

Propagules of *Pyrenophora trichostoma*

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ABSTRACT

Conidia and dark aerial hyphae of *Helminthosporium tritici-repentis* on wheat stubble appeared to be, like ascospores, viable propagules of *Pyrenophora trichostoma*. They developed in lesions on green wheat leaves, on mature standing wheat, on year-old wheat stubble, and on pseudoperithecia on wheat stubble. In the

differing environments of North Dakota, Canada, and North Africa they varied in their abundance, their time and place of appearance, and in their relationship to epiphytotics of leaf blight in wheat.

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Additional key words: *Helminthosporium tritici-vulgaris*, *Leptosphaeria avenaria* f. sp. *triticea*, *Septoria*.

Pyrenophora trichostoma (Fr.) Fckl. causes leaf blight of wheat and other grasses (6, 16). It is a major contributor to a complex of similar leaf spot diseases related to yield losses in wheat (7). Its ascospore propagules (Fig. 1), present in pseudoperithecia on stubble of overwintering wheat, are abundant throughout the growing season in North Dakota. It has been consistently isolated as mycelial colonies from ascospores and from leaf spots on wheat. Hyphal fragments from these mycelial colonies have consistently produced a degree of leaf blighting in the greenhouse similar to that observed on susceptible, resistant, and immune cereals in the field (6, 7).

The objectives of this study were to determine whether or not conidia (Fig. 2) and/or dark aerial hyphae (Fig. 3) on wheat stubble were propagules of *P. trichostoma*, and what roles they may play in nature. The materials and methods used were the standard procedures described previously (6). Approximately 20 conidia and 20 fragments of dark aerial hyphae (conidiophores) on 1-year-old stubble of the durum (*Triticum turgidum* L.) cultivar Hercules from Carrington, N.D., were taken from the stubble in the field on 15 June 1971 and placed in distilled water. Within 6 hr, 80% of the conidia and 50% of the fragments of dark aerial hyphae produced vigorously growing vegetative hyphae (Fig. 2, 3). Individual conidia and dark aerial hyphae from the same stubble were isolated and cultured. Single ascospore isolates of *P. trichostoma* were subcultured at the same time the conidia and hyphae were cultured. Nine of 18 conidia and 8 of 24 aerial hyphae survived the isolation procedure and produced mycelial colonies identical to previously described colonies of *P. trichostoma* (6) from ascospores and leaf spots. Isolates from ascospores, conidia, and dark aerial hyphae were inoculated onto North Dakota spring wheat (*Triticum aestivum* L.) selection 495, the spring wheat cultivar Chris, and spring oat cultivar *Avena sativa* L. 'Lodi'. All isolates produced the severe leaf spotting typical of *P. trichostoma* on ND 495 and Chris, and typically failed to cause spotting on Lodi (6). Check plants inoculated with a medium that did not contain the fungus were not spotted.

In their appearance and dimensions, the conidia and hyphae (conidiophores) fit the descriptions of *Helminthosporium tritici-repentis* Died. and *H. tritici-vulgaris* Nisikado (3, 4, 12, 15, 16). The conidia did not display frequent enlargement or inflation of the basal cell, as previous reports had mentioned (3, 15). The similarity in culture and pathogenicity of isolates from these conidia and hyphae with isolates from ascospores and from leaf spots added further support to the concept that *P. trichostoma*, *H. tritici-repentis*, and *H. tritici-vulgaris* on wheat are the same fungus (1, 6, 15).

In North Dakota, ascospores of *P. trichostoma* have been abundantly produced throughout the growing seasons on wheat stubble, and have been associated with epiphytotics (6, 7). Conidia on dark aerial hyphae have appeared rarely on wheat stubble. Occasionally, they have been produced on pseudoperithecia of *P. trichostoma* on wheat stubble (Fig. 4). Dark aerial hyphae in the form of setae have been common on pseudoperithecia. No propagules of *P. trichostoma* have appeared in leaf spots on green wheat leaves in North Dakota. However, once in 1965 (R. L. Kiesling, *personal communication*) and once in 1970 (E. H. Lloyd, *personal communication*), conidia appeared in vast numbers on mature wheat in western North Dakota. Drechsler (4) reported that most conidia remain viable for only 1-2 months. During the growing seasons of 1966 and 1967, Sheehy (14) found that conidia of *P. trichostoma* and dark mycelial fragments, some of which may have been *P. trichostoma*, were common in the air around wheat in eastern North Dakota; from 1969 to 1971, R. A. Moreno (*personal communication*) found that conidia occurred commonly, and that fragments were present but did not occur commonly. Since conidia were rare on wheat stubble, they may have developed on potential grass hosts (6). Their presence in the air around growing wheat, vigorous germination in water, and morphological and pathological similarity in culture to colonies from ascospores and from leaf spots indicated that conidia and dark aerial hyphae are propagules of *P. trichostoma*. To further test this theory, quantities of conidia and dark aerial hyphae

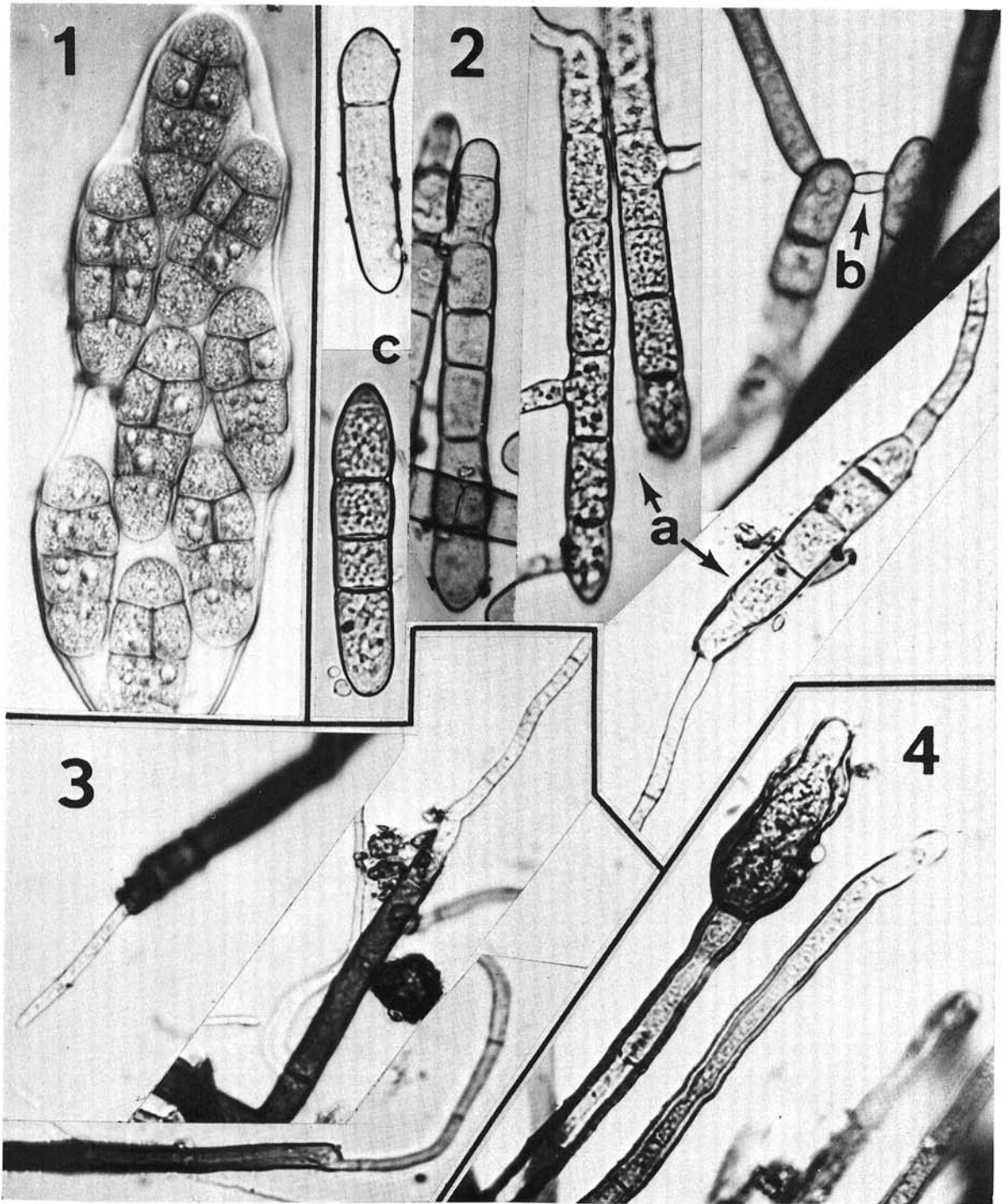


Fig. 1-4. *Pyrenophora trichostoma*: 1) Ascospores in ascus (X 580). 2) Conidia germinating (a); anastomosing (b); variation in size and septation (c) (X 645). 3) Germinating fragments of dark aerial hyphae (X 645). 4) Two dark aerial hyphae or setae on a pseudoperithecium (not shown) with a conidium developing from one hypha or conidiophore (X 636) (printing by H. B. Caldwell).

are being sought in nature and in artificial culture for infection studies.

In North Africa, a severe leaf spotting on wheat in 1968 through 1970 was attributed to *Septoria* (9, 10). Most leaf spots on severely spotted green durum sent from Tunisia, North Africa, in March 1970, contained conidiophores and conidia of *H. tritici-repentis*. A few spots contained pycnidia of *Septoria tritici* Rob. ex Desm. This spotting (S. C. Litzenberger, I. M. Mekni, *personal correspondence*) was evident on durum and less prevalent on bread wheats in Tunisia and Morocco in 1969 and 1970; J. C. Santiago had identified its major cause as *H. tritici-vulgaris*. *P. trichostoma* attacks green wheat leaves of all ages (6). It and *Septoria avenae* f. sp. *triticea* cause a similar leaf spot on wheat previously attributed only to *Septoria* in North Dakota (6, 7, 8). The findings reported herein would lead one to suspect that *P. trichostoma* was involved in the leaf spotting attributed to *Septoria* in North Africa.

P. trichostoma appears to be a worldwide pest of wheat. Often reported as *H. tritici-repentis*, it has been associated with damage to wheat in Canada (1, 2, 16), Japan (12), Israel (11), Cyprus (13), Kenya (5), Tanganyika (17), and other countries (1). In Canada, ascospores from overwintering wheat stubble are thought to function exclusively as primary inoculum (1, 2). In North Dakota, ascospores are a major form of primary inoculum, but conidia and dark aerial hyphae may function in a minor capacity. In North Africa, conidia may be important as secondary inoculum.

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