Barn Mold of Burley Tobacco Caused by *Botryosporium longibrachiatum*

T. R. ANDERSON, Plant Pathologist, and T. W. WELACKY, Tobacco Agronomist, Agriculture Canada, Research Station, Harrow, Ontario N0R 1G0

ABSTRACT

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In 1982, barn mold of burley tobacco caused by *Botryosporium longibrachiatum* caused moderate damage at several locations and severe damage at one location in Ontario, Canada. Lesions and sporulation of the fungus occurred first on the midribs and laminae of lower leaves. Eventually, the mold was evident on all leaves. Based on the pattern and extent of mold development, it was concluded that inoculum of *B. longibrachiatum* was probably present on the crop before harvest. Secondary infection and humid weather contributed to the damage. *Botrytis cinerea* was present in most curing barns but sporulation was confined to leaf midribs and plant stems.

During the 3- to 5-mo period required to air-cure burley tobacco (*Nicotiana tabacum* L.), the crop is susceptible to a number of molds capable of causing severe damage (4,6). Gray mold (*Botrytis cinerea* Pers. ex Nocca & Balbis) is the predominant barn mold of air-cured tobacco in southwestern Ontario; however, barn mold caused by *Botryosporium longibrachiatum* (Oud.) Maire has been observed in recent years. *Botryosporium* sp. has been associated with decay of tobacco in previous literature. *Botryosporium pulchrum* Cda. was reported as a weak parasite on air-cured tobacco and *Botrytis longibrachiata* (Oud.), possibly synonymous with *Botryosporium longibrachiatum*, caused mold of tobacco in the United States and Germany in 1892 (6).

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At present, *Botryosporium* is readily distinguished from *Botrytis*. *Botryosporium* has distinctive hyaline conidiophores bearing lateral, fertile branches. *Botrytis* has pigmented conidiophores with apical branching and sporulation (1). Recently, the effect of temperature, humidity, leaf position, and curing stage on lesion development caused by *Botryosporium* sp. was studied in Japan (2). *B. longibrachiatum* has been found associated with various greenhouse crops (5) and with organic matter in greenhouse and field soil (1). This is the first report of *B. longibrachiatum* causing damage to burley tobacco in Canada.

FIELD OBSERVATIONS

Before 1982, sporulation of *B. longibrachiatum* had been observed on burley tobacco in numerous curing barns that were visited during extension activities. The white, feathery conidiophores and mycelium were confined to lesions ranging from 1 to 20 cm long on midribs and secondary veins of lower leaves (Fig. 1). Infrequently, sporulation was noted on laminae adjacent to infected areas on midribs and veins. Moldy plants occurred singularly or in groups of 12–24 lathes in the lower tiers of curing barns, indicating the mold had developed and spread from a limited source. Spread and sporulation of *B. longibrachiatum* was reduced with the advent of cooler, drier weather and overall damage caused by the fungus was considered unimportant.

In 1982, weather conditions favoring development of barn mold occurred shortly after harvest and continued intermittently during the normal curing period. Relative humidity of 85–90% has been reported to increase the danger of barn mold in burley tobacco (4), and the average relative humidity exceeded 85% on 5, 1, 11, and 13 days in September, October, November, and December, respectively, at the Harrow Research Station. In random surveys of tobacco barns in the district, the severity of damage varied considerably. *Botrytis cinerea, Botryosporium longibrachiatum*, and species of *Fusarium, Alternaria, Cladosporium,* and *Penicillium* were observed frequently on the same plants. Sporulation of *B. longibrachiatum* was evident on all plants that had symptoms of advanced leaf decay.

At one location, the total 5-ha crop was completely destroyed. This crop had been grown on land that had produced cucumbers the previous year. The crop, apparently healthy at harvest, was housed in four separate barns, one of which was 3 km from the others. All the

barns relied on ambient air for curing. Barn mold appeared simultaneously in all four barns within 4 wk of harvest, whereas tobacco in neighboring barns in the same vicinity was free of mold. Initially, *Botrytis cinerea* was considered the primary cause of deterioration based on the presence of active sporulation and sclerotia on stems and petioles of lower leaves. Limited sporulation of *Botryosporium longibrachiatum* was visible on petioles of the same leaves. During October, *B. longibrachiatum* continued to sporulate but lesions did not enlarge. In November, water-soaked lesions developed on leaf laminae adjacent to infected portions of midribs and veins, and a progressive spread of mold to the tip leaves occurred. By mid-December, sporulation of *B. longibrachiatum* was evident on all leaf surfaces. Lower leaves had dropped to the barn floor and those remaining on the stalks were severely water-soaked and decayed. Sporulation on upper or tip leaves was uniform and sparse without discrete lesions. It is possible that the rot on tip leaves was initiated by multiple infections from spores produced on lower leaves. *Botrytis cinerea* was still present on stems and petioles but had not spread to upper leaves. Whereas *B. cinerea* was responsible for considerable leaf drop, *B. longibrachiatum* caused deterioration of the leaf lamina. Based on observations of development and spread of mold in the barn, we concluded that the lower leaves received inoculum or were infected latently at harvest. Humid, wet conditions in November and December evidently favored sporulation and secondary spread of *B. longibrachiatum*, resulting in complete destruction of the crop.

Observations of tobacco grown at five locations and cured at the research station support the hypothesis that inoculum of *B. longibrachiatum* originated in the field before harvest. Tobacco from each location was hung randomly in one section of a barn equipped with supplementary heat. Sporulation of *B. longibrachiatum* occurred on lower leaves of tobacco from only one location. Tobacco plants originating at other locations but hanging on adjacent lathes were not affected. Tobacco at each location was grown following standard cultural practices, except mushroom compost had been applied to sandy areas of the location that produced moldy plants.

LABORATORY OBSERVATIONS

Although *B. longibrachiatum* and *Botrytis cinerea* were frequently found in close association on air-cured tobacco, *B. longibrachiatum* can cause deterioration independently. Leaf samples containing lesions of *B. longibrachiatum* were incubated on moist filter paper in petri plates in the laboratory. Lesions

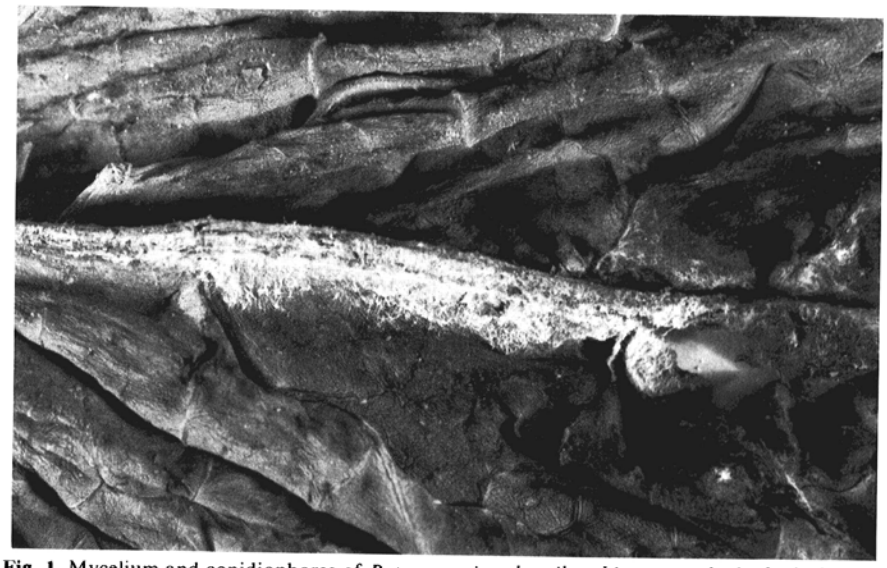

Fig. 1. Mycelium and conidiophores of *Botryosporium longibrachiatum* on the leaf midrib and lamina of burley tobacco.

continued to expand and sporulation occurred in the presence of moisture. Growth of the fungus ceased if the filter paper was allowed to dry but resumed if moisture was added. Sporulation also developed on several leaf samples without distinct lesions. Point-inoculation of cured leaves with dry conidia or mycelium produced on potato-dextrose agar (PDA) (Difco) resulted in brown water-soaked lesions 2–5 cm in diameter after incubation for 1 wk in a moist chamber at 20–22 C. Sparse sporulation was observed within the lesions after 2 wk.

On PDA, *B. longibrachiatum* produced characteristic hyaline conidiophores about 5 mm long. Numerous conidia were produced synchronously on ampullae located on short lateral branches of the main conidiophore as described (1,3). Sclerotia were not observed.

DISCUSSION

It is evident that *B. longibrachiatum* can cause severe damage to air-cured burley tobacco and the fungus was probably present on the crop before harvest in 1982. Chiba and Uozumi (2) demonstrated that lesions developed only when leaves were inoculated at the brown stage in the curing process. Lesions did not develop when green or yellow leaves were inoculated and incubated 120 hr. The effect of extended incubation period was not studied. Based on their results and our observations of barn mold development, the apparently healthy tobacco probably received inoculum or was latently infected at harvest. Lesion development and sporulation occurred after the tobacco reached the brown stage of curing. Humid weather contributed to secondary infection observed on upper leaves and subsequent leaf decay.

Although tobacco in the brown stage of curing may be infected by secondary inoculum from a few infected plants as observed before 1982, severe damage occurs if primary infections are numerous and weather favors development of mold. Because the fungus was reported on greenhouse plants (5) and on organic matter in greenhouse soil (1), it is possible that the previous crop of cucumbers at one location and mushroom compost added at the other location may have been sources of inoculum. Crop rotation with cucumbers has been practiced at other locations in Ontario but without development of barn mold. It is possible that weather conditions more suitable for air-curing suppressed mold growth in those cases. Supplementary heating to assist drying appeared to restrict spread of the fungus during curing operations at the research station. Further research on control measures should focus on prevention by identifying sources of inoculum and reducing inoculum levels in the field.

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