Blossom Blight of Guayule Caused by *Alternaria infectoria*

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ABSTRACT

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Alternaria infectoria caused severe "blossom blight" of several strains of *Parthenium argentatum* (guayule) growing in India. The pathogen was isolated from blighted capitula and its pathogenecity was established. This is the first report of blossom blight of guayule caused by *A. infectoria* and is also a first report on its recovery from a dicot.

Additional keywords: rubber crop

Parthenium argentatum A. Gray (family: Asteraceae) (guayule), native of the Chihuahuan Desert of Mexico, is a source of natural rubber that is qualitatively as good as that of *Hevea brasiliensis* (Willd. ex Adr. Juss.) Müll. Arg. (17). The shrub was extensively grown in the southwestern region of the United States during World War II under the Emergency Rubber Project (9) but was later abandoned. Because of concern about the availability of *Hevea* rubber, in recent years, interest has focused on commercialization of guayule production in the arid southwest region of the United States (5) and many other countries such as Australia, Israel, Argentina, South Africa, and India. The shrub was introduced into India during the early 1980s and is under trial in semiarid and arid agroclimatic zones.

Several diseases of guayule were reported during the Emergency Rubber Project (1942–1946) in the United States, however, most of these pathogens were fungi associated with soils and/or debris (2,7,14). Species of *Pythium*, *Phytophthora*, and *Rhizoctonia* (1,14), and *Fusarium solani* (Mart.) Sacc. (6) cause damping-off of seeds and seedlings resulting in preemergence seed decay, postemergence wilting, and death of young seedlings. *Botrytis* spp. and *Sclerotinia* spp. were reported to cause extensive loss of plants during shipment of young seedlings (7). Many seedborne pathogens have been reported from seeds produced and stored in India (18), however, none of these diseases were reported to be epidemic. *Phymatotrichum omnivorum* (Shear) Duggar (causing Texas root rot) (4,13), *Verticillium dahliae* Kleb. (causing Verticillium wilt) (15,16), *Macrophomina phaseolina* (Tassi) Goid. (causing charcoal rot) (10,12), *Phytophthora drechsleri* Tucker (2), *Pythium ultimum* Trow (causing pink root rot) (3), and *P. aphanidermatum* (Edson) Fitzp. (11) have been reported to damage older seedlings and mature plants of guayule. In this study, we report blight that caused severe damage to the capitula of several strains of guayule.

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MATERIALS AND METHODS

Eleven promising lines of guayule (ARIZ 101 from Arizona; CAL-1, ALI-10, C-244, and USS 2X from the University of California, Davis; USDA lines 12229, 11605, 11619, and 11591; UCR-1 from the University of California, Riverside; and G-88, an unidentified strain) are under investigation at the National Botanical Research Institute, Lucknow. Diseased samples were collected from 2- to 4-yr-old plants of all 11 experimental lines growing in the field. These plants were characterized by discoloration of the capitula, which turned brownish and later black. The pathogen was isolated from florets on potato-dextrose agar (PDA) medium.

Spores were dislodged from the surface of agar plates and suspended in sterile water. Spore suspensions were then adjusted to 5×10^4 spores per milliliter. Seedlings were inoculated by spraying the inoculum onto healthy unopened capitula of 8-mo-old seedlings with an atomizer. Plants were incubated for 48 hr at 25 C in a moist chamber with an 18-hr dark period each day. Three isolates, one each from ARIZ 101, USDA 11605, and G-88, were tested. Pathogenicity was tested on all 11 experimental lines by applying the inoculum to a set of 10 plants from each of the lines, and the experiment was repeated three times. An uninoculated set of plants was used as a control. After the 48-hr incubation, pots were randomly distributed on the greenhouse bench.

Seeds from inoculated plants were sterilized with 2.5% NaOCl, chopped into pieces, and cultured on PDA. The resulting fungus isolates were found to be similar to the identified cultures. Histopathology of contaminated seeds was studied in cotton blue-stained microtome sections from paraffin-embedded seeds prepared according to Johansen (8).

RESULTS AND DISCUSSION

The disease was first observed in October 1988 when relative humidity (RH) was 70–75% and daytime temperatures were between 28 and 30 C. No symptoms were observed during the rainy months (July to September). During November 1989, there was a heavy outbreak of the disease. The average temperature range during this period was 30 (maximum) to 14 C (minimum) with 60–70% RH.

Most of the flowering heads of all the cultivars under trial were found to be affected, with symptoms being confined to the capitula. Both ray and disk florets could be blighted, with irregular brown spots of varying sizes appearing on the petals. In severe cases, entire capitula were blighted. Such capitula produced infected and infertile seeds. We propose the term "blossom blight" for this disease.

Cultures of the fungus from infected flowering heads on PDA produced greenish brown, mycelial growth with abundant sporulation when incubated in the dark. Primary conidiophores initially were simple with a single apical conidiogenous locus but later became elongate and geniculate at five to six or more loci. The conidiophores were 41.6–116 μm (mean = 71.1 μm) long. Conidia were almost smooth-walled and greenish brown when young and somewhat rough in outline at maturity. Mature conidia were dark brown with six to seven transverse and one to three longitudinal septa, elongate, ovoid, or ellipsoidal and measured 8.4–62.4 μm long with an average length of 37.4 μm. Secondary conidiophores arose from apical cells of primary

conidia and were identical to the primary conidia. The fungus was identified as *Alternaria infectoria* E. Simmons (19). Identification was confirmed by B. C. Sutton of the Commonwealth Mycological Institute, Kew, Surrey, England (IMI Herbarium 329617).

The susceptibility of *P. argentatum* to *A. infectoria* was verified with all 11 lines being susceptible. The resulting symptoms were identical to those from natural infections. The pathogen was reisolated from experimentally infected plants, thus completing Koch's postulates. Microtome sections revealed that hyphae were present in all tissues within the seeds.

The type specimen of *A. infectoria* was isolated from *Triticum* spp. by J. Webster in 1969 (19) and has been known to infect only Gramineae. We are not aware of any report of *A. infectoria* parasitizing a host other than in the Gramineae. Thus, this is the first report of the occurrence on *A. infectoria* on a dicotyledonous host and the first report of a blossom blight of guayule. Simmons (19) described five new anamorphs of *Alternaria* in conjuction with their teleomorphs, which were described in a new genus, *Lewia*. *L. infectoria* (Fuckel) Barr & E. Simmons in E. Simmons was described as a teleomorph state of *A. infectoria*. It is of interest, however, that the teleomorph, *L. infectoria* is very similar to *L. scrophulariae* (Desmaz.) Barr & E. Simmons in E. Simmons. The former has been reported as a pathogen of only members of the Gramineae, whereas the latter occurs on dicotyledonous hosts (19).

Occurrence of *A. infectoria* on *P. argentatum* in its new environs is, thus, of great concern. Guayule is under trial for exploitation as an alternative rubber crop. Because the plant is largely propagated as seedlings, the occurrence of blossom blight infection needs early attention.

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