

***Penicillium claviforme*  
and *Penicillium variabile*:  
Pathogens of Stored Sugar Beets**

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Cooperative investigations of Agricultural Research Service and North Dakota Agricultural Experiment Station. Published with the approval of the Director of the North Dakota Agricultural Experiment Station as Journal Series Article No. 572.

ABSTRACT

*Penicillium claviforme* and *P. variabile* were identified as pathogens of stored sugar beets. *P. claviforme* was more pathogenic than *P. variabile*, but less pathogenic than *Phoma betae* or *Botrytis cinerea* at 5 or 20 C. *P. claviforme* was more prevalent than *P. variabile*. The distinctive coremia of *P. claviforme* aided in identification, both in culture plates and storage piles.

Phytopathology 65:926-927

*Additional key words:* *Beta vulgaris*, sugar beet storage rot.

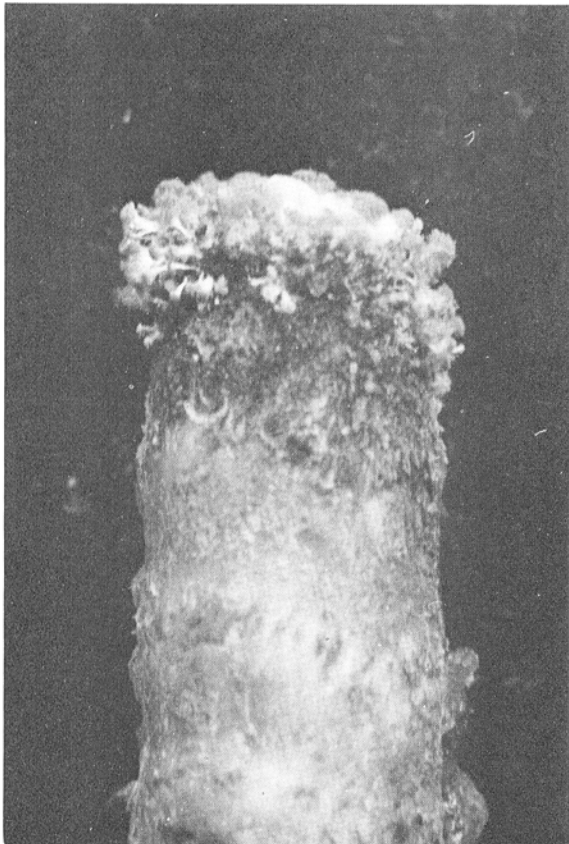


Fig. 1. Coremia of *Penicillium claviforme* produced on a core taken from a sugar beet root. Magnification  $\times 2.2$ .

*Penicillium claviforme* Bainier (ATCC 28702) and *P. variabile* Sopp (ATCC 28703) frequently were found to be associated with decayed sugar beet (*Beta vulgaris* L.) tissue in routine examinations. Pathogenicity at various temperatures and prevalence in commercially stored roots are reported. *P. stoloniferum*, *P. bordzilowskii*, *P. expansum*, *P. duclauxi*, and *P. rubrum* also have been reported as storage rot pathogens of sugar beet (1).

To determine prevalence, on alternate days we collected from the picking table two samples of roots weighing 10 to 14 kg each from the American Crystal Sugar Co. factory at Moorhead, MN. Roots were collected at randomly selected 12-hour intervals on the sample days. Decayed tissue was taken from the pith, crown (stem), body (tap root), and tail (tip of tap root) and weighed. Eight pieces of tissue were randomly taken from each of the four zones for each sample and plated on potato-dextrose agar. Thus, 64 pieces were plated-out each sample day and, after incubation for 10-14 days at 23 C, examined for the distinctive coremia produced by *P. claviforme* (Fig. 1). *P. variabile* was very rare during this survey, so its prevalence was not recorded. This rarity may have been due to the ability of *P. claviforme* to decay roots at lower temperatures than *P. variabile*. The prevalence of *P. claviforme* increased from 4 to 44 of 64 pieces examined per day on alternate days for 50 days beginning on 8 November 1974. *Phoma betae* (Oud.) Frank, an important storage rot pathogen, was present on 8 to 17 of 64 pieces during this period. The widespread occurrence of *P. claviforme* was indicated by its high prevalence on commercially stored roots in Washington (author, *personal observation*).

To test pathogenicity, cores 18 mm in diameter were removed with a cork borer from roots of the sugar beet cultivar American 3 Hybrid T. About 2 mm was removed from the epidermal end. The cores were surface-disinfested in 1% sodium hypochlorite for 1 minute and then rinsed once in sterile distilled water. To prepare inocula of single-spore cultures of the two fungi, conidia of one plate culture were suspended in 100 ml sterile distilled water. Cores weighing about 10 g each were dipped in the conidial suspensions and placed on 1% sterile water agar in 80  $\times$  100-mm petri dishes. Four dishes, each with four cores, were incubated at 5, 10, and 20 C in the dark. Decayed pieces of cores were removed and weighed after 2 weeks of incubation.

*P. claviforme* decayed more tissue than *P. variabile* at 5 and 20 C (Table 1). Tissue decayed by *P. claviforme* was light tan to brown and that decayed by *P. variabile* was of similar color, but occasionally the latter had a dark-brown margin.

Disinfested cores also were placed on end on cultures of

TABLE 1. Percentage of weight loss of sugar beet tissue rotted by *Penicillium claviforme* and *P. variabile* after incubation for 2 weeks at three temperatures

Inoculum	Weight loss (%)		
	5 C	10 C	20 C
<i>P. claviforme</i>	17	90	100
<i>P. variabile</i>	0	81	78
Noninoculated control	0	0	0
LSD ( $P = 0.05$ ) = 13			

*Phoma betae* and *Botrytis cinerea* Pers. ex Fr., pathogenic to sugar beet, or three single-spore cultures of *P. claviforme*, incubated at 22 C for 9 days (11 days for *P. betae*), cut longitudinally, and then rated for the distance rot had progressed: 0 = 0 mm, 1 = 1 to 5 mm, 2 = 5 to 10 mm, 3 = 10 to 15 mm, etc. The decay ratings for *P. betae*, *B. cinerea*, and the average of the single-spore isolates of *P. claviforme* were 3.4, 3.5, and 1.6, respectively; LSD ( $P = 0.05$ ) = 0.7. *P. claviforme* is less pathogenic than *P.*

*betae* or *B. cinerea*, but could be more destructive, if extensive dissemination within a storage pile compensated for low pathogenicity.

#### LITERATURE CITED

1. MOROTCHKOVSKY, S. F. 1936. Fungi of the genus *Penicillium* in sugar beets [in Russian, English summary]. Bull. Sci. Recueil Biol. Univ. Kiev 2:57-86.