A Strawberry Fruit Rot Caused by Colletotrichum fragariae

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Journal Series Paper No. 4144, Institute of Food and Agricultural Sciences.
Accepted for publication 3 January 1972.

ABSTRACT

During recent years, a new fruit rot has caused severe fruit losses in some Florida plantings of the California strawberry cultivars Tioga and Fresno. Isolations from fruit rot lesions consistently yielded *Colletotrichum fragariae*, the incitant of strawberry anthracnose. Inoculation of fruit and potted plants with isolates from fruit rot lesions and from anthracnose lesions on runners proved that isolates from either source could cause wilt, fruit rot, and anthracnose on runners and petioles. When these isolates were grown on potato-dextrose agar, the spore sizes were within the range reported in the original description for *C. fragariae*.

Phytopathology 62:600-602.

Additional key words: Fragariae × *ananassa.*

Strawberry anthracnose was first described in 1931 by Brooks (1), who named the causal organism *Colletotrichum fragariae* Brooks. He considered anthracnose primarily a disease of the stolons, but reported that the pathogen occasionally attacked the petioles of nursery plants. Brooks (2) later reported that the pathogen also caused rhizome rotting and wilt in severely diseased summer nurseries during periods of high temperature and moisture. Horn & Carver (3, 4) reported that all three phases of the disease occurred in Louisiana.

Sturgess (5) in Queensland was the first to report a fruit rot which may have been caused by *C. fragariae*. He stated that the causal organism was not identical to *C. fragariae*, and attributed the rot to a species of *Gloeosporium* (6). In 1960, Wright et al. reported a similar *Gloeosporium* rot in the United States (7).

The California cultivars Tioga and Fresno were first grown extensively in Florida in 1968. During 1968 and 1969, a fruit rot which resembled the description of *Gloeosporium* ripe fruit rot (5, 6, 7) caused extensive losses in some fields of these cultivars. Most of the crop from individual harvests in some fields was lost during periods of high temperatures in late March and April. The disease is characterized by dark brown, circular, sunken, firm-rot lesions occurring anywhere on ripe fruit (Fig. 1-A). Two or more lesions may coalesce, and are occasionally covered by masses of buff-colored spores. Isolation from the lesions usually yielded only a fungus which was tentatively identified as *C. fragariae*. Therefore, experiments were undertaken to determine if anthracnose and this fruit rot were caused by the same pathogen.

MATERIALS AND METHODS.—Spore suspensions in sterilized distilled water were prepared from isolates grown on potato-dextrose agar. The isolates were obtained from a typical anthracnose lesion on a stolon and from a fruit rot lesion. Ripe and green Tioga berries were surface-sterilized by immersion for 1 min in 95% ethyl alcohol, followed by 20 min in a 0.525% sodium hypochlorite solution. They were then rinsed 4 times in sterilized distilled water and placed aseptically in autoclaved jars, one fruit/jar. After drying, each berry was inoculated at two points with a small droplet of spore suspension. Controls received sterilized distilled water. The jars containing inoculated fruit were then placed under fluorescent lights in the laboratory where the temperature fluctuated from 24 to 27 C. The numbers of lesions in each series were recorded after

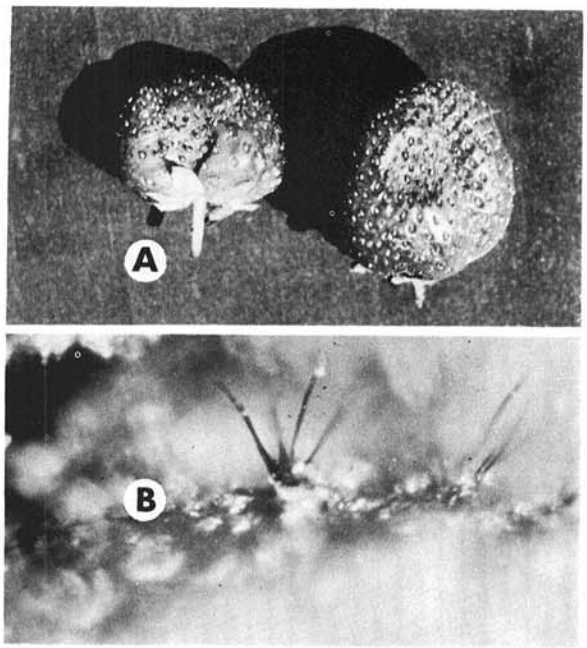

Fig. 1. A) Strawberry fruit rot caused by *Colletotrichum fragariae.* **B)** Setae formed by acervuli produced on fruit inoculated with *C. fragariae.*

5 and 7 days' incubation. There were 10 ripe and 10 green berries in each series.

The remainder of each spore suspension was atomized onto six potted Tioga plants, some of which were producing stolons. Sterilized distilled water was used on control plants. All plants were covered with clear polyethylene bags immediately after inoculation and were placed under a greenhouse bench to prevent leaf scald while the bags were in place. The bags were removed after 5 days. Counts of lesions on stolons and petioles were made 7 days after inoculation, and the plants were observed for an additional 80 days. The photoperiod was ca. 14.5 hr/day during the first 7 days after inoculation. These experiments were repeated 3 times with similar results.

Five groups of 25 spores of each isolate were measured. The measurements in each group were averaged to obtain a range of average spore size for each isolate. Measurements were made from 5-day-old cultures grown on potato-dextrose agar under constant fluorescent lighting (40 w cool-white) and temperatures which fluctuated between 24 and 27 C.

RESULTS.–Within 5 days, lesions typical of this fruit rot as it occurs in the field had developed at all points of inoculation of ripe fruit with either isolate, and at 60% and 40% of the points on green berries inoculated with the stolon isolate and the fruit rot isolate, respectively. After 7 days, lesions had developed at 70% and 75% of the points on green berries inoculated with the stolon isolate and the fruit rot isolate, respectively. Most of the green berries had begun to ripen before lesions developed. No lesions developed on the green control berries, and only two lesions occurred on ripe controls.

Black setae (Fig. 1-B) characteristic of the genus *Colletotrichum* were clearly visible in many of the acervuli produced in the lesions on fruit inoculated with either isolate. The setae were most abundant in acervuli produced on the strawberry seeds.

When the polyethylene bags were removed from inoculated plants, numerous small black lesions were visible on all stolons on plants inoculated with either isolate. Within 2 more days, two or more major lesions 1.5 cm or longer had developed on all stolons on inoculated plants. At this time, there were major lesions on two and six petioles of plants inoculated with the stolon isolate and the fruit rot isolate, respectively. Petiole lesions occurred within 35 days on all plants inoculated with either isolate. All lesions were typical of those formed by *C. fragariae* in the field. Within 57 days, two and three plants inoculated with the fruit rot and stolon isolate, respectively, developed typical *Colletotrichum* wilt and died. All inoculated plants wilted and died within 80 days. The pathogen was readily reisolated from lesions on fruit, stolons, and petioles. No lesions developed on stolons or petioles of control plants and only one died, apparently from some other cause.

The ranges of average spore measurements were 16.7-17.75 μ X 5.1-5.39 μ for the stolon isolate, and 15.89-17.63 μ X 5.1-5.28 μ for the fruit rot isolate.

DISCUSSION.–It is concluded from the evidence presented that *C. fragariae* causes a fruit rot of strawberry in Florida as well as anthracnose in the nursery and wilt in the nursery and fruiting field. Isolates from either rotting fruit or stolon lesions were equally capable of causing anthracnose, wilt, and fruit rot. Spore sizes of both isolates fall within the size range reported by Brooks (1) in the original description of *C. fragariae.*

Sturgess (5) reported considerably smaller spores (average 10.8 X 3.1 μ) from the *Gloeosporium* sp. causing ripe fruit rot in Queensland, but his description of lesions on petioles and flower stalks seems identical to the appearance of lesions on petioles and stolons caused by *C. fragariae.* Wright et al. (7) reported spore sizes only slightly smaller (average 4.8 X 14 μ) than those of the isolates used in this study. Fruit rot lesions caused by *C. fragariae* in Florida appear identical to their description and photograph of *Gloeosporium* rot of Louisiana berries (7). Since isolates were not obtained from Sturgess or Wright for comparison with Florida isolates, it cannot be determined whether the rots of Queensland and Louisiana berries were caused by *C. fragariae.* It seems probable that they were, and that differences in cultural characteristics were caused by differences in ages of cultures when they were observed or differences in environmental conditions under which they were grown.

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