

## Phyllosticta maydis species nova, the Incitant of Yellow Leaf Blight of Maize

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### ABSTRACT

*Phyllosticta maydis* sp. n. is designated as the incitant of yellow leaf blight of maize, first observed in 1967. Pycnidia develop in older lesions, especially if held under moist conditions. The conidia are

*Additional key words:* corn, *Zea mays*.

generally within the range of  $12-15 \times 4-6 \mu$ . Newly emerged conidia are single-celled, although some crosswalls are formed upon germination. Phytopathology 61:1170-1172.

Yellow leaf blight, a recently discovered disease of *Zea mays* L., has been described in several papers. It was first observed in 1967 in Wisconsin (1) and in Ontario, Canada (3). It is now known to occur across the northern part of the corn belt, throughout the northeastern states (5), and in Ontario. Local outbreaks have developed, frequently in epidemic proportions. The southern limits of the disease are uncertain at present.

No definitive study of the taxonomy of the causal fungus has been published. In this report, we describe the pathogen and resolve the uncertainty regarding its identity.

*Symptoms.*—The yellow leaf blight disease is characterized by necrotic lesions and a yellowing of the surrounding tissue of the leaf blade. On the lower leaves, the lesions are rectangular to oblong-elliptical in outline, usually  $7-10 \times 15-20$  mm, running parallel with (but not delimited by) the veins. They are buff colored in the center, and commonly have a brown border. Foliage of any age may be invaded, and if the infection is heavy, entire leaf blades may die, beginning with the older ones. Lesions on the upper leaves are usually confined by the veins and, thus, are more linear. Lesions may also develop on the leaf sheaths and on ear husks, but are ordinarily less conspicuous here. Seedlings attacked heavily in early stages are stunted or killed. Dark pycnidia, mainly epiphyllous, may be found in the central area of older lesions, although in nature they are frequently sparse or absent entirely. Leaf blade lesions are similar in appearance to those incited by *Helminthosporium maydis*, and differentiation may be difficult when fructifications are lacking.

*The pathogen.*—The pycnidia of the yellow leaf blight fungus are reddish-brown, subglobose,  $60-150 \mu$  in diam, and immersed in the necrotic tissue of the host (Fig. 1), with ostioles usually located at the upper surface of the diseased leaf. When leaf fragments bearing pycnidia are moistened, the conidia are extruded in cirri, but are soon dispersed in the water. The conidia are single-celled, hyaline, somewhat variable in shape, but mostly oblong-ellipsoidal to subcylindrical, and typically biguttulate (Fig. 2). The spore

size varies considerably even within a given collection ( $8-20 \times 3-7.5 \mu$ ), although a majority of them fall within the range  $12-15 \times 4-6 \mu$ . The ratio of length to width is commonly about 3:1, but may vary from 2:1 to 4:1. Some spores are slightly curved. Spores held in water for several hours show considerable swelling. We have not observed crosswalls in spores freshly emerged from pycnidia, although germinating spores often develop septa (Fig. 3).

The fungus grows and sporulates well on potato-dextrose and V-8 (Campbell's V-8 vegetable juice) agars or on sterile oat kernels. Aerial mycelium is fairly abundant, usually white at first, and becoming gray. Considerable sectoring and variation in color occurs with continued subculturing on artificial substrates. Pycnidia develop most rapidly and abundantly when cultures are incubated under continuous illumination.

The fungus is pathogenic on maize, although there is a wide range of reactions among inbreds and hybrids. The presence of the Texas male-sterile cytoplasm increases susceptibility in most inbreds and hybrids (1, 6, 7). We have found what appeared to be the same fungus on Sudan grass (*Sorghum vulgare* var. *sudanense*) and on a *Setaria* sp. which were exposed to infested corn debris in the field. Other natural hosts are unknown at this time.

*Comparisons with similar fungi.*—Scheifele & Nelson (5), who first described yellow leaf blight of maize, found fruiting bodies of a *Phyllosticta* on the lesions and assumed the incitant to be *Phyllosticta zae* Stout. Gates & Mortimore (3) suggested that the causal organism is *Ascochyta zae* Stout. *Phyllosticta zae* and *A. zae* were among 16 different fungi collected by G. L. Stout on corn leaves and stalks in Illinois during the fall of 1926, and described (7) as new species, but which were not demonstrated to be pathogenic.

The dimensions recorded by Stout for the pycnospores of *P. zae* ( $4.5-7 \times 2.0-3.5 \mu$ ) indicated that the yellow leaf blight pathogen is not referable to this species, and a direct comparison of the two fungi removed all doubt. One of us examined a specimen of *P. zae* which Stout deposited in the herbarium of the

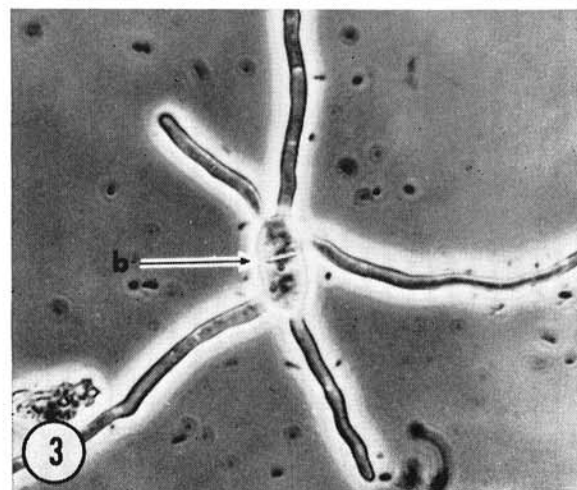
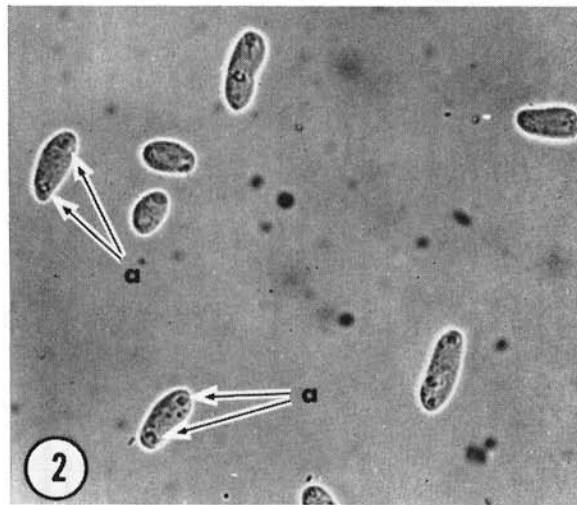
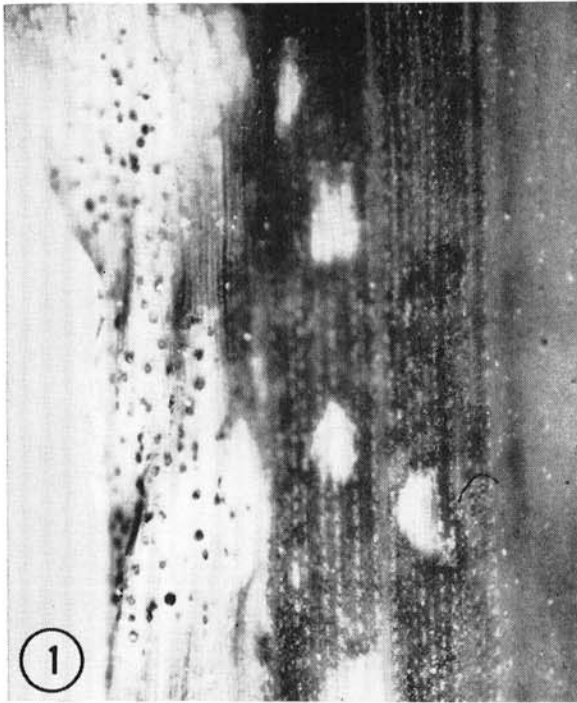


Fig. 1-3. 1) Pycnidia of *Phyllosticta maydis* on maize leaf (ca.  $\times 100$ ). 2) Conidia of *P. maydis* with guttulae (a) (ca.  $\times 650$ ). 3) Germinating conidium of *P. maydis* showing septum (b) (ca.  $\times 800$ ).

Illinois Natural History Survey, and found that the spores in the pycnidia of the preserved leaves are very much smaller than those of the yellow leaf blight fungus, and also differ in shape. *Phyllosticta zaeae* Stout has been reported from several widely scattered geographical locations, including French Equatorial Africa (4) and Czechoslovakia (2); in all cases where spore measurements are given, they agree with those of the species description. In making isolations from various collections of maize leaves, we obtained several pycnidial cultures with spores similar in size to those of *P. zaeae*, but these were nonpathogenic in every case.

Gates & Mortimore (3) had substantial reason for tentatively identifying the yellow leaf blight fungus as *A. zaeae*, since Stout described conidia of this fungus which closely resembled those of the yellow leaf blight pathogen in form and in size. Stout (7) gives the spore dimensions of *A. zaeae* as  $8.5-13.5 \times 3-4.5 \mu$ , and states that the spores are "obscurely uniseptate" and that the septum is "often apparently lacking", although the three spores figured do show definite crosswalls. Thus, it seemed desirable to examine authentic material of *A. zaeae*, and this was kindly supplied by authorities at the Illinois Natural History Survey, Urbana, Ill. The specimen sent to us was collected by Stout at Mt. Carmel, Ill., on 9 November 1926, and although not so marked, unquestionably is the type for the species, since Stout (7) indicates that only one collection was made. Unfortunately, no pycnidia could be found on the specimen itself. However, a labeled slide accompanying the specimen showed a crushed fructification and a considerable number of spores. As expected from the diagnosis, the conidia were found to be somewhat smaller than those of the yellow leaf blight fungus. Of greatest interest was the fact that an appreciable number of the conidia were observed to be definitely septate. Thus, it became clear that the yellow leaf blight organism cannot reasonably be identified with *A. zaeae* Stout.

Since further review of the literature failed to reveal any fungus recorded on maize or related plants which corresponds to the yellow leaf blight pathogen, we conclude that the latter is new to science and, accordingly, name and formally describe it here.

***Phyllosticta maydis*** Arny & Nelson, sp. nov. (Fig. 1-3).

Pycnidii praesertim epiphyllis, in maculis pallidis emortuis disseminatis, immersis, rufobrunneis, subglobosis,  $60-150 \mu$  in diametro; ostiolo subpapillato. Sporis hyalinis, typice biguttulatis, eseptatis etsi frequenter uniseptatis per germinationem, forma et magnitudine variabilibus, fere oblongo-ellipsoideis vel subcylindricis, parce oblongo-ovatis, interdum aliquantum falcatis,  $8-20 \times 3-7.5 \mu$ , fere  $12-15 \times 4-6 \mu$ . Hab. in foliis *Zea maydis* in America boreali.

TYPE: on leaves of *Zea mays*, inbred W59M Tcms, Hancock, Wisc., 4 August 1970, collected by D. C. Arny. Deposited in herbaria: Holotype, Department of Botany, University of Wisconsin, Madison. Isotypes, National Fungus Collections, Beltsville, Md., and Commonwealth Mycological Institute, Kew.

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