Distribution in the Southeastern United States of Peach Tree Fungal Gummosis Caused by *Botryosphaeria dothidea*

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ABSTRACT

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Visual assessments and fungal isolations were used to determine the distribution and severity of fungal gummosis of peach trees caused by *Botryosphaeria dothidea*. The disease is present in the major peach-producing areas in central and southern Georgia, central Alabama, Florida, Louisiana, and possibly Texas and Tennessee. The disease is apparently not present in North or South Carolina, Mississippi, or Arkansas.

Fungal gummosis is characterized by numerous gum deposits on the trunk, limbs, and twigs of infected peach (*Prunus persica* (L.) Batsch) trees. Gum appears to exude through lenticels in the bark. When the bark under the gum deposit is removed, an area about 1–2 cm in diameter appears moist, brown, and gummy. This brown necrotic tissue extends slightly into the wood of the tree. Initial symptoms are usually observed on the trunk between the ground and the scaffold branches in the second or third season after planting. In older trees, the disease may also occur on branches and twigs.

Many factors, including fungi, bacteria, insects, and mechanical injury, can cause gum exudation from peach trees (8). The etiology of severe peach tree gummosis in the Fort Valley area of central Georgia was uncertain throughout the 1960s. *Botryosphaeria dothidea* (Moug. ex Fr.) Ces. and de Not. (*B. ribis* Gross. & Dug.) was consistently isolated from diseased peach bark and identified as the causal organism in 1974 (9). *B. dothidea* can cause dieback, canker, and fruit rot on a wide variety of hosts (3).

Documentation of the actual spread and distribution of the disease is sketchy. Initially, it was found on peach trees only in the vicinity of Fort Valley. In 1976 it was described as having spread throughout central Georgia into Alabama and Arkansas (10). The report from Arkansas was probably erroneous.

The disease is of great concern to peach growers in central and southern Georgia, where the 1980 crop was estimated at 54,500 metric tons (1). Little research has been done on fungal gummosis, and no control for the problem is known. The intent of this survey was to determine the

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geographic distribution of fungal gummosis and its possible impact on peach production in the southeastern United States.

MATERIALS AND METHODS

Survey procedure. We sampled all, or at least three, of the largest peach orchards in each county in Georgia reported to have commercial plantings. Orchard size ranged from less than 5 to more than 100 ha. A visual assessment of gummosis severity was made on a minimum of 100 trees per orchard. Disease severity for an orchard was estimated by averaging individual scores for trees rated as follows (Fig. 1): 0 = no gummosis; 1 (light) = sparse gum deposits on trunk only; 2 (medium) = gum deposits on trunk and scaffold branches; 3 (heavy) = many deposits on trunk and scaffold branches and infection on fruiting wood. Only orchards in the second growing season after planting or older were surveyed. Similar surveys were conducted in the major production areas in Chilton County, AL, and Madison County, FL. State extension horticulturists and pathologists helped coordinate sample collection and orchard assessment in the aforementioned areas as well as in areas not visited by the authors.

Sampling procedure. To confirm the diagnosis, we sampled a minimum of three trees in each orchard surveyed by collecting bark and wood around and under gum deposits. The sample tissue was taken by cutting from ca. 2 cm above to ca. 2 cm below the gum deposit deeply enough to remove xylem tissue directly underneath. Orchards not showing gummosis symptoms were not sampled because previous work had indicated that the fungus could not normally be isolated from healthy bark (Reilly and Okie, *unpublished*).

Fungus isolation and identification. Bark samples were soaked for 1 min in a sodium hypochlorite solution (Clorox diluted 2:1) and then soaked for 2 min in sterile distilled water. The bark surface was removed aseptically, and bark and wood about 5 cm square were cut from the edge of the diseased area. Two samples from each piece of bark were transferred to a petri dish measuring 15× 100 mm containing Difco potato-dextrose agar (PDA) and then incubated in the dark at 28 C for 3 days. Fungal growth was subcultured by cutting a 5-mm-diameter plug from the edge of the colony and transferring it to a fresh PDA plate. Isolates that resembled stock *B. dothidea* cultures were transferred onto Difco oatmeal agar. These cultures were maintained for 10 days at 22 C under fluorescent lights 15 cm above the plates. Colonies so maintained produced pycnidia and conidia. Based on spore production and morphology (3,4,9), colonies of *B. dothidea* and *B. obtusa* (Schw.) Shoemaker were identified.

RESULTS

Survey. The survey concentrated on major peach-producing areas in Georgia, where orchards in 29 counties were inspected (Table 1). *B. dothidea* was isolated from bark samples from 24 counties. Orchards in uninfected counties were either far from other peach producing areas, young, or both. The fungus was isolated from only 62% of orchards with light gummosis, whereas a 95% isolation rate occurred from orchards with medium to heavy gummosis. *B. obtusa* was isolated from bark from nine Georgia counties and from Madison County, FL (Table 1). The two organisms were never isolated from the same lesion but in some cases were found in the same orchard.

The survey indicated that fungal gummosis was more widespread than expected. Inspection of the major production area in Alabama and in Florida and contact with state extension specialists confirmed the spread of gummosis to these states (Table 1). Peach producers and extension agents in Alabama reported that gummosis appeared in the past 4–6 yr and has been increasing in severity. The pathogen was isolated from peach bark from the North Louisiana Experiment Station at Calhoun. According to researchers there, symptoms first appeared in 1979. Reports from Texas and Tennessee indicated that the disease may be present there, but no

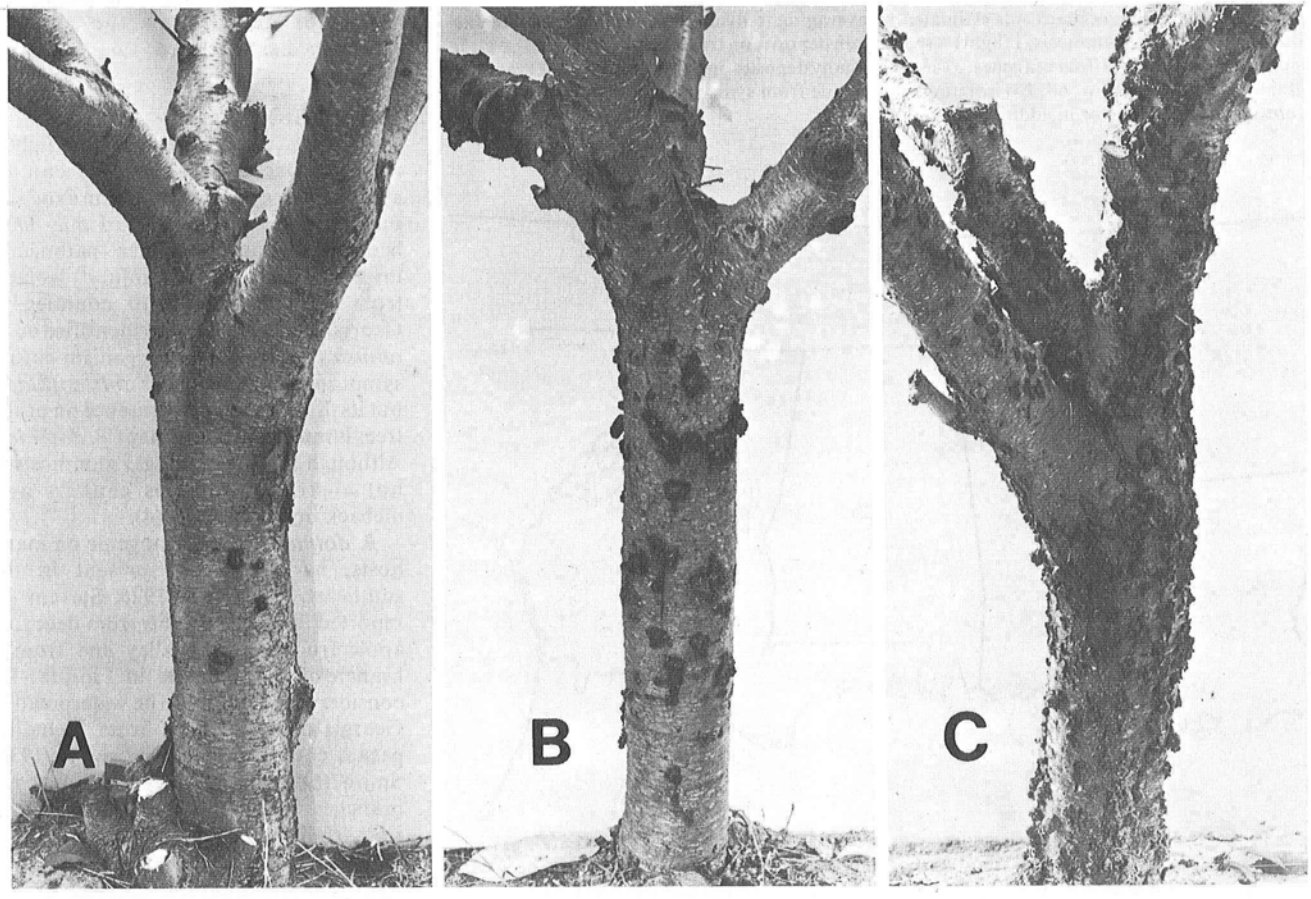

Fig. 1. Symptoms of **(A)** light, **(B)** medium, and **(C)** heavy fungal gummosis on peach trees.

Table 1. Visual rating of fungal gummosis and isolation of *Botryosphaeria dothidea* from peach orchards in Georgia, Alabama, and Florida

Map no.[a]	County	Orchards with positive isolations/orchards surveyed[b]			
		None	Light	Medium	Heavy
		Georgia			
N	Banks	3			
N	Crisp		0/1		
N	Hall	3			
N	Sumter	2			
N	Wayne		0/1[c]		
1	Peach			2/2	4/5[c]
2	Houston		1/1	3/3	3/3
3	Macon		0/1	2/2[c]	3/3
4	Taylor			3/4[c]	2/2
5	Crawford		1/2	2/2	2/2
6	Upson		1/1		
7	Pike		1/3		
8	Monroe			1/1	
9	Bibb		1/1		
10	Jones		0/2[c]	2/2[c]	
11	Butts		3/3[c]		
12	Spalding		2/3		
13	Henry		3/4[c]	1/1[c]	
14	Meriwether		1/4[c]		
15	Talbot		4/4		1/1
16	Dooly		2/2	2/2	
17	Bleckley			1/1	2/2
18	Brooks		3/3		1/1
19	Washington		3/4		
20	Burke	2	1/2		
21	McDuffie		0/3	1/1	
22	Wilkes		2/2		
23	Morgan	2	3/3	1/1	
24	Oconee		2/3[c]		
		Florida			
25	Madison		1/3[c]		
		Alabama			
26	Chilton				3/3
TOTAL		12	35/56	21/22	21/22

[a] See Figure 2.

[b] Disease severity for an orchard was estimated by averaging individual scores for trees rated as follows: 0 (none) = no gummosis; 1 (light) = sparse gum deposits on trunk only; 2 (medium) = gum deposits on trunk and scaffold branches; 3 (heavy) = many deposits on trunk and scaffold branches and infection on fruiting wood. No isolations were made from symptomless orchards.

[c] *B. obtusa* isolated alone or in addition to *B. dothidea*.

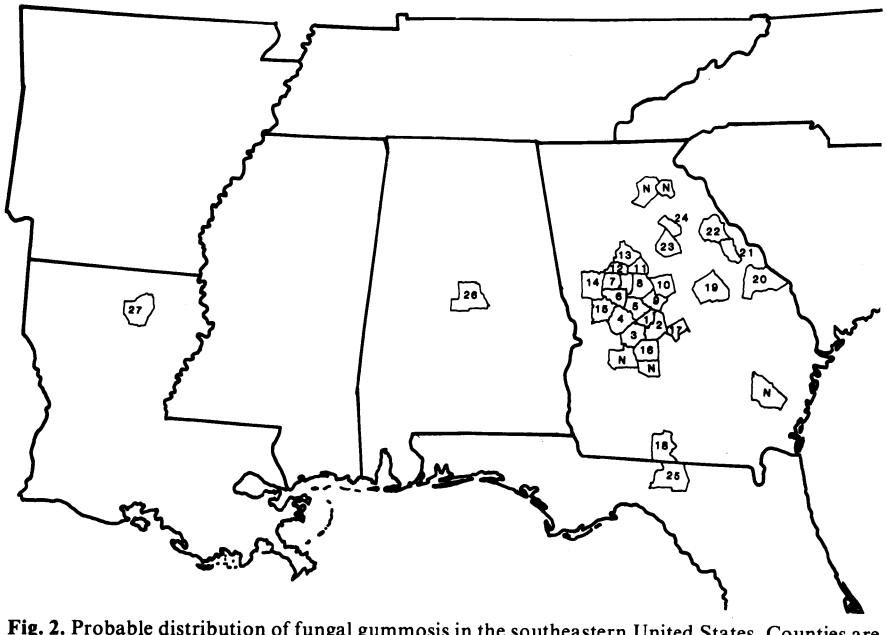

Fig. 2. Probable distribution of fungal gummosis in the southeastern United States. Counties are identified by number in Table 1. N signifies that the county was surveyed but the pathogen not found. Number 27 was not surveyed by the authors, but the pathogen was isolated from samples obtained there.

samples were available to allow confirmation.

Fungal gummosis was not observed in orchards in North or South Carolina, and extension specialists there stated that gummosis has not been found. Extension specialists from Arkansas and Mississippi also reported that the disease has not appeared in their states. The probable distribution of fungal gummosis of peach trees in the southeastern United States is presented as of spring 1981 (Fig. 2).

Fungal isolations and description. Colonies of *B. dothidea* were about 3 cm in diameter after 3 days of growth on PDA. Colonies consisted of white, cottony mycelium with a light olive tint in the center. Subcultures obtained from the edge of the colony produced white, cottony mycelium that overgrew the plate in 4 days. The culture then began to turn gray brown and subsequently became entirely black by 7 days. This growth pattern was characteristic of isolates obtained throughout the survey area. Sporulation did not occur on PDA.

On oatmeal agar, 6 days were required for the culture to overgrow the agar. Mycelium, initially white and cottony, gradually turned olive, beginning at the center of the colony. Pycnidia formed after 8–10 days. Conidial production was profuse after 10 days, with the conidia being exuded in cirrhi up to 2 mm in length. Cultures required continuous light for pycnidial formation. Conidia were hyaline, fusoid, and measured 17–25 × 5–7 μm. Perithecia and ascospores were not detected in the cultures maintained as described.

DISCUSSION

Negative fungal isolations from lightly infected orchards (Table 1) can be attributed to misdiagnosis. Gum exudates on a few trees in an orchard may have been the result of other pathogens, insects, or mechanical injury. Isolates from 12 orchards in 10 counties of Georgia and Florida were identified as *B. obtusa* (Table 1). This organism causes symptoms similar to those of *B. dothidea*, but its distribution and presence on peach trees is much less than that of *B. dothidea*. Although its role in fungal gummosis is not clear, it produces cankers and dieback on many hosts (4).

B. dothidea, also pathogenic on many hosts, has long been present in the southeast. As early as 1926, Stevens (7) reported isolating *B. ribis* from decaying apple fruit in Fort Valley and from a branch of a peach tree in Florida. He considered the fungus to be widespread in Georgia on a variety of hosts, including pecan, cotton, and *Cassia* sp. In 1934, Smith (6) reported infection on peach branches inoculated with isolates of *B. ribis* from walnut, avocado, and citrus. He also noted that a large amount of gum was often present at the wound.

The first occurrence of fungal gummosis

on peach trees has been variously reported to be the late 1960s (10), about 1970 (9), and 1971 (11). It apparently was first detected, however, in the early 1960s in an orchard near Fort Valley (V. E. Prince, *personal communication*). Cultural practices that changed about this time may have influenced the spread and severity of the disease. The practice of clean cultivation diminished as herbicides became available. Tree rows were sprayed while the row middles were mowed. In chemical control of insects and diseases, liquid lime-sulfur was discontinued and organic insecticides were introduced. In addition, a more virulent strain of the pathogen capable of producing the characteristic profuse gumming may have arisen or been introduced. No infection on peach trees is apparent in North or South Carolina, although susceptible hosts of *B. dothidea* (such as apple and blueberry) are grown there (2,5,12); this suggests that the peach gummosis strain is different. Efforts to distinguish the peach gummosis strain from apple and blueberry canker-forming strains are under way.

The spread of gummosis is poorly documented. In a 1975 survey in Georgia (C. Hendershott, *unpublished*), gummosis symptoms were moderate to severe in Peach, Macon, Crawford, Jones, and Bibb counties in all surveyed orchards more than 2 yr old. No symptoms were seen at that time in six orchards in Taylor County, which the present survey shows now has a high incidence (Table 1). Locally, spores could probably be spread by farm equipment. Peach County, GA, was the focus for the disease, but it is not known how gummosis spread to Chilton County, AL, Brooks County, GA, or the Louisiana experiment station, all far from other areas with infected trees. Commercial nurseries obtaining budwood from within the region where gummosis exists may be shipping infected trees to other states. The appearance of the disease in Wilkes, McDuffie, and Burke counties of Georgia near South Carolina is cause for concern because South Carolina produced about 143,000 metric tons of peaches in 1980 (1), nearly one-third of the freestone peaches grown outside California.

No data are available on economic loss, primarily because trees cannot be kept uninfected for comparison of growth reduction and yield loss. Severe infection apparently can kill twigs, reduce fruiting wood, cause brittleness, and result in tree decline.

Studies under way include testing fungicides, measuring the effect of cultural practices on infection, screening germ plasm for a source of resistance, and determining the methods of long distance dissemination of the disease.

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