SWEET-POTATO SCURF

By L. L. Harter,
Pathologist, Office of Cotton and Truck Disease Investigations,
Bureau of Plant Industry

INTRODUCTION

The scurf disease of the sweet potato (*Ipomoea batatas*) was first described by Halsted,1 who published a brief account of it in 1890. To the fungus he gave the name *Monilochaetes infuscans*, a new genus and species, of which, unfortunately, he gave no technical description. For many years following his pioneer work little or no attention was given to sweet-potato diseases. This very common and interesting disease was therefore passed over until a few years ago, when the writer and others took up a study of them. For almost five years the disease has been under observation and study. It is therefore for the purpose of completing the description of the organism and recording the results of inoculation experiments and certain characteristics of the fungus heretofore unpublished that this paper is prepared.

GENERAL APPEARANCE OF THE DISEASE

Scurf is characterized by a brown discoloration of the surface of the underground parts of the sweet potato (Pl. LVII). The discolored areas may occur as spots of varying size and shape, with no definite outline, or as a uniform rusting of the entire surface. In gross appearance it reminds one somewhat of the silver scurf of the Irish potato, although it is somewhat darker. However, it does not penetrate the host to the extent that silver scurf does. The scurf of the sweet potato produces no rupture of the epidermis and is so superficial as to be easily scraped off by the finger nail.

DISTRIBUTION, PREVALENCE, AND LOSS

The writer has found the scurf very prevalent on sweet potatoes in New Jersey, Delaware, Maryland, Virginia, North Carolina, Ohio, Illinois, Iowa, and Kansas, and to a slight extent in other States. The following varieties are susceptible to scurf in varying degrees: Eclipse Sugar Yam, General Grant Vineless, Florida, Nancy Hall, Yellow Yam, Miles Yam, Red Brazilian, Dahomey, Yellow Strasburg, Pierson, Key West Yam, Vineless Yam, Southern Queen, Big Stem Jersey, Yellow Jersey, and Early Carolina. It is probable that the disease occurs on other varieties as well.

---

Scurf is more prevalent in heavy, black soils and in soils that have been heavily manured or contain a larger amount of organic matter than in light, sandy soils.

The loss to the crop caused by the scurf is perhaps small in comparison with that caused by some of the more virulent diseases. Nevertheless, the actual financial loss throughout the country that can be attributed to this disease alone amounts to considerable. Scurfy potatoes do not command as high a price in the markets as clean ones, though if otherwise sound they are just as good for consumption. The fungus under favorable conditions, such as a relatively high humidity and temperature, continues to develop under storage conditions to a limited degree. It weakens the host, so that during periods when the storage house is rather dry the potato loses moisture and becomes shriveled and dried, rendering it unfit for sale and at the same time less resistant to the attacks of other parasites. Taubenhaus\(^1\) claims that the fungus on the potato is easily killed by immersing for 10 minutes in a solution of mercuric chlorid (\(1:1,000\)).

### ISOLATION OF THE FUNGUS

Some difficulty was experienced at first in isolating the fungus, since it proved to be a very slow grower and developed but little or not at all on some kinds of media. After some experimentation with different media it was found to make a slow growth in Irish-potato, string-bean, and oatmeal agar. By thoroughly washing the potato and disinfecting for about one minute in a solution of mercuric chlorid (\(1:1,000\)) and planting bits of the tissue in plates of oatmeal agar by means of sterile instruments a pure culture could generally be secured. In a week or 10 days transfers were made to media in test tubes, usually cooked rice in water or sterile, moistened corn meal. At the end of three or four weeks on these media a matted growth of dark-brown hyphae developed. Hyaline spores are produced in abundance on long, stout conidiophores in tubes of cooked rice.

### INOCULATION EXPERIMENTS

Inoculation experiments were begun on October 13, 1914, and performed as follows: Sound potatoes were thoroughly washed in water and placed in moist chambers with moistened filter paper in the bottom. They were then sprayed with a suspension of spores and bits of broken hyphae of the scurf fungus in sterile water and exposed to laboratory room conditions. Water was added from time to time, as necessity required, to maintain the humidity of the moist chamber. At the end of two weeks small centers of infection appeared indiscriminately over the surface of the potatoes. These centers gradually enlarged, either by the merging of two or more spots or by the enlargement from a single center. There is undoubtedly considerable enlarging of the spots in moist chambers from

---

1 Taubenhaus, J. J. Soil stain and pox, two little known diseases of the sweet potato. (Abstract.) *In Phytopathology, v. 4, no. 6, p. 405.* 1914.
centers of infection, in view of the fact that conidiophores often 200μ in length stand erect or at an angle on the surface of the potato and drop their spores, starting new infections outside the point of original growth. The spots, however, so far as the writer has been able to determine, do not enlarge by the branching and creeping of the hyphae over the surface. Repeated inoculation experiments gave similar results. The checks remained free from the disease.

DESCRIPTION OF THE FUNGUS

The young vegetative growth of *Monilochaetes infuscans* is hyaline and septate. At the end of a few days, however, with the exception of the terminal cell of the conidiophore, the hyphae turn densely brown. On the host little or no branching of the vegetative growth takes place. Although Halsted figured a branching of the hyphae which was hyaline in color within the tissues of the host, the writer, after long and detailed examination of paraffine sections and sections prepared in other ways, has not been able to find a sure example. The sporophores, for such they appear to be, arise from the surface of the host and are attached to it by an enlarged end cell slightly buried in the cuticle (Pl. LVIII, E, C, D). Occasionally a second (Pl. LVIII, I) or third (Pl. LVIII, J) enlargement or bulblike growth is found deeper in the host or parallel with the surface (Pl. LVIII, G). From some of these secondary enlargements a conidiophore may be developed (Pl. LVIII, F, H). Plate LVIII, E, C, shows conidiophores bearing conidia produced on the host. The brown septate conidiophores vary in length from 40 to 175μ and bear at the end a single-celled spore, which on the host is slightly brown or hyaline. The conidia are 12 to 20μ in length by 4 to 7μ in thickness.

This fungus, as might be expected, behaves differently when grown artificially. Growth has been carefully observed on a few of the common media—namely, Irish-potato agar, beef agar, rice agar, oatmeal agar, string-bean agar, Irish-potato cylinders, sweet-potato stems, and stems of *Melilotus alba*. At the end of 24 days a very slight growth appeared on string-bean agar, rice agar, and oatmeal agar at a temperature varying from 6° to 7° C. Conidia were very sparingly produced. At room temperature (23° to 26°) growth was visible on all media in 4 days, except on rice agar and the stems of sweet potatoes and *Melilotus alba*. In 13 days a small growth appeared on rice agar, but on stems of sweet potatoes and sweet clover no growth was detected at the end of 4 weeks. There is very little difference in the gross appearance of the growth on any of the media used. Enlargement from a single center is very slow, attaining a diameter of about 2 to 5 mm. in 14 days. The fungus piles up in an almost black feltlike mass 2 to 3 mm. in height, with an entire margin. It penetrates the medium but little. The vegetative hyphae in mass are almost charcoal-black, although in gross appearance there is some variation on different culture media. On Irish-
potato cylinders and Irish-potato agar the growth has a darker appearance than on oatmeal agar, beef agar, and string-bean agar, owing to the fact that the numerous erect conidiophores bearing hyaline spores are produced in greater abundance on the three latter media and give a grayish appearance to the upper surface. If the conidiophores and spores be scraped away, the mass is black beneath. Growth appeared only on oatmeal agar at temperatures varying from 30° to 32° in 14 days. From these results it appears that temperatures as low as 6° to 7° and as high as 30° to 32° prohibit the normal growth of the fungus.

The vegetative growth on artificial cultures is hyaline at first and later brown (Pl. LVIII, L), with the exception of the end cell of the conidiophore, which at its outer extremity is hyaline to slightly brown (Pl. LVIII, A, B, L). The conidiophores are branched, septate (Pl. LVIII, A, L), and vary in length from 30 to 225μ. The conidia are continuous, granular, and hyaline to slightly brown with age (Pl. LVIII, M). As soon as one conidium is mature, it separates easily from the conidiophore and another begins growth by a swelling of the end cell of the conidiophore, to be dropped in turn when mature. This process is repeated as long as the environment of the host will permit. It should be noted in this connection also that this fungus can be reproduced by hyphae as well as from the spores. It is likely also that vegetative reproduction accounts for a larger part of the infections under natural conditions. In fact, certain vegetative parts might be confused with or mistaken for conidia. Although conidia are not produced in abundance on the host, they frequently develop normally on diseased potatoes kept for some days in a moist chamber.

The conidia under laboratory conditions germinate slowly in rice or sweet-potato decoction. One or two growths (Pl. LVIII, K) are thrown out usually at the end of the conidia, which attain in 24 hours a length about equal to that of the spore. The branching of the hyphae begins the second day (Pl. LVIII, N), and the production of the brown pigment in about three days.

TAXONOMY OF THE FUNGUS

Halsted attributed the scurf to a new genus and species, Monilochaetes infuscans, but he gave no technical description of it that the writer has been able to find. The fungus belongs to the Dematiaceae of the Hypomycetes. However, the writer has been unable, after considerable study of the fungus, to fit it into any of the genera so far described. It is, however, desirable, in view of the fact that it is a rather common and conspicuous fungus, that it have a description by which it may be recognized. The fungus has been known as Monilochaetes infuscans and as the cause of the sweet-potato scurf for 25 years. Taubenhaus and Manns ¹ in a recent publication likewise refer to Monilochaetes infuscans

as the cause of the disease. In view of these facts, it is believed preferable to give it a description and permit it to maintain generic rank rather than to place it in a genus where it does not naturally belong.¹

**Monilochaetes**

Hyphae dark, erect, rigid, septate, not in definite fascicles; conidia distinctly different from the sporophores and hyphae, hyaline, slightly brown with age, continuous, not in chains, acrogenous.

**Monilochaetes infuscans**

On the host definite vegetative hyphae are lacking; sporophores septate, erect, unbranched, dark, and attached to the host singly or by twos, by a bulblike enlargement 40 to 175μ long, 4 to 6μ wide, bearing rarely a hyaline one-celled oblong spore. In cooked rice the hyphae are much branched, septate, brown; sporophores brown except at terminal cell, which is frequently hyaline to slightly brown, septate, branched, stout, 30 to 225 by 4 to 6μ; conidia abundant, one-celled, hyaline, ovoid to oblong, 12 to 20 by 4 to 7μ, solitary, terminal.

Parasitic on the underground parts of *Ipomoea batatas*. Type specimens deposited in the pathological collection of the herbarium of the United States Department of Agriculture, Washington, D. C.

**SUMMARY**

The scurf disease of the sweet potato was first recognized in 1890 by Halsted, who named the fungus "*Monilochaetes infuscans*," a new genus and species. He failed, however, to describe either the genus or species. The scurf has been found prevalent in nine States and sparingly in others, and on 16 varieties of sweet potatoes. The organism has been shown by inoculation experiments to be the true cause of the disease. A detailed discussion of the morphology of the organism is taken up, also its growth on different culture media at different temperatures. It was found that the organism on the host consisted merely of sporophores and conidia. In culture, however, well-defined branched mycelia and spores developed.

¹ The writer is indebted to Dr. C. L. Shear and Mrs. Flora W. Patterson, of the Bureau of Plant Industry, for having examined specimens of this fungus.
PLATE LVII
A sweet potato showing the discoloration produced by *Monilochaetes infuscans*.

(792)
PLATE LVIII

Monilochaetes infuscans:

A, a branched conidiophore with conidia attached.  B, an unbranched conidiophore, showing septation; conidium attached.  C, a conidiophore from host, with conidium attached.  D, a conidiophore from the host, showing the peculiar basal cell and septation.  E, a conidiophore bearing conidium, showing diagrammatically the attachment to the host by a bulblike enlargement of the basal cell.  F, two conidiophores joined at the base and slightly sunken in the tissue of the host.  G, two conidiophores joined by a single oblong cell.  H, two conidiophores joined at the base and slightly sunken in the tissue of the host.  I, a conidiophore from the host with an almost spherical cell attached to the enlarged end cell.  J, a conidiophore, showing an attachment of two almost round cells to the enlarged basal cell.  K, germination and growth of conidia in a sweet-potato decoction in 24 hours.  L, hyphae from a culture, showing characteristic branching and septation.  M, a group of mature conidia.  N, germination, growth, branching, and septation of the fungus at the end of 42 hours in a sweet-potato decoction.

E is drawn to a scale of 200; all others to a scale of 500.