Anthracnose of Strawberry Fruit Caused by *Glomerella cingulata* in Florida

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ABSTRACT

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Glomerella cingulata was isolated from anthracnose lesions on strawberry fruits. Lesions caused by *G. cingulata* on fruits in the field and inoculated fruits were indistinguishable from those caused by *Colletotrichum fragariae*. Conidia of *G. cingulata* were slightly shorter but larger in diameter than those reported for *C. fragariae*.

Additional key words: *Colletotrichum gloeosporioides, Fragaria* × *ananassa*

Since 1972 (2), *Colletotrichum fragariae* Brooks has been recognized as causing a serious fruit rot of strawberry (*Fragaria* × *ananassa* Duch.) in Florida. Several species of fungi cause anthracnoselike diseases of strawberry fruit. A *Gloeosporium* sp., later named *C. acutatum* Simmonds (7), caused serious losses in Queensland, Australia (9,10). A similar disease caused by a *Gloeosporium* sp. was found in fruit shipped from Louisiana to Chicago (12). *C. dematium* (Pers. ex Fr.) Grove was reported to cause fruit rot in Michigan (1). Strawberry fruit rots caused by *C. fragariae* or *Colletotrichum* spp. have been reported in Argentina (6), India (8), and Mexico (5). Maas (4) reported anthracnose of strawberry fruit in Maryland caused by a species of *Gloeosporium* that was similar to *C. gloeosporioides* (anamorph of *G. cingulata*).

C. fragariae was the only *Colletotrichum* sp. isolated from anthracnose lesions on strawberry fruits in Florida until 1980. Since then, although most isolates obtained from fruit lesions have been *C. fragariae*, a small percentage have been *Glomerella cingulata* (Stonem.) Spauld. & Schrenk (telemorph of *C. gloeosporioides* Penz.). This is believed to be the first report of naturally occurring strawberry fruit rot caused by *G. cingulata*, although Simmonds (7) reported infection of strawberry fruits after inoculation with *G. cingulata* from papaw and passion fruit. This report describes experiments to determine pathogenicity of Florida isolates of *G. cingulata* to strawberry fruit.

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MATERIALS AND METHODS

The isolates used in this study were obtained from crowns of strawberry plants that were wilting from the crown rot phase of anthracnose. The *G. cingulata* isolate was obtained from a plant that had been grown in a nursery in Nova Scotia, Canada, and transplanted into a fruit production field in Florida. The plant was apparently infected in the nursery (3). This isolate was identified by J. E. M. Mordue at the Commonwealth Mycological Institute, Kew, Surrey, England, where it is on deposit as IMI 259098. The *C. fragariae* isolate was obtained from a plant grown in Florida. The isolates were grown for 7 days on potato-dextrose agar (PDA, Difco) in petri dishes. The cultures were flooded with sterilized distilled water and the resulting spore suspensions were used to inoculate strawberry fruits. There were 10,000 and 3,250 spores per milliliter from the *G. cingulata* and *C. fragariae* isolates, respectively. Spore concentrations of the two isolates were not equalized because we had found in previous work (*unpublished*) that, under our conditions, spore concentrations ranging from 250 to 10,000 per milliliter had little effect on the numbers of lesions that developed on fruit within 7 days of inoculation.

Ripe fruits of the Tufts cultivar were surface-sterilized by immersion in 95% ethyl alcohol for 30 sec followed by 15 min in a 0.525% sodium hypochlorite solution. They were rinsed four times in sterilized distilled water and placed aseptically into autoclaved jars, one fruit per jar. After drying, each fruit was inoculated at two points with small droplets of spore suspension. Ten fruits were inoculated with each isolate. Control fruits received sterilized distilled water. Jars containing inoculated fruit were placed under fluorescent lights (1,880 lux) in the laboratory, where temperatures fluctuated between 20 and 29 C. The number of lesions in each series was recorded after 5 and 7 days of incubation.

A few drops of the conidial suspensions that were prepared as inocula were used to measure five groups of 25 conidia of each isolate. Measurements for each group were averaged to obtain ranges of average conidial sizes for each isolate. Measurements were also made of one group of 25 ascospores of the *G. cingulata* isolate.

RESULTS

Seven days after inoculation of fruits, lesions had developed at 15 of 20 sites and 13 of 20 sites inoculated with *G. cingulata* and *C. fragariae*, respectively. Lesions caused by either isolate appeared identical. They were similar to lesions shown by Howard (2) and by Maas (4) and typical of those that occur in the field, except there was more aerial mycelium on experimentally infected fruit. The increased aerial mycelium was probably due to the high humidity in the tightly closed jars used in this trial. Reisolations from fruit lesions yielded only the species with which the particular fruit was inoculated. Lesions did not develop on control fruits. This trial was repeated with similar results.

The ranges of average spore measurements for the two isolates were 13.7–16.1 × 6.9–7.1 and 16.9–17.7 × 6.3–6.8 μm for *G. cingulata* and *C. fragariae*, respectively. Thus, the *G. cingulata* spores were slightly shorter but larger in diameter than spores of the *C. fragariae* isolate used in this study and those used in previous studies (2,3). The ascospores of *G. cingulata* averaged 16.1 × 5.8 μm.

DISCUSSION

All *G. cingulata* isolates we obtained from strawberries in Florida (whether from crowns, stolons, or fruit) produced colonies that became dark gray to nearly black as they enlarged. Perithecia, which were covered with flexuous appendages, developed in the cultures within 1–2 wk. The appendages later collapsed and disappeared. Perithecia were formed primarily on the surface of the medium but some were suspended in the aerial mycelium. Most isolates failed to produce perithecia, or produced them sparcely after they were subcultured two to five times.

Although von Arx (11) placed *C. fragariae* in synonomy with *C. gloeosporioides* (anamorph of *G. cingulata*), researchers have retained the name *C. fragariae* when dealing with this pathogen on strawberries. We have isolated *Colletotrichum* spp. from plants

40–75 times each year since 1968 and from fruit an estimated 3–10 times during each of most of those years. Until 1980, all isolates obtained from fruit, and until 1982, all isolates obtained from plants grown in Florida, conformed to the original description of *C. fragariae* except for slight differences in spore size. These isolates never formed perithecia and acervulispores were always salmon-colored en mass. Since 1977, most isolates obtained from plants that had been grown, and apparently infected (3), in nurseries in Arkansas, Tennessee, or North Carolina and had then wilted from crown rot after being transplanted into fruit production fields in Florida were *G. cingulata*. These isolates always formed perithecia when first cultured and acervulispores were always whitish or translucent en mass.

G. cingulata was isolated for the first time from fruit in Florida in 1980. In 1982, it was isolated for the first time from Florida-grown plants. Thus, if *C. fragariae* is a variant of *C. gloeosporioides* (= *G. cingulata*), the variant characteristics remained stable for many years and *G. cingulata* was not isolated from fruit or from Florida-grown plants until after it had been introduced into the state many times over a period of several years in plants from other areas.

LITERATURE CITED

1. Beraha, L., and Wright, W. R. 1973. A new anthracnose of strawberry caused by *Colletotrichum dematium*. Plant Dis. Rep. 57:455-448.
2. Howard, C. M. 1972. A strawberry fruit rot caused by *Colletotrichum fragariae*. Phytopathology 62:600-602.
3. Howard, C. M., and Albregts, E. E. 1983. Black leaf spot phase of strawberry anthracnose caused by *Colletotrichum gloeosporioides* (= *C. fragariae*). Plant Dis. 67:1144-1146.
4. Maas, J. L. 1978. Anthracnose of strawberry fruit in Maryland. Plant Dis. Rep. 62:488-492.
5. Martinez, A. L., and del Rio Mora, A. O. 1975. Principales enfermedades de la fresa en el valle de Zamora, Mich. Instituto Nac. Invest. Agric. SAG, Cent. Invest. Agric. Bajio Folleto Misc. 27. 22 pp.
6. Mena, A. J., De Garcia, M. E. P., and Gonzalez, M. A. 1974. Presencia de la antracnosis de la frutilla en la Republica Argentina. Rev. Agron. Noroesta Argent. 11:307-312.
7. Simmonds, J. H. 1965. A study of the species of *Colletotrichum* causing ripe fruit rots in Queensland. Queensl. J. Agric. Anim. Sci. 22:437-459.
8. Singh, S. J. 1974. A ripe fruit rot of strawberry caused by *Colletotrichum fragariae*. Indian Phytopathol. 27:433-434.
9. Sturgess, O. W. 1954. A strawberry ripe fruit rot. Queensl. Agric. J. 78:269-270.
10. Sturgess, O. W. 1958. A ripe fruit rot of strawberry caused by a species of *Gloeosporium*. Queensl. J. Agric. Sci. 14:241-251.
11. von Arx, J. A. 1957. Die Arten der Gattung *Colletotrichum* Cda. Phytopathol. Z. 29:413-468.
12. Wright, W. R., Smith, M. A., Ramsey, G. B., and Beraha, L. 1960. *Gloeosporium* rot of strawberry fruit. Plant Dis. Rep. 44:212-213.