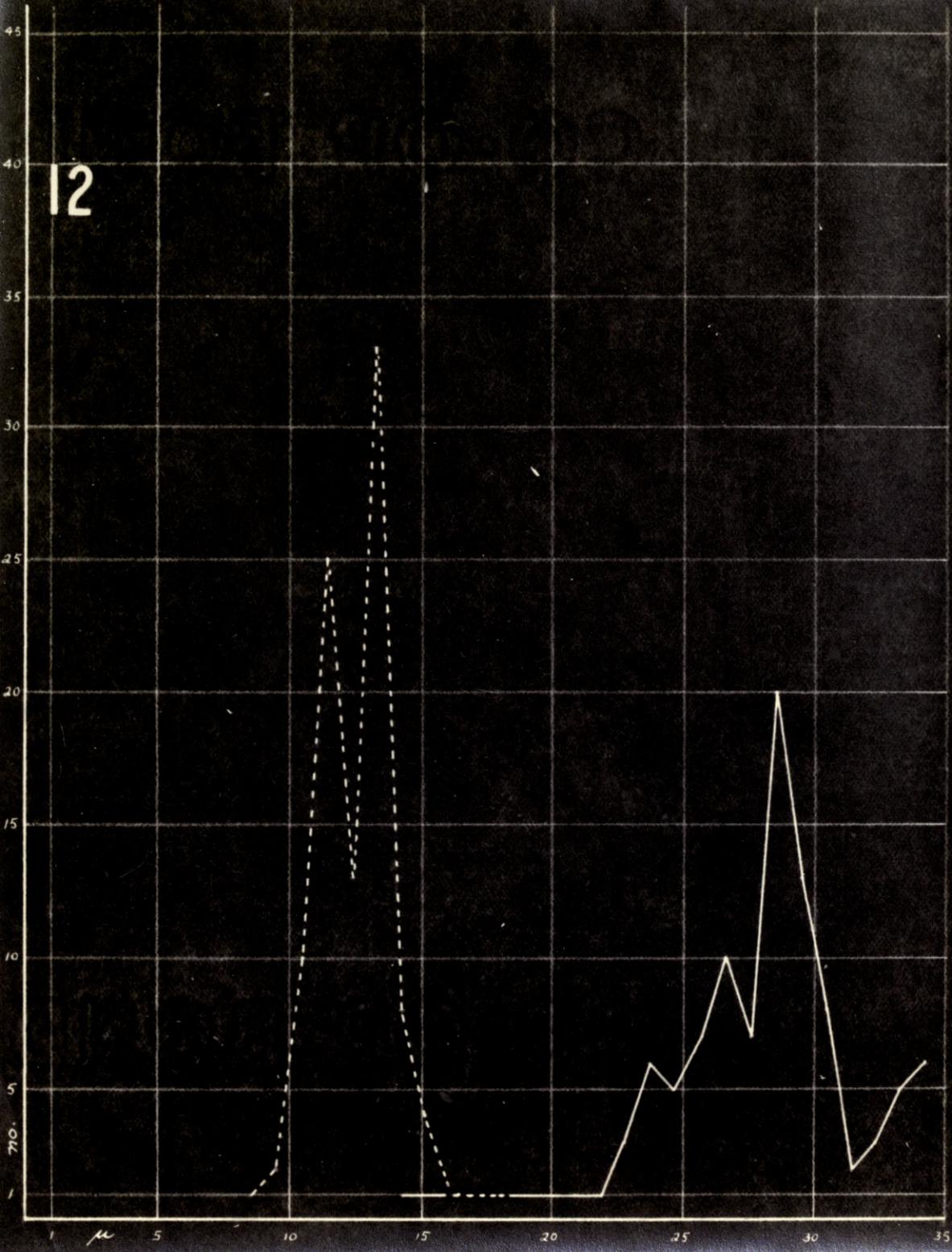






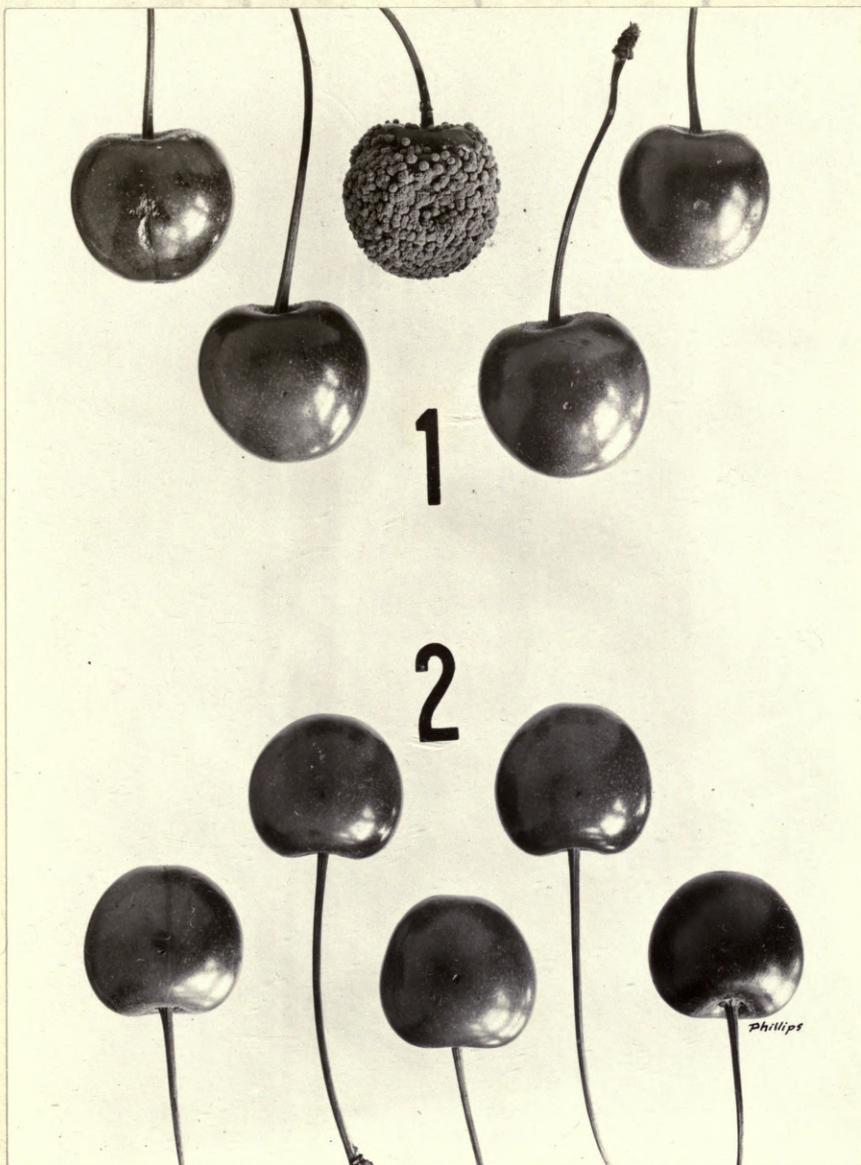


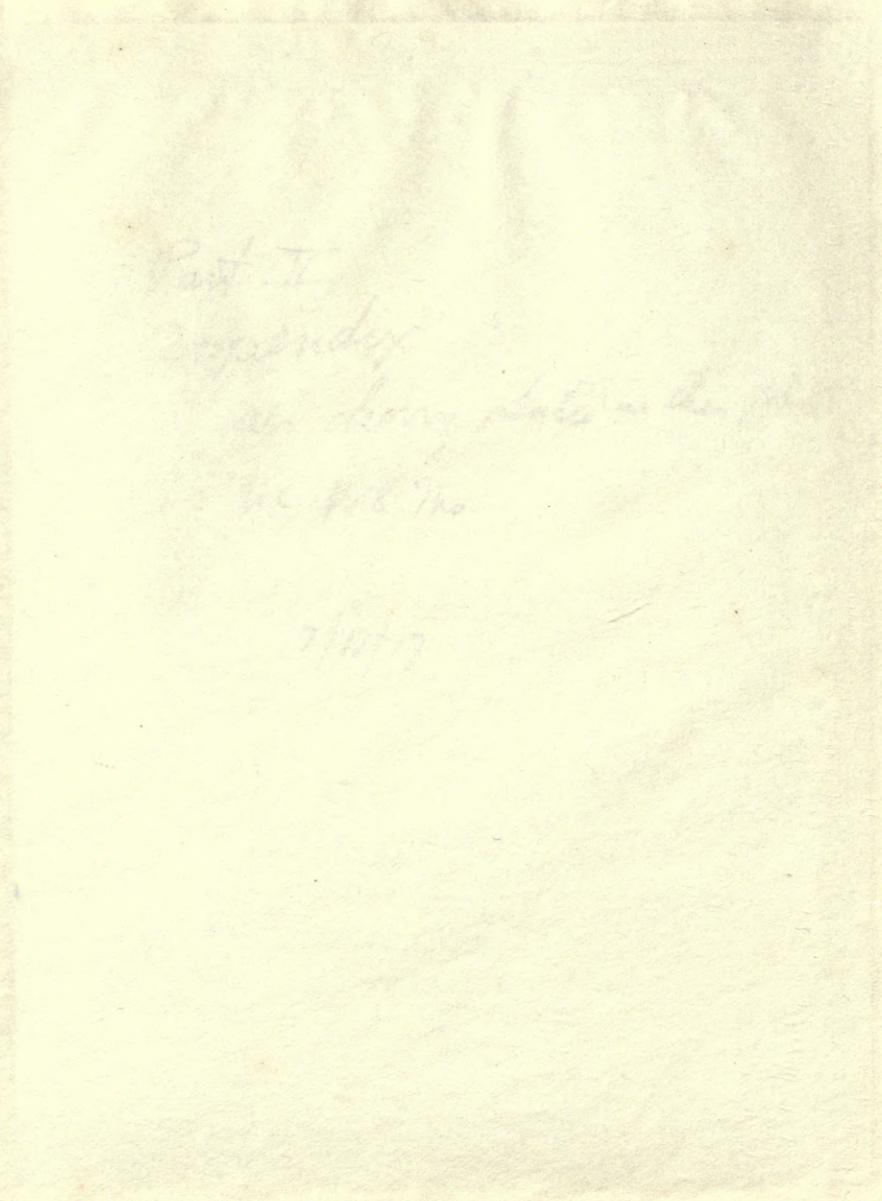
12



Plates 13-20. Photographs showing the results
of inoculating the Royal Anne
cherries with strains 1-16 inc.
respectively.

Fruit inoculated June 30, 1917
Photographed July 7, 1917
Cherries are natural size.

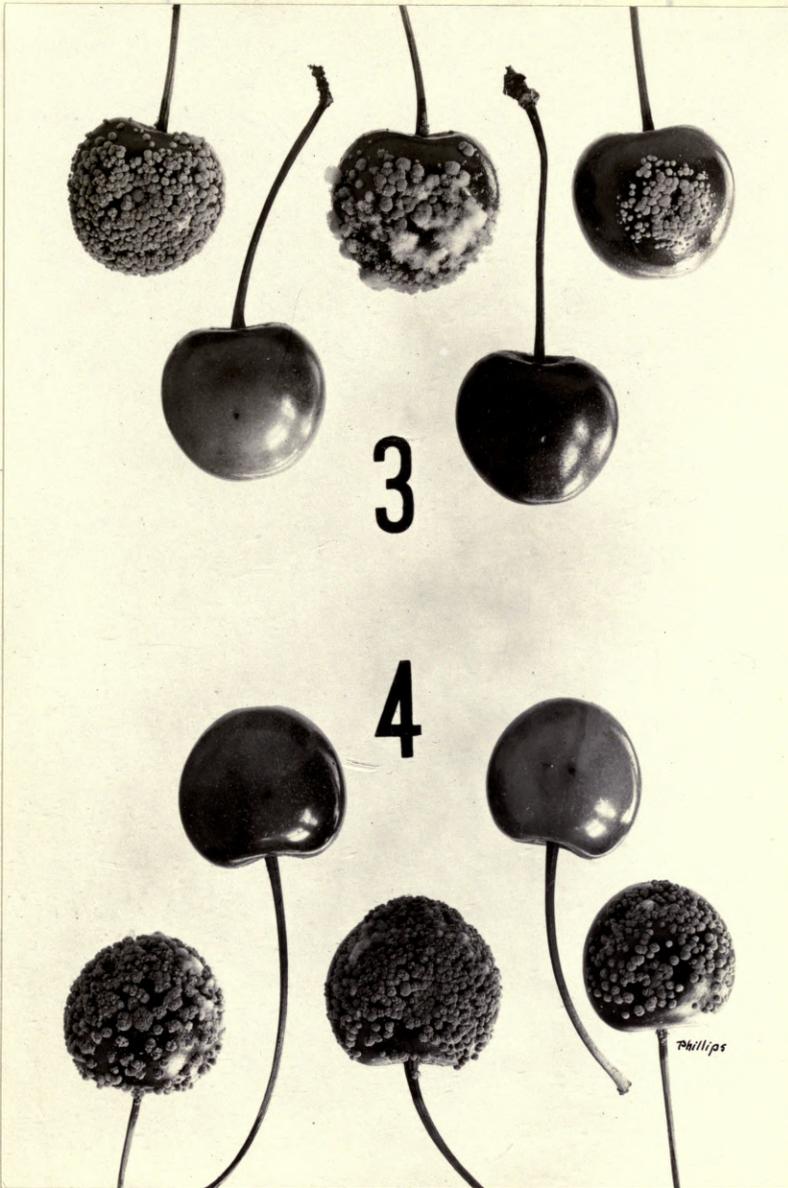




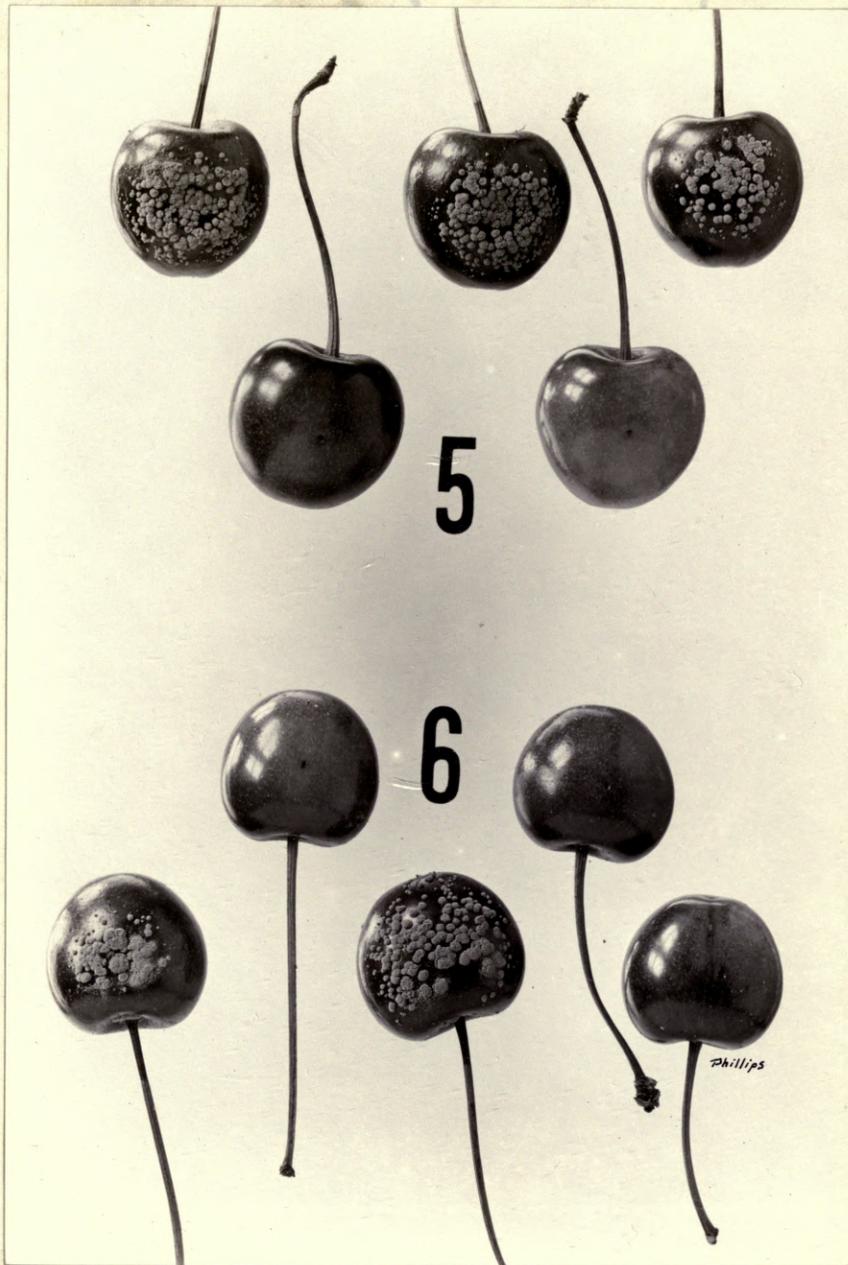
Part II
Appendix

in some plates in the
in the

1817



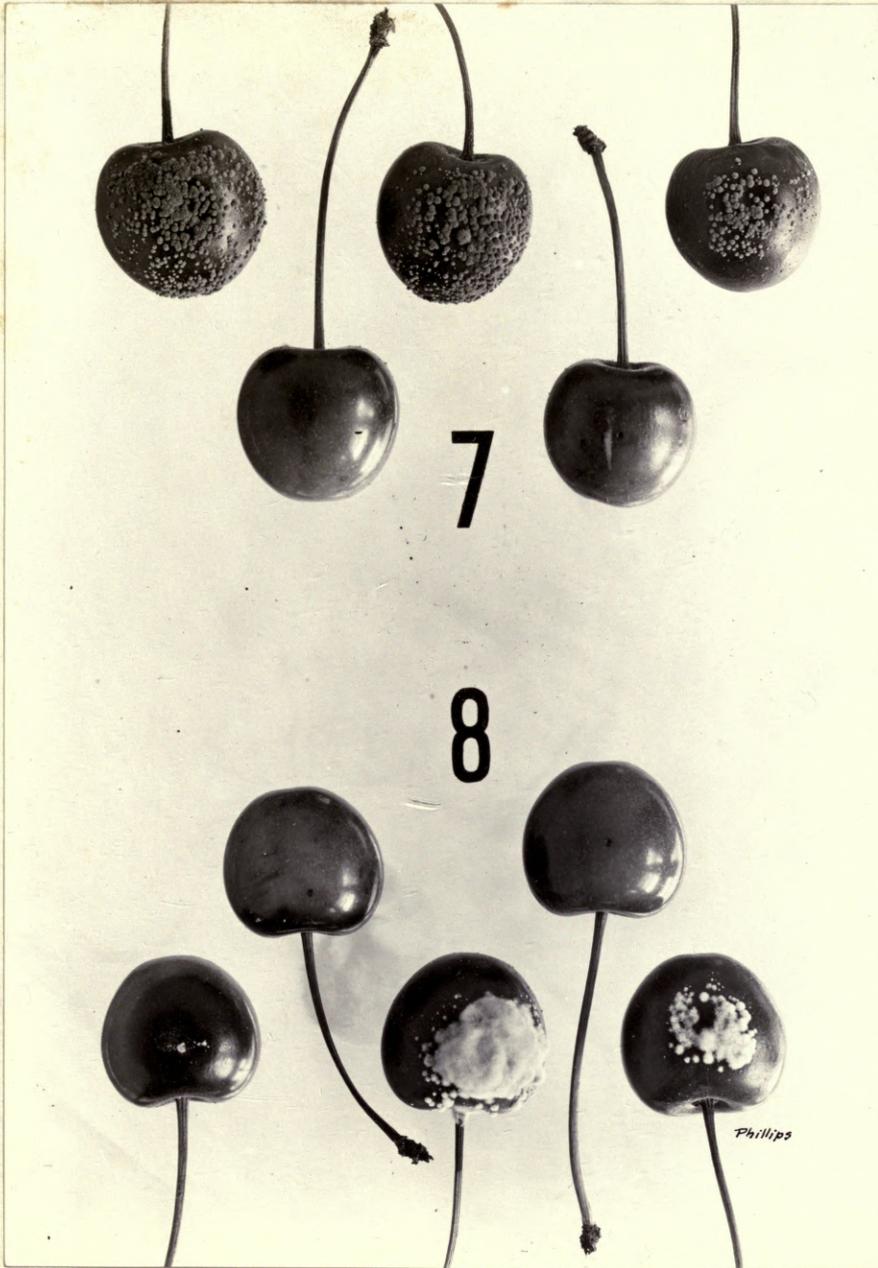




5

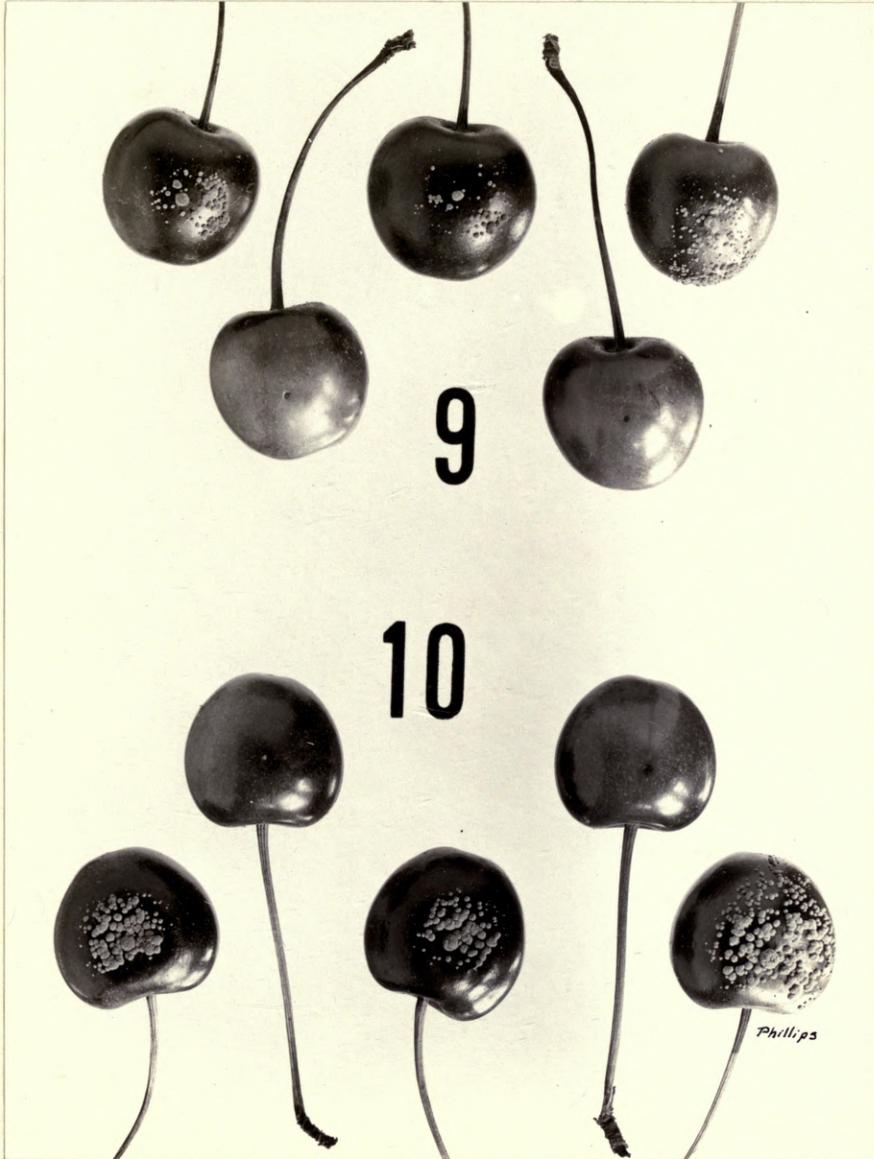
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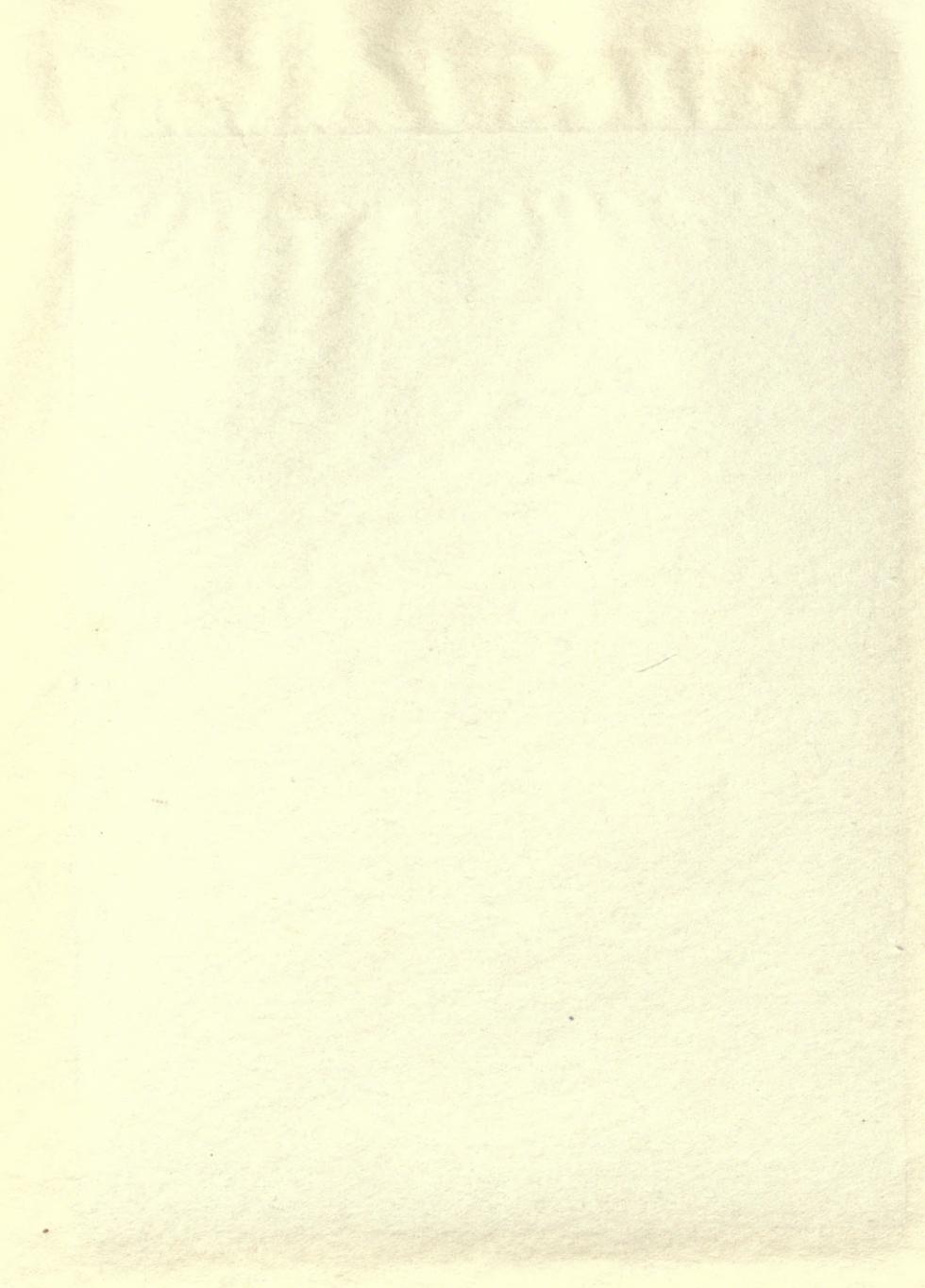
Phillips

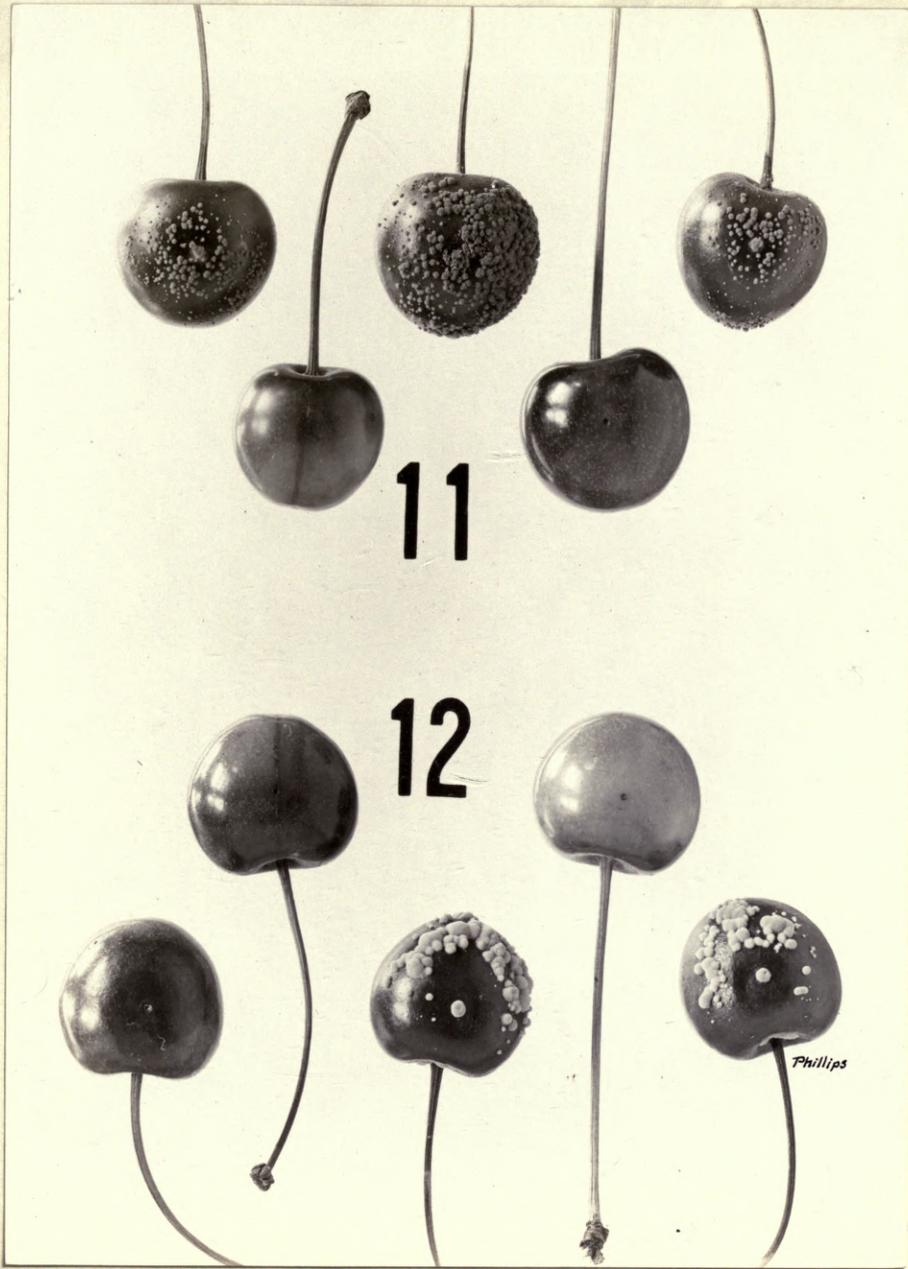


Phillips

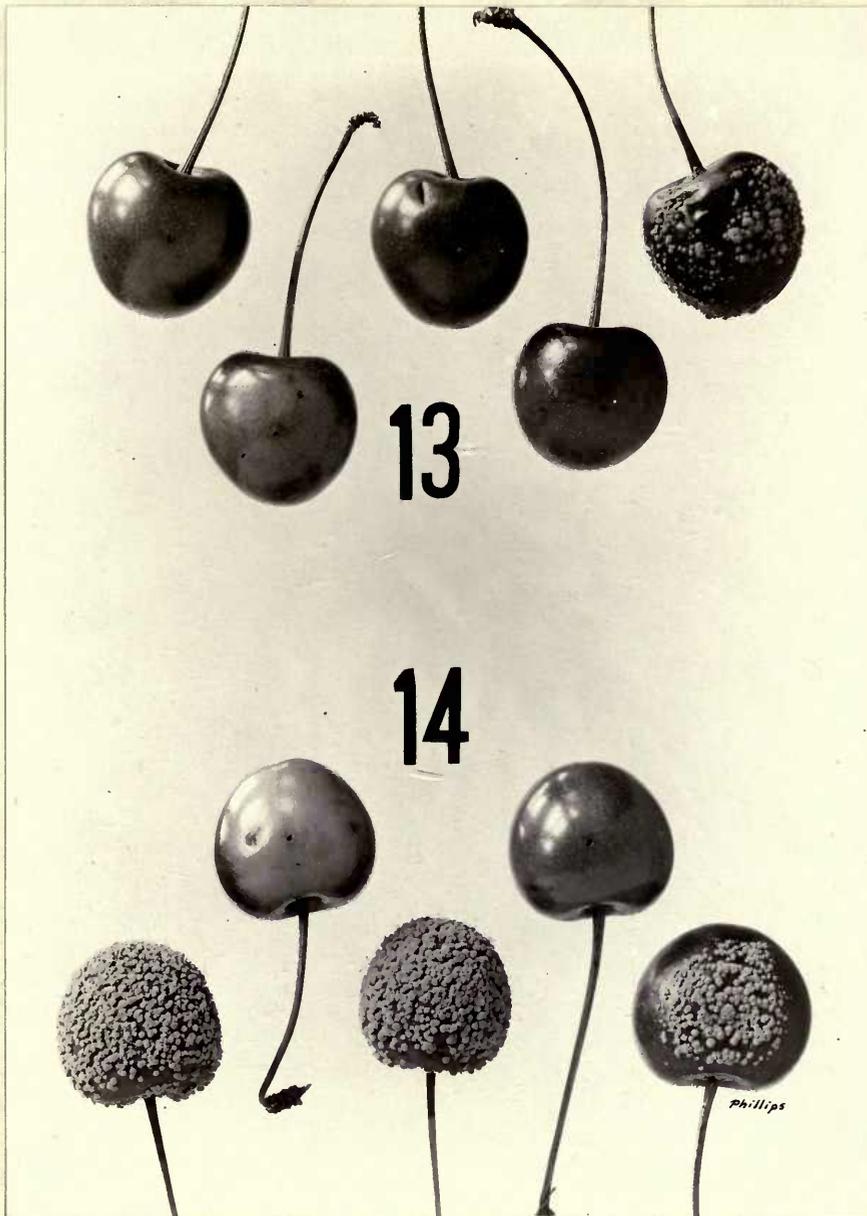




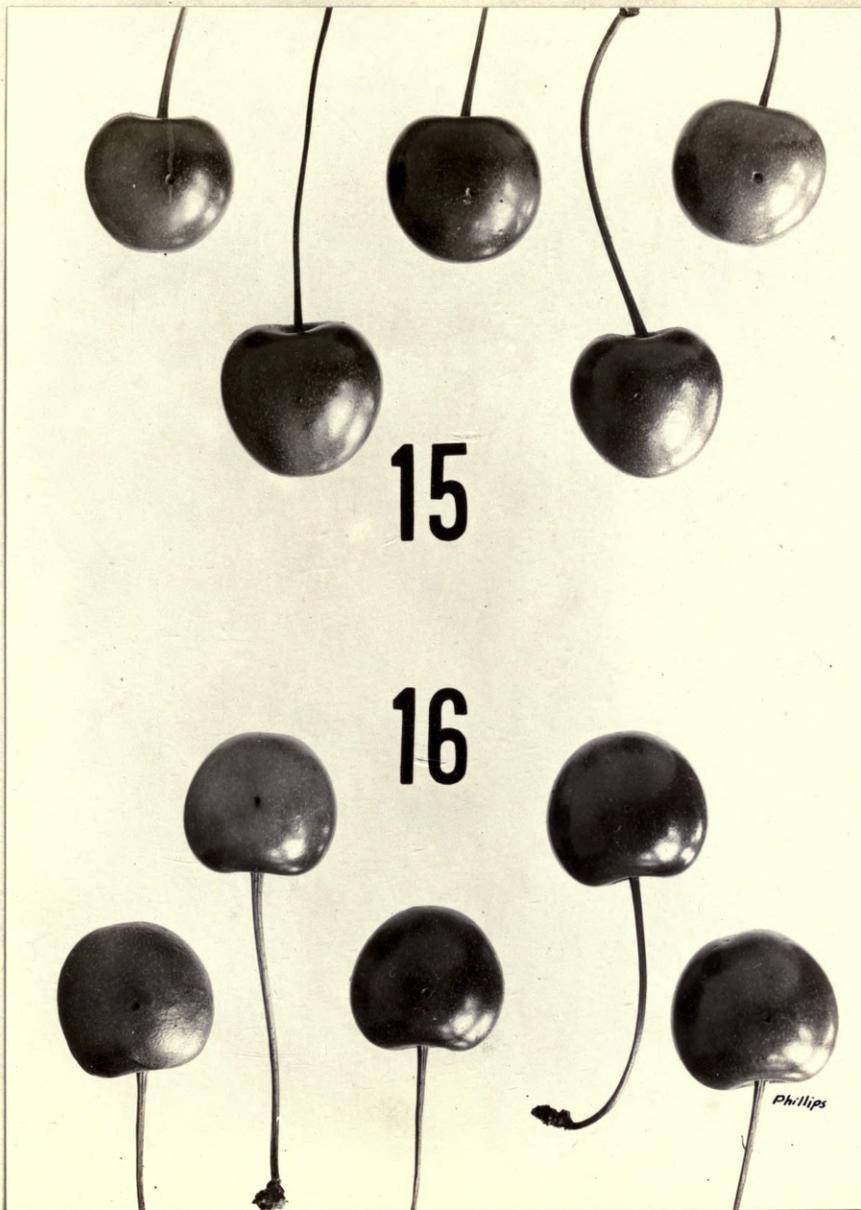




2/7/7



7/107



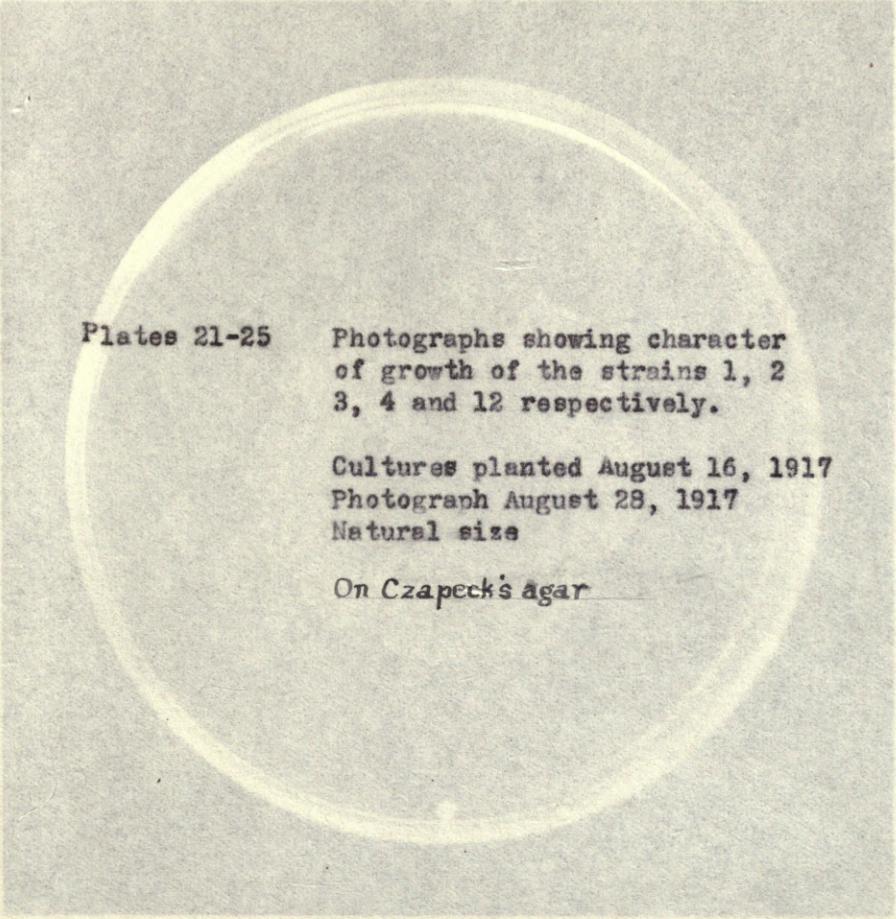
15

16

Phillips



[Faint, illegible handwritten or stamped text]



Plates 21-25

Photographs showing character
of growth of the strains 1, 2
3, 4 and 12 respectively.

Cultures planted August 16, 1917
Photograph August 28, 1917
Natural size

On Czapeck's agar

Strain 1

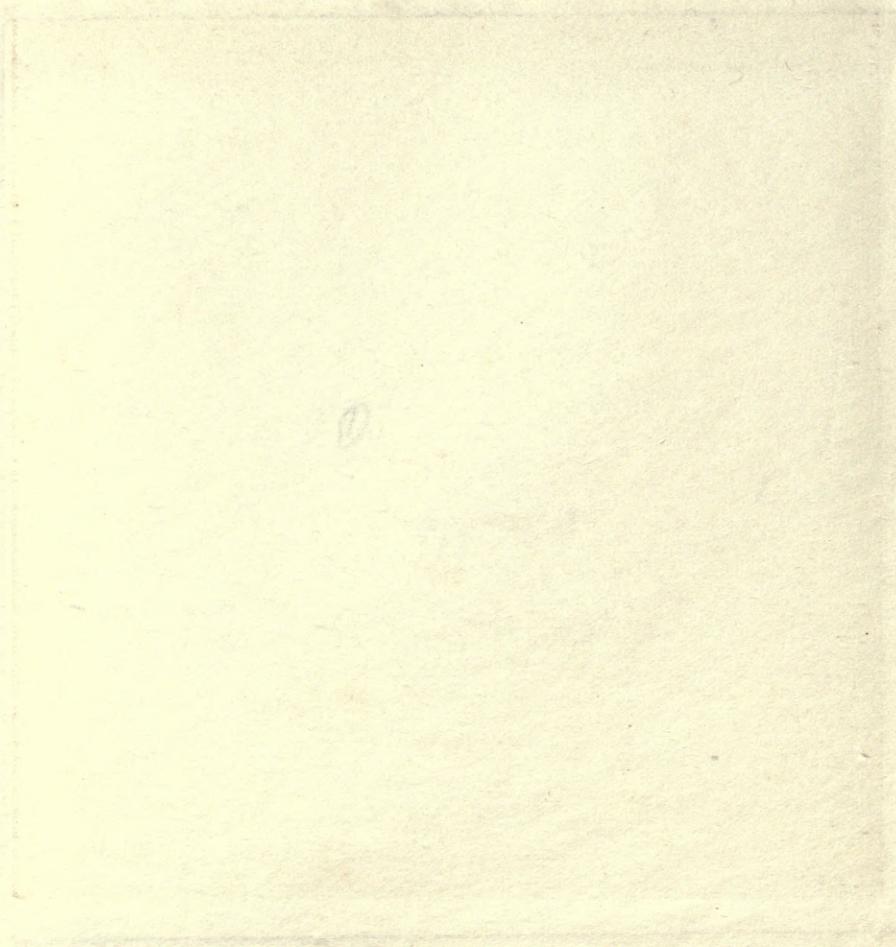
Plates 21-22
Photographs showing character
of growth of the strains 1, 2,
3, 4 and 12 respectively.

Cultures planted August 16, 1914
Photographs August 28, 1917
Material also

On Czapeck's agar



Strain #1



0

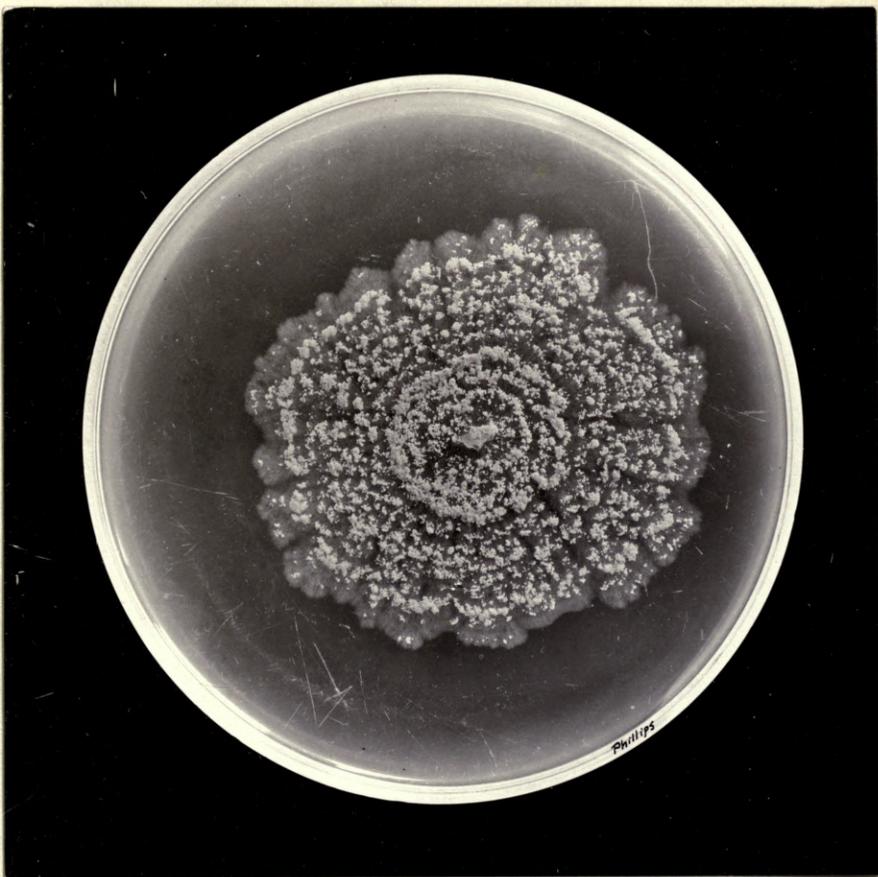
Stran 11



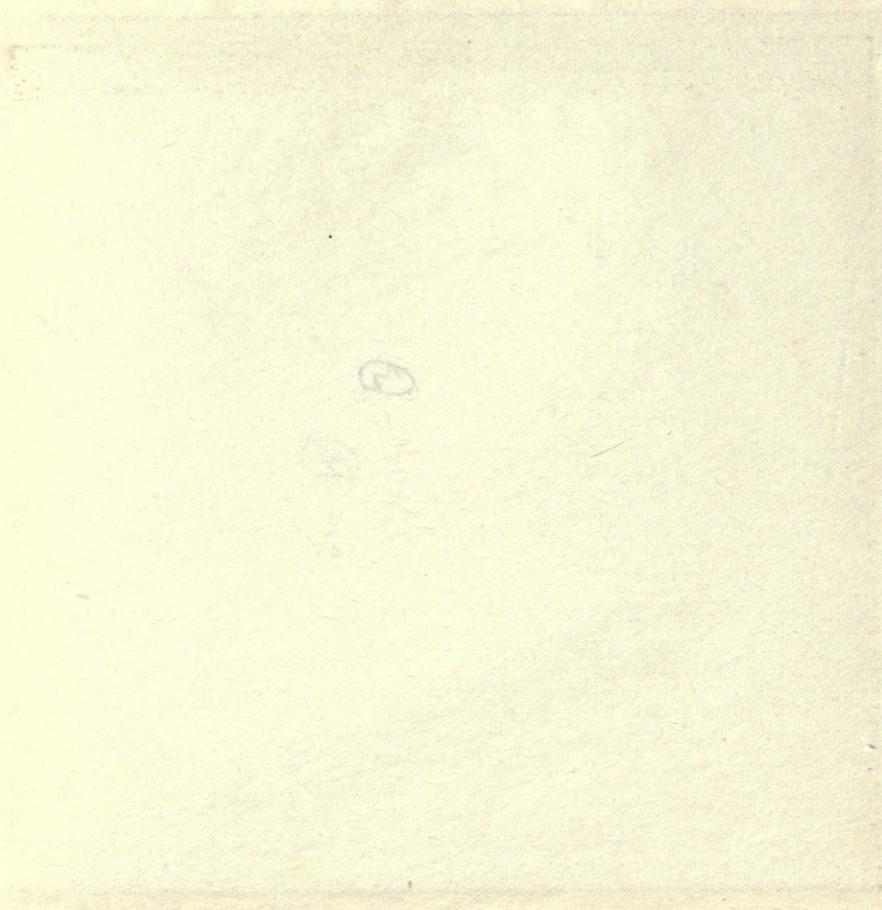
Strain 2



1879

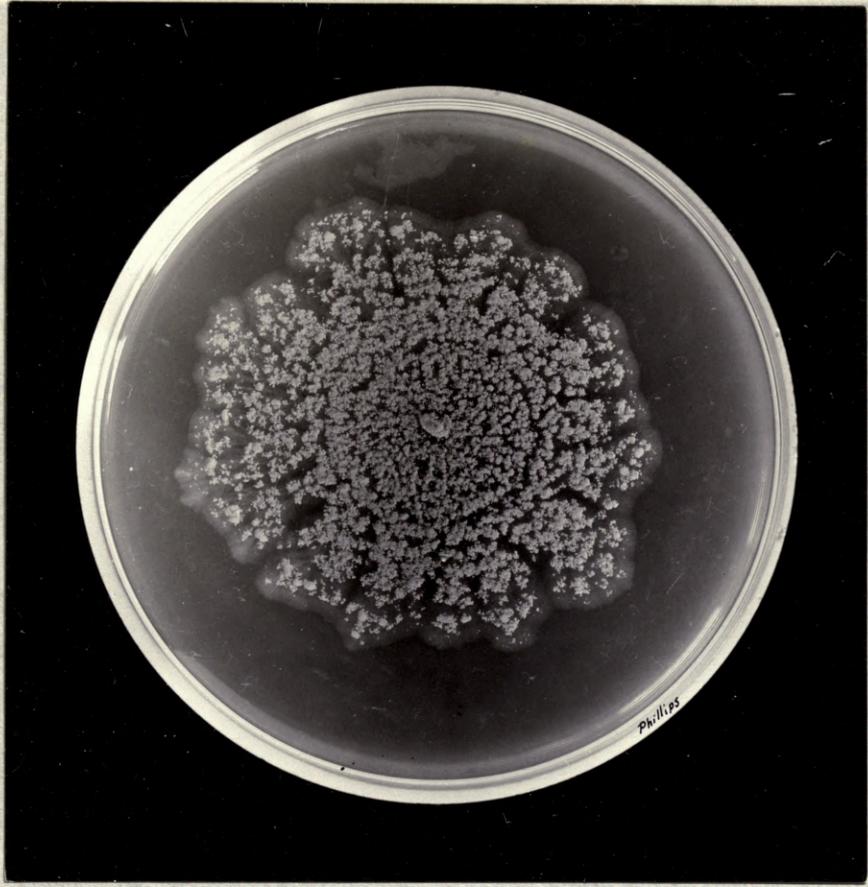


Strain #3

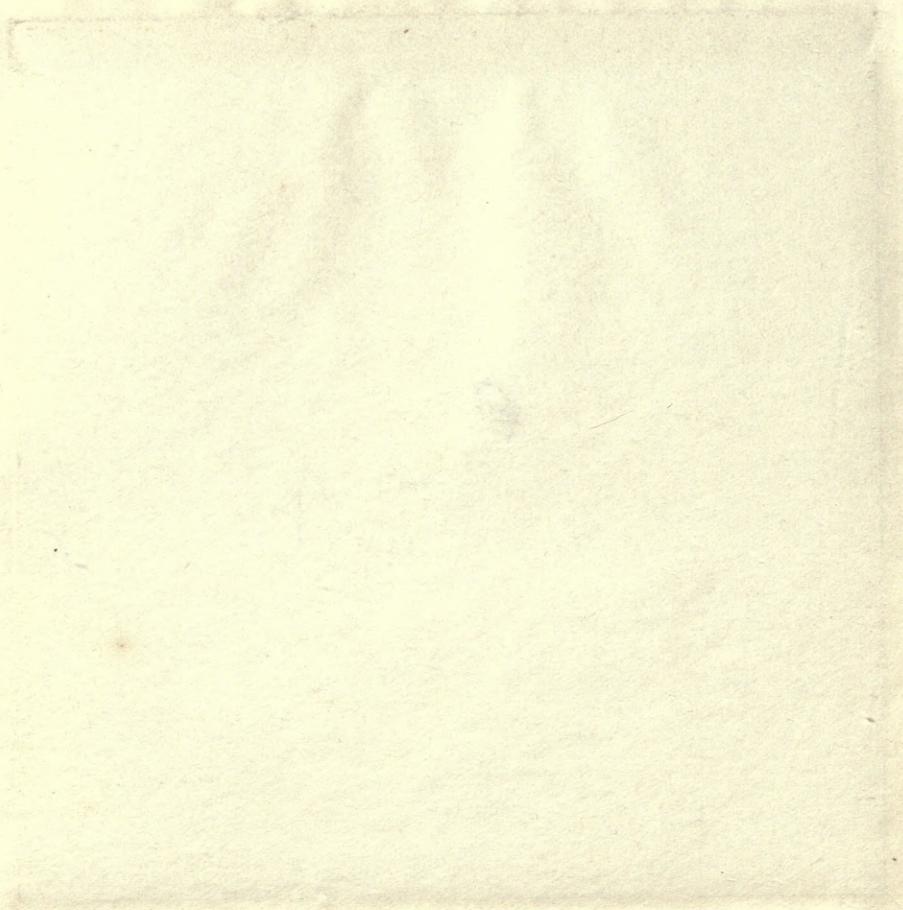


3

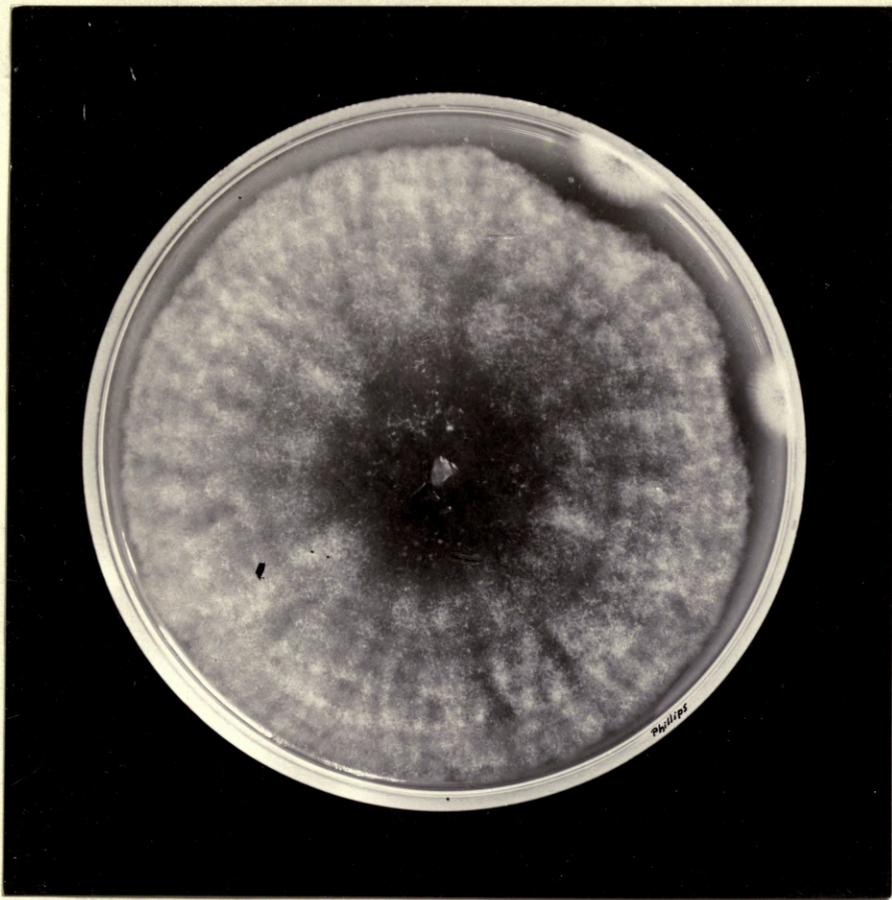
21st 3



Strain #4



Strain 4



Strain #12

12

Spain 12

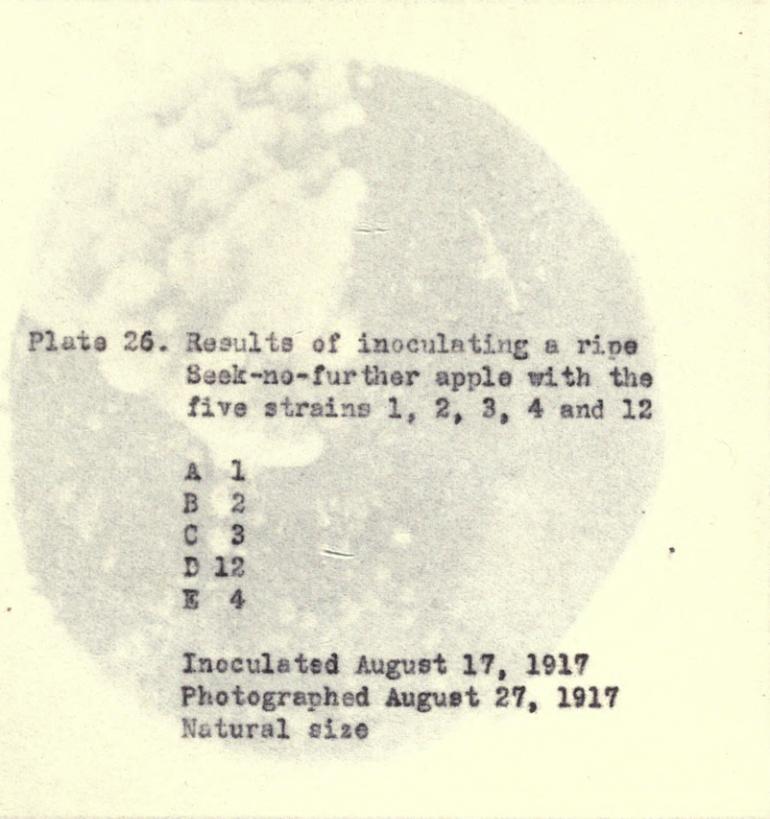


Plate 26. Results of inoculating a ripe
Seek-no-further apple with the
five strains 1, 2, 3, 4 and 12

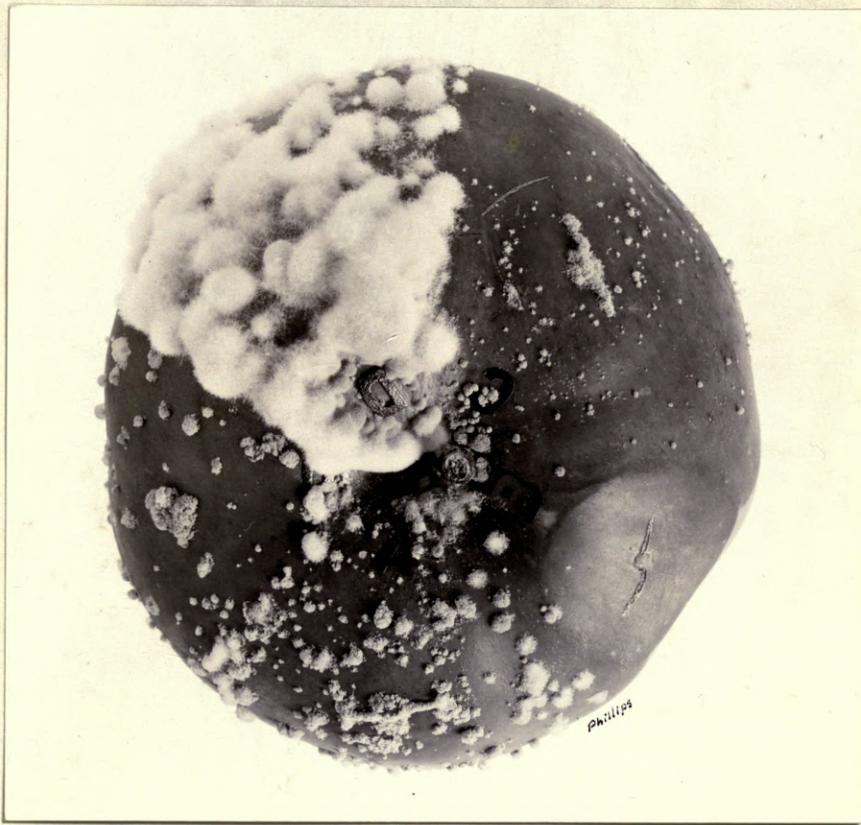
- A 1
- B 2
- C 3
- D 12
- E 4

Inoculated August 17, 1917
Photographed August 27, 1917
Natural size

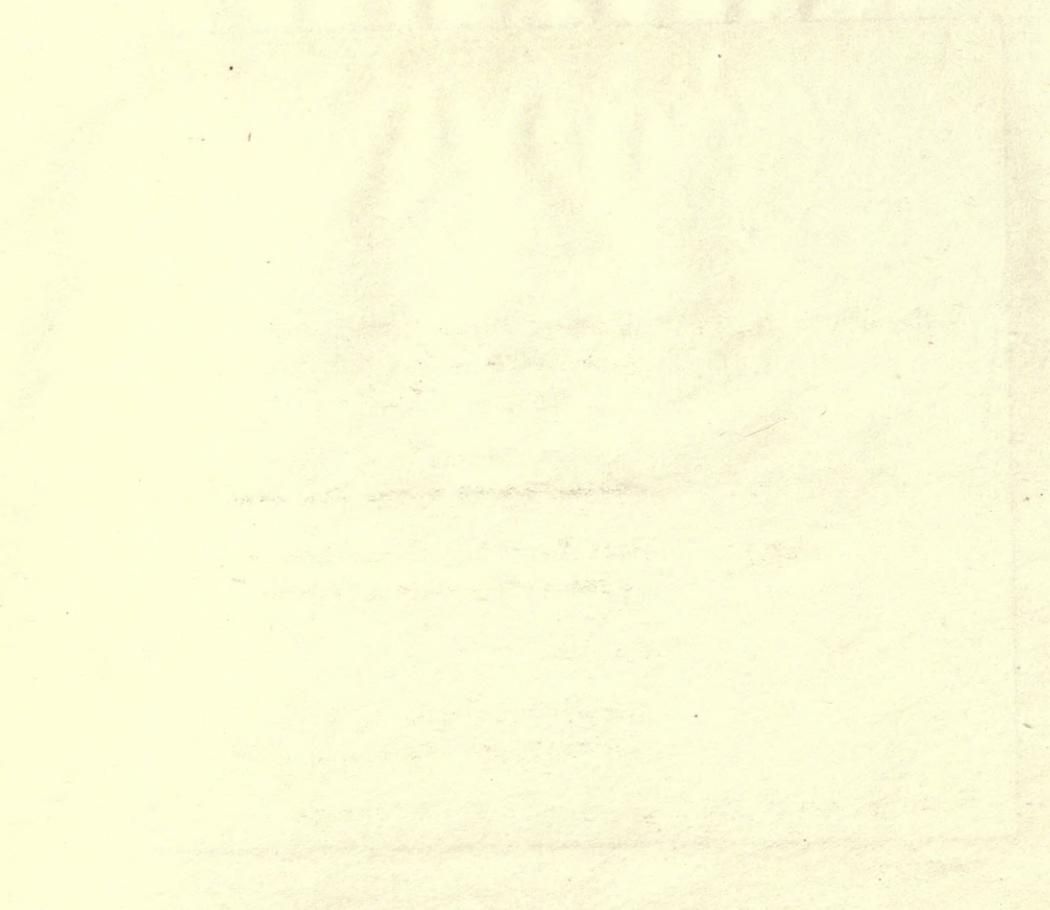
Plate 26. Results of inoculating a rose
bush no further with the
five strains I, B, C, D and E

A
B
C
D
E

Inoculated August 17, 1917
Photographed August 27, 1917
Natural size



Apple, moldy



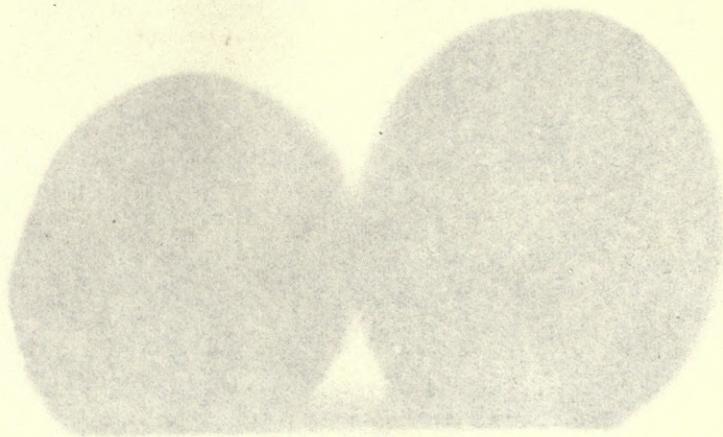


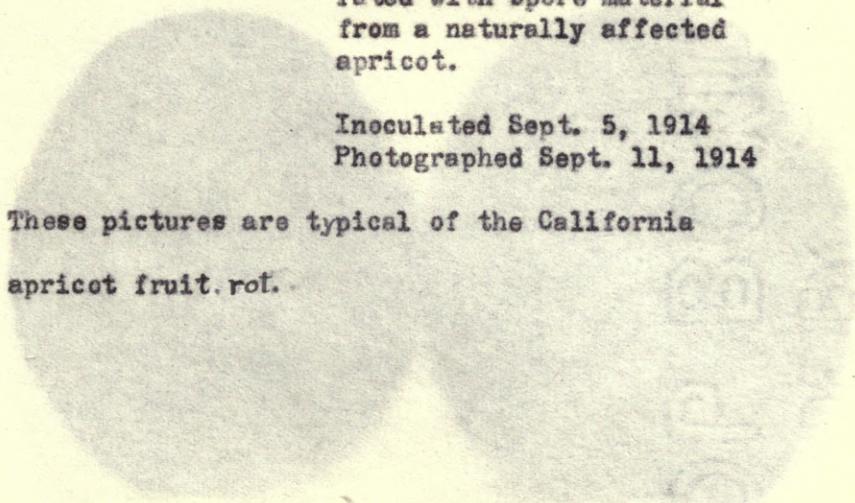
Plate 27. Upper. Diamond plums inoculated with spore material from a naturally infected apricot

Inoculated Sept. 5, 1914
Photographed Sept. 11, 1914

Lower. Pond Seedling plums inoculated with spore material from a naturally affected apricot.

Inoculated Sept. 5, 1914
Photographed Sept. 11, 1914

These pictures are typical of the California apricot fruit rot.



Diamond plums inoculated
with spore material from
a naturally infected sprout

Plate 27. Lower

Inoculated Sept. 5, 1914
Photographed Sept. 11, 1914

Pond Seedling plums inocu-
lated with spore material
from a naturally infected
sprout.

Lower

Inoculated Sept. 5, 1914
Photographed Sept. 11, 1914

These pictures are typical of the California

sprout fruit rot.

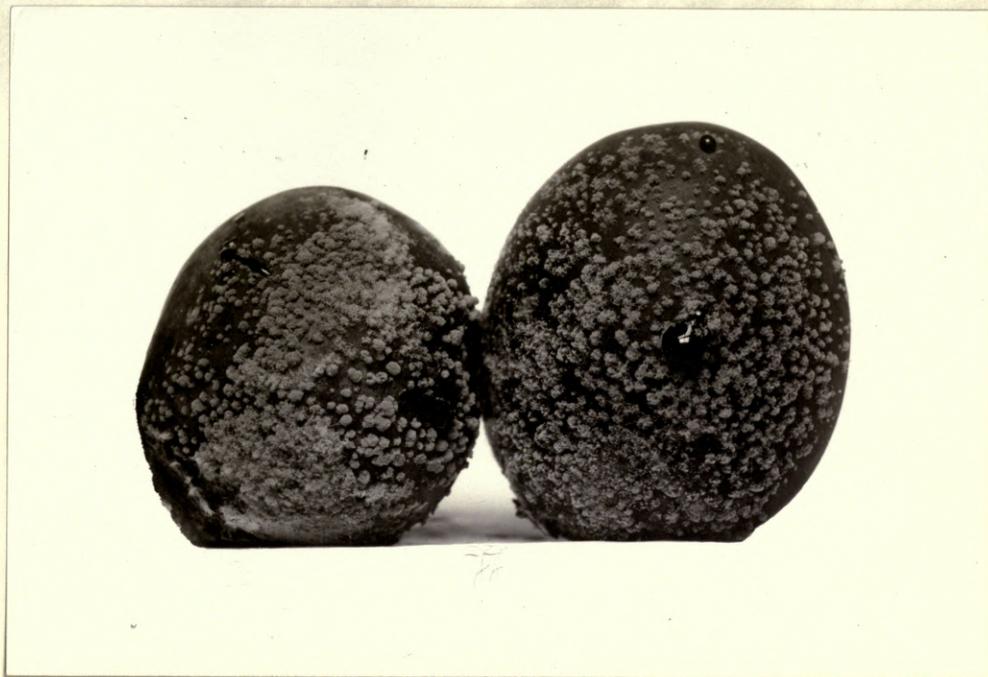


Plate 28. Upper. Photograph showing result of inoculating a quince with spore material from a naturally infected apricot.

Inoculated Sept. 28, 1914
Photographed about October 21, 1914

Lower. A. Sclerotinia cinerea, color of pustules. Copied from Woronin's work in St. Petersburg Academie Memoires Ser. Viii, V. 10, pl. IV, 1900.

B. Sclerotinia fructigena, color of pustules. Same source as A.

C. California Apricot rot, Sclerotinia, strain 1, Showing color of pustules on prune juice and bread culture in a flask.. 23 days old. This color is typical.

D. Color of gonidial mass of strain 1 when grown on sterilized green beans in a test tube. Culture 2 months old.

Plate 28. Upper. Photograph showing result of inoculating a quince with spore material from a naturally infected quince.

Inoculated Sept. 28, 1914
Photographed about October 21, 1914

Lower. A. Sclerotinia glauca, color of pustules. Copied from Woronin's work in St. Petersburg Academic Magazine Ser. VII, V. 10, pl. IV, 1900.

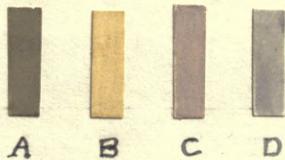
B. Sclerotinia fusiformis, color of pustules. Same source as A.

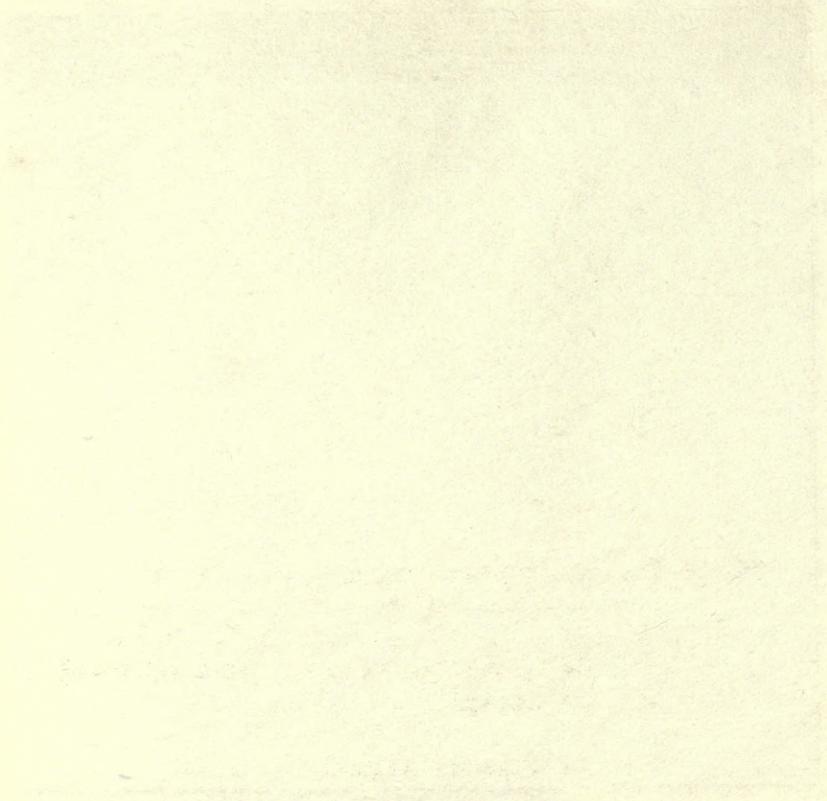
C. California Aoyote rot, Sclerotinia, strain I. Showing color of pustules on quince fruit and bread culture in a flask. 28 days old. This color is typical.

D. Color of conical mass of strain I when grown on sterilized green beans in a test tube. Culture 2 months old.



Photographed August 27 11, 1914





A	B	C	D
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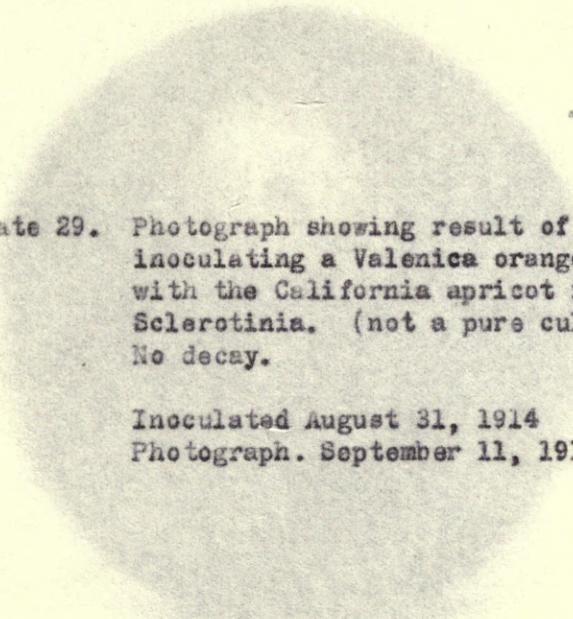


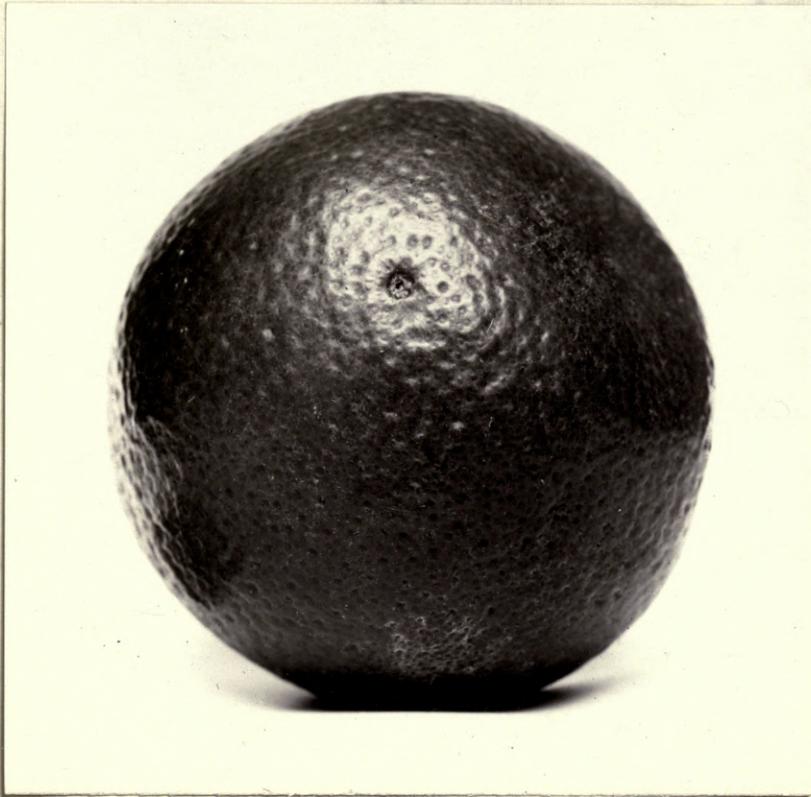
Plate 29. Photograph showing result of
inoculating a Valenica orange
with the California apricot rot
Sclerotinia. (not a pure culture)
No decay.

Inoculated August 31, 1914
Photograph. September 11, 1914

Plate 20. Photograph showing result of
inoculating a Valencia orange
with the California spirit rot
bacterium. (not a pure culture)
No decay.

Inoculated August 21, 1914
Photograph September 11, 1914

Plate 30. Upper Photograph showing fresh cankers being produced on an apricot that was attacked the previous year and which remained hanging in the tree through the winter. These fresh



Thomas

Plate 30. Upper

Photograph showing fresh conidia being produced on an apricot that was attacked the previous year and which remained hanging in the tree through the winter. These fresh conidia serve as a source of infection to the blossoms, as well as fresh conidia produced on twigs killed the previous season with the fungus.

Photograph during the blossoming period Spring, 1917

Lower.

Photograph showing result of inoculating Spitzenberg apple with the California apricot rot Sclerotinia (not a pure culture) Inoculated November 7, 1914

Photograph

by W. W. Thomas



Photograph showing fresh conidia
being produced on an ascus that
was attacked the previous year and
which remained hanging in the tree
through the winter. These fresh
conidia serve as a source of in-
fection to the disease, as well
as fresh conidia produced on trees
killed the previous season at the
lumber.
Photograph during the blossoming
period Spring, 1917

Upper Plate 30.

Photograph showing result of
inoculating Epilobium sp.
with the California species of
Gibberella (not a pure culture)
Inoculated November 7, 1914
by W. W. Thomas

Lower

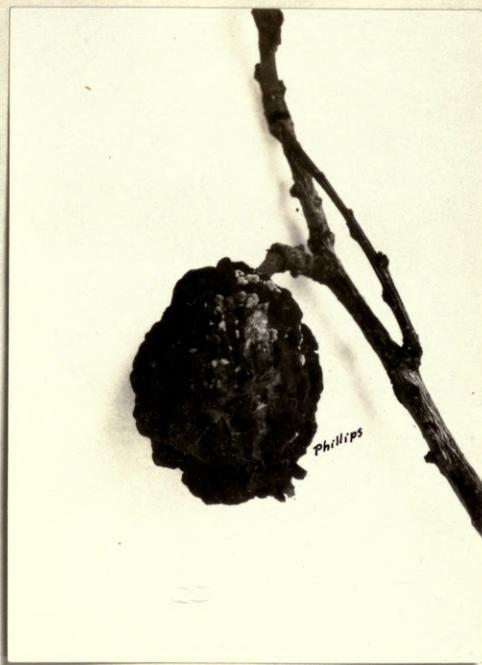


Plate 31. Photograph showing results of
inoculating a seedling with a fungus



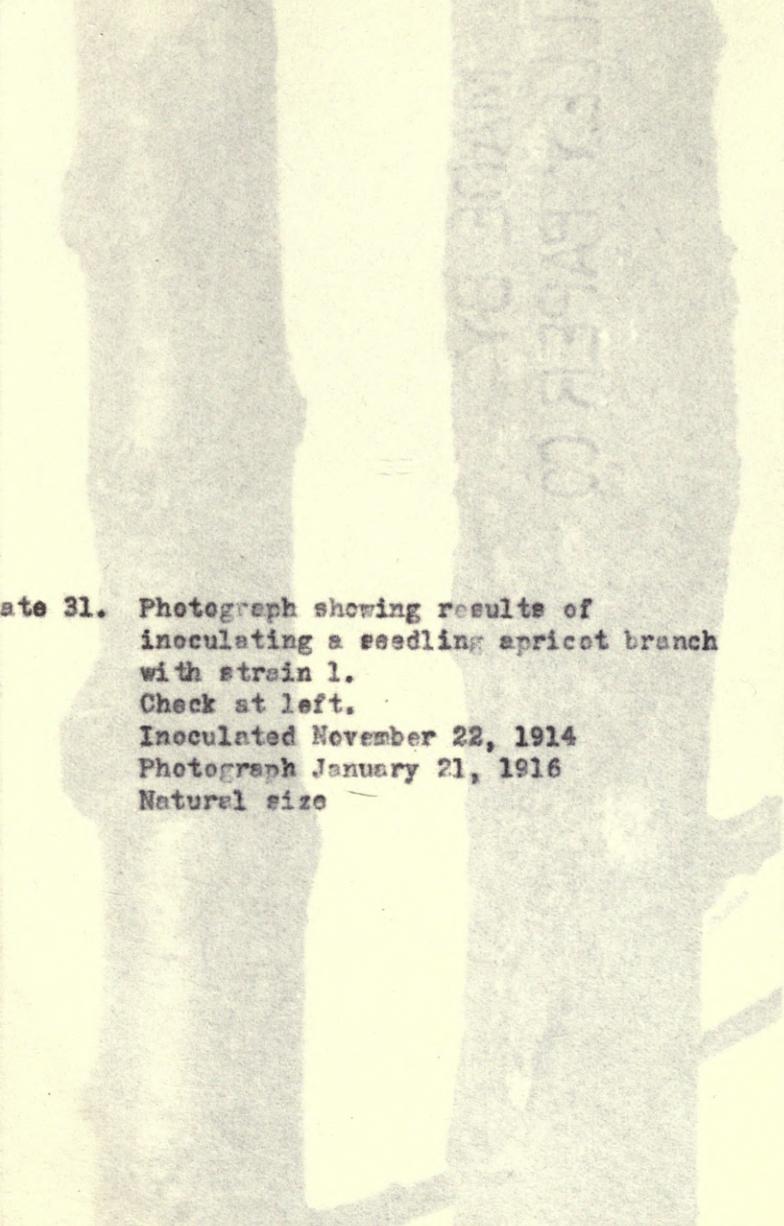


Plate 31. Photograph showing results of
inoculating a seedling apricot branch
with strain 1.
Check at left.
Inoculated November 22, 1914
Photograph January 21, 1916
Natural size

Plate 31. Photograph showing results of
incubating a seedling sprout from
with strain A.
Checked at left.
Incubated November 22, 1914
Photograph January 21, 1915
Natural size



1/21/16

XI

Plate 32. Photograph showing results of
inoculating a seedling peach branch
with strain 1.
Check at lower right
Inoculated November 22, 1914
Photograph January 21, 1916
Slightly reduced.

Plate 32. Photograph showing results of
inoculating a seedling peach branch
with strain I.
Check at lower right
Inoculated November 22, 1914
Photograph January 21, 1915
Slightly reduced.



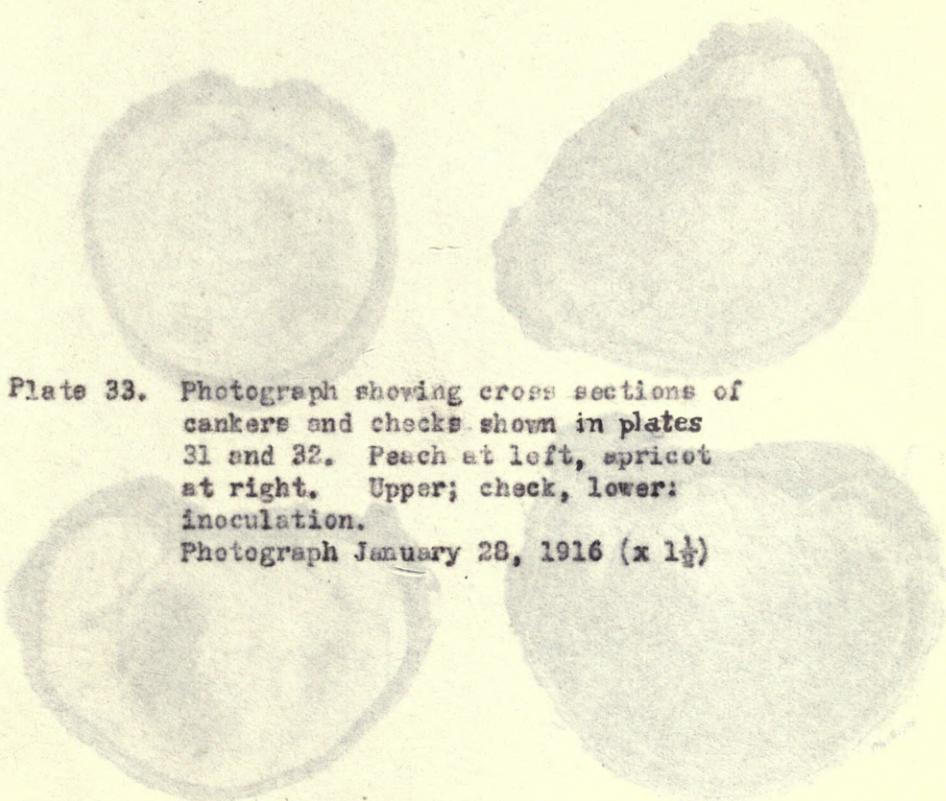


Plate 33. Photograph showing cross sections of cankers and checks shown in plates 31 and 32. Peach at left, apricot at right. Upper; check, lower: inoculation.
Photograph January 28, 1916 (x 1 $\frac{1}{2}$)

Plate 33. Photograph showing cross sections of
canals and ducts shown in plates
31 and 32. Piece of leaf, epinot
at right. Upper; black, lower;
translucent.
Photograph January 28, 1916 (x 15)

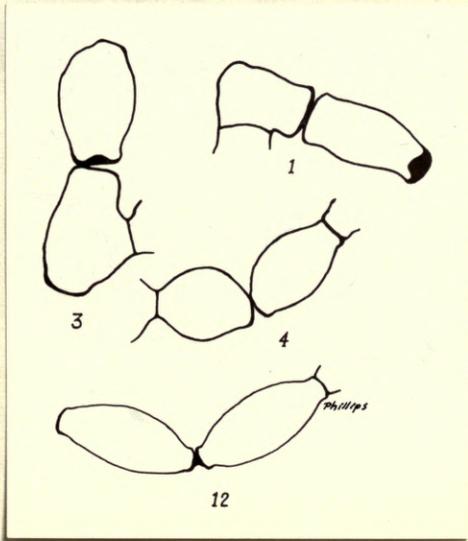
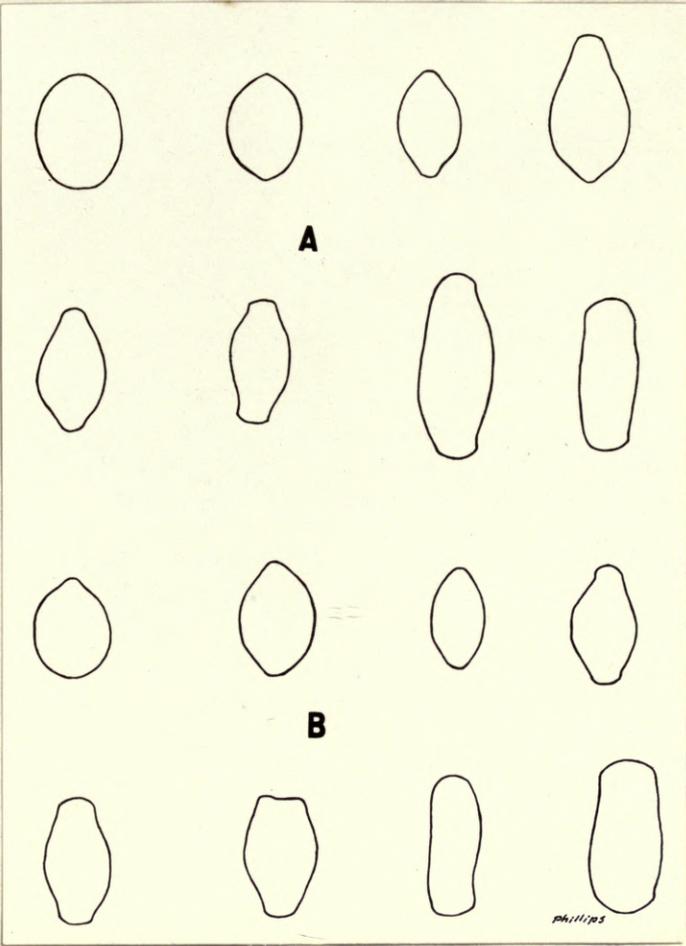


Plate 34.

A. Showing variation in size and shape of conidia of strain 1 when grown on sterilized plum wood in a test tube. Culture 15 days old. (x1000)

B. Showing variation in size and shape of conidia of strain 1 when grown on standard nutrient gelatine in a test tube. Culture 15 days old. (X 1000)

C. 1) These numbers 1, 3, 4, 12
3) correspond to the strains of
4) the same number, and show the
12) appearance of separating conidia.
Taken from Royal Anne cherries
July, 1917. (x 1000)



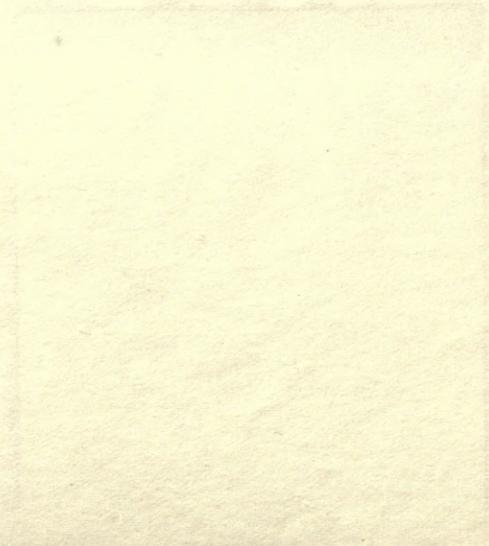
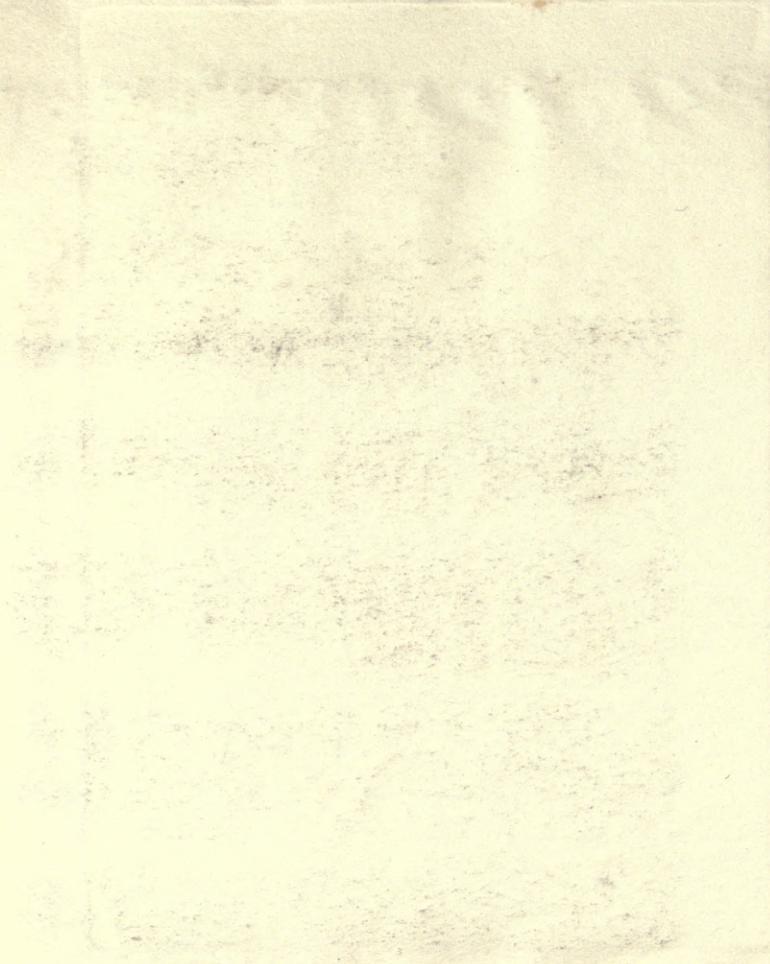


Plate 35. A) Conidia from the surface of an apricot
B) naturally infected with the California apricot rot Sclerotinia (x 1000)

C. 3 mature conidia from a culture of strain 1 on Solanum tuberosum 14 days old (x 1000) and germinating conidium of California apricot rot Sclerotinia (2 days in tap water) (X 1000)

D. Spore-like bodies from culture on Diamond plum (x 1000) September 19, 1914. See plate 27, upper photograph.

E. Germinating gonidium of the California apricot rot Sclerotinia in 100% peach juice, the acidity of which was +10.4. Drop culture 8 days old. (x 2000).

F. Gonidia of the California apricot rot Sclerotinia produced in a tap water drop culture of conidia from a naturally infected apricot. 49 days old. (x 1000).

G. 3 germinating gonidia of the California apricot rot Sclerotinia in distilled water drop culture. 3 days old. (x 2000)

A) Conidia from the surface of an apricot

B)

naturally infected with the California
apricot rot *Botrytis* (x 1000)

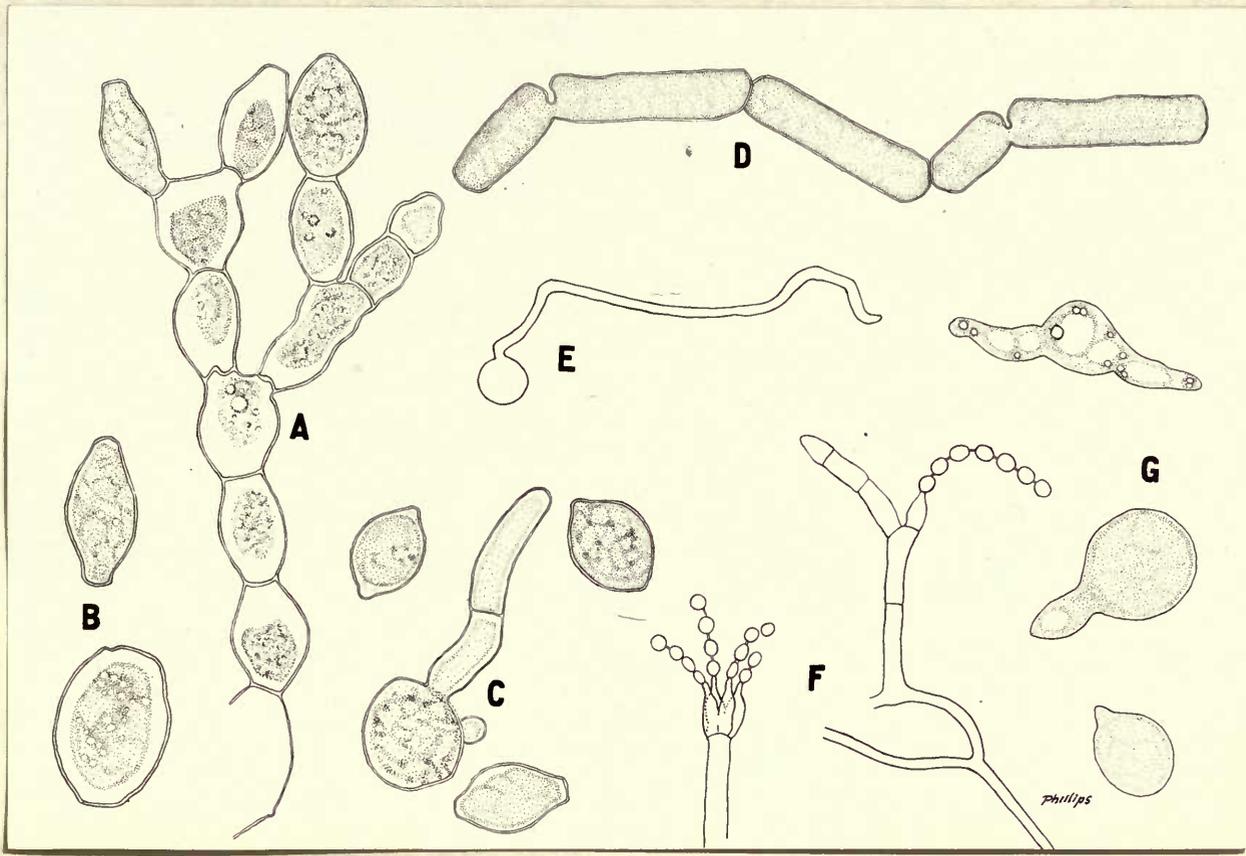
C. 3 mature conidia from a culture of
strain I on *Solanum tuberosum* 14 days old
(x 1000) and germinating conidium of
California apricot rot *Botrytis* (2 days
in tap water) (x 1000)

D. Spore-like bodies from culture on
Diamond plum (x 1000) September 12, 1914.
See plate 27, upper photograph.

E. Germinating conidium of the California
apricot rot *Botrytis* in 100% peach juice,
the acidity of which was 10.5. In tap culture
8 days old. (x 2000).

F. Conidia of the California apricot rot
Botrytis produced in a tap water drop
culture of conidia from a naturally infected
apricot. 48 days old. (x 1000).

G. 3 germinating conidia of the California
apricot rot *Botrytis* in distilled water
drop culture. 3 days old. (x 2000)







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