

# Incidence of Tar Spot Disease of Corn in Puerto Rico<sup>1</sup>

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## INTRODUCTION

The genus *Phyllachora* consists of at least 600 species which infect leaves of angiosperms and produce diseases known as "tar spots." Tar spot of corn, caused by *Phyllachora maydis* Maubl., has been reported in France (1), the Dominican Republic, Guatemala and Mexico, and in Puerto Rico in 1944 (2). The disease was reported subsequently from the West Indies, Panama, Canal Zone and northern South America (5). It occurs mostly under hot and humid conditions and has been reported rarely in the corn-producing regions of the United States (5).

Although tar spot of corn was reported some 28 years ago in Puerto Rico, the incidence of the disease did not cause concern. Lately, inbred lines of corn have been introduced into Puerto Rico from Jamaica and other Caribbean countries. One of the Jamaica lines planted in the Corozal and Cidra areas was severely infected by a fungus of the genus *Phyllachora*.

The purpose of this paper is to report the results of investigations on the pathogenicity, morphology and identity of the tar spot causal organism.

## DESCRIPTION OF SYMPTOMS

## METHODS AND RESULTS

In the early stage of infection, affected corn leaves show circular, minute irregular yellowish to brown spots. The color of the spots soon becomes black with chlorotic borders on both sides of the leaf. The black spots measure 0.5 to 2.5 mm. wide  $\times$  2 to 3 mm. long and sometimes are confluent to form black stripes up to 10 mm. long (fig. 1). Tar spot symptoms appear on leaves of corn when approaching maturity. No spots were observed on young leaves. The affected leaves turned brown and died.

## FUNGUS MORPHOLOGY, PHYSIOLOGY AND IDENTIFICATION

Perithecia are black and compound and measure 300 to 350  $\mu$  long  $\times$  220 to 250  $\mu$  wide; ascocarps nearly spherical, immersed in mesophyl (figs. 2, A and B) asci cylindrical, 53 to 60  $\mu$  long  $\times$  10 to 12.50  $\mu$  wide with a short pedicel; 8 ascospores, hyaline, broadly ellipsoid, measuring 8.2 to 12.5  $\mu$  long  $\times$  7.2 to 8.5  $\mu$  wide (figs. 2, C and D).

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Affected leaves of corn containing perithecia were cut longitudinally with a razor blade under the compound microscope. Ascospores were secured from fresh perithecia. The ascospores were left in petri dishes containing distilled water. The dishes with the ascospores were then incubated in incubators at 24°, 28°, 30° and 36° C. Initial germination of the ascospores were observed in about 2 hours at 24° C. and reached a maximum of 60 percent in 2 days. Germination did not occur, however, when incubated at a temperature above 36° C. No in vitro mycelial growth of the ascospores was observed.

A dry corn leaf specimen affected by the *Phyllachora* sp. was sent to

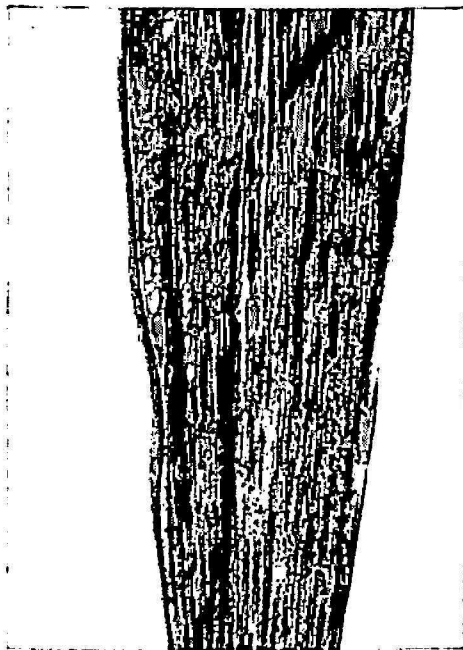


FIG. 1.—Symptoms of the tar spot disease on corn leaves under field conditions.

Dr. M. B. Ellis, Principal Mycologist of the Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey, England for identification. Dr. Sivanesan from the Institute identified the fungus as *Phyllachora maydis* Maubl.

#### PATHOGENICITY TESTS

Ascospores of *Phyllachora* sp. were sown on leaves of corn plants (Jamaica line) kept in an air-conditioned room (20°–22° C.). Plants were covered with plastic bags. Yellow circular lesions were visible after 7 days. The non-inoculated leaves did not show such yellow circular spots. Immature ascocarps were formed after 15 days of inoculation. However, only a few of the ascocarps developed into mature perithecia because corn plants collapsed before formation of the perithecia was completed.

A second test was performed in the same air-conditioned room with de-

tached corn leaves floating on distilled water. Again, yellow circular lesions appeared on leaves placed with an affected leaf. No symptoms appeared on the controls.

A third experiment was carried out with corn seedlings planted at 10, 30, 50, 70, 100, and 200 feet from a diseased corn plant, affected by the *Phyllachora* sp. (source of inoculum), under a shed covered with 75-percent

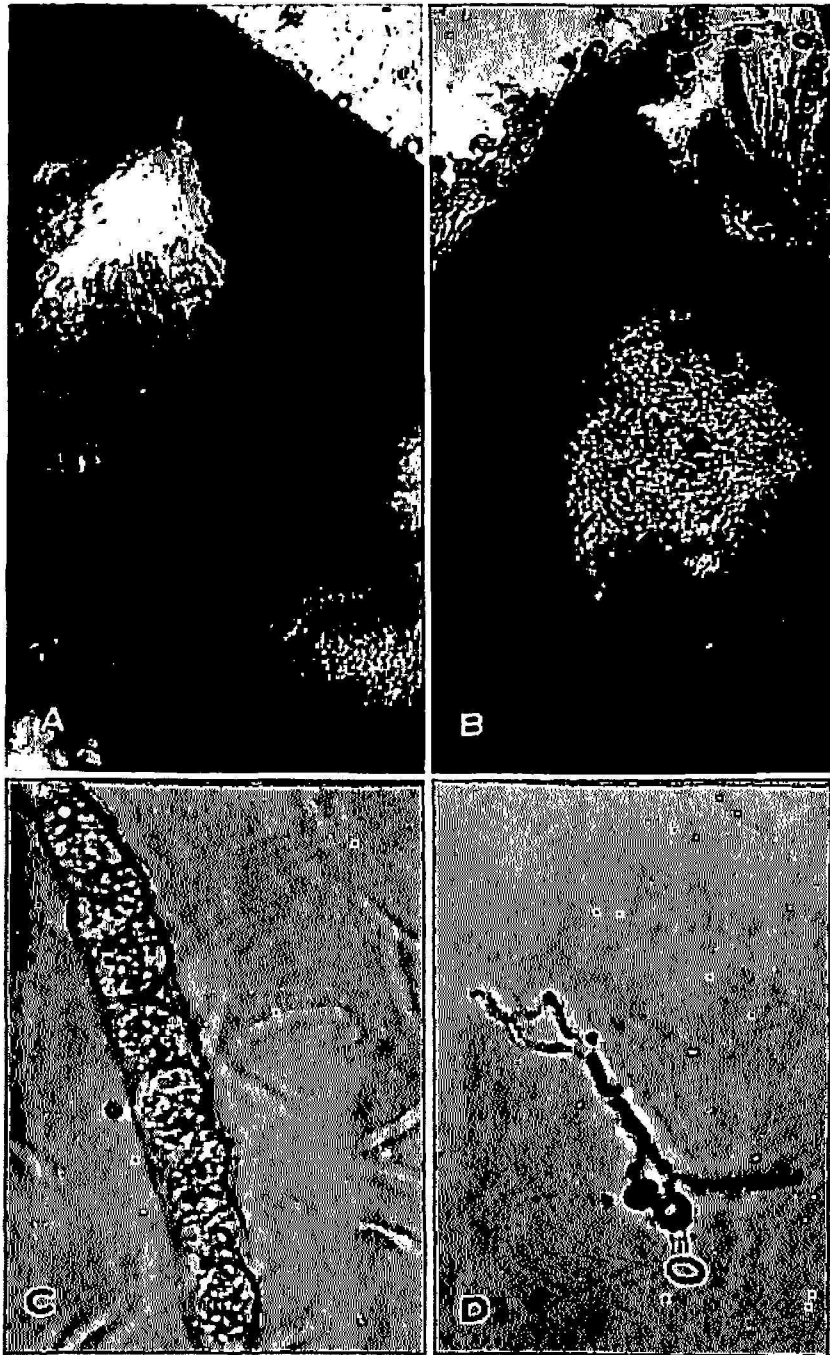


FIG. 2.—Perithecia and asci of *Phyllachora maydis*: A, cross section, B, longitudinal section of the affected leaves, C, asci and ascospores, and D, germination of ascospores.

shade Saran cloth. The initial symptoms (yellow circular spots) appeared 7 days after placing the diseased corn plants with the healthy seedlings (fig. 3, A). However, tar spots (perithecia in mesophyll of the affected leaves) appeared only when corn plants were approaching maturity (fig. 3, B). As shown in table 1, the highest numbers of tar spots were observed on leaves of seedlings planted 10 feet away from the source of inoculum. No lesions were observed on leaves of seedlings planted 200 feet away.

Ascospores, immature ascocarps and mature perithecia were isolated from mesophyll of the leaves of the corn seedlings. The ascospores, immature ascocarps and perithecia developed on corn seedlings were morpho-



FIG. 3.—Symptoms of tar spots on inoculated leaves of corn seedling: A, early and B, late symptoms.

logically identical to those obtained from leaves of the corn planted originally as a source of inoculum.

### DISCUSSION

The results obtained in these investigations agree in general with the findings of Purbery (3), who in 1963 observed that ascospores of *Phyllachora* germinated 2 hours after placing them in distilled water. However, no mycelial growth was observed when ascospores of *Phyllachora maydis* were placed on potato dextrose agar medium.

Purbery (4), in his studies on graminicolous species of *Phyllachora* Fckl., observed that the time required by *Phyllachora* to complete its life cycle was influenced by seasonal conditions. In many instances the full life cycle of *Phyllachora* took more than 75 days to complete. Similarly, the results

TABLE 1.—*Pathogenicity of Phyllachora maydis on corn*

Distance from the source of inoculum	Leaves observed	Leaves with tar spots	Leaves with tar spots	Tar spots per leaf
<i>Feet</i>	<i>Number</i>	<i>Number</i>	<i>Percent</i>	<i>Number</i>
10	19	19	100	33*
30	18	7	38.8	23
50	20	4	20.0	16
70	18	5	27.7	11
100	18	3	16.6	10
200	30	0	0	0

\* Average of 5 leaves.

obtained from this study indicate that although the initial symptoms expressed as yellow circular spots appeared 7 days after inoculation, tar spots (perithecia in mesophyll of the affected leaves) appeared only when corn plants were approaching maturity.

Results obtained from our controlled studies indicate that ascospores of *Phyllachora maydis* spread to leaves of adjacent corn plants via air currents. These spores can affect leaves of corn severely and produce tar spots. No tar spots were observed on leaves of corn planted 200 feet away from the source of inoculum. Similarly, under field conditions, tar spots were observed more frequently on leaves of corn planted in the windward side of the fields during cooler months.

### SUMMARY

Tar spot of corn was observed for the first time during the last decade in Puerto Rico at the Corozal Substation and then on the farm at Cidra infecting an inbred line of corn introduced recently from Jamaica. Studies on the morphology of ascospores and perithecia revealed that the tar spot

fungus resembles *Phyllachora maydis* Maubl. Results of pathogenicity trials indicate that the fungus can infect only corn seedlings approaching maturity.

#### RESUMEN

La enfermedad del maíz denominada "mancha de brea" se observó por primera vez durante la última década en Puerto Rico en la Subestación de Corozal y luego en la finca de Cidra en una línea de maíz autofecundada que se introdujo de Jamaica recientemente. Los estudios que se hicieron respecto a la morfología de las ascoporas y los peritecios revelaron que el hongo que causa la "mancha de brea" se parece al *Phyllachora maydis* Maubl. Los resultados de las pruebas realizadas indican que este hongo solo puede infectar las plantas de maíz al aproximarse éstas a la madurez.

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