Differentiation of *Ustilago scitaminea* Isolates in Greenhouse Tests

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ABSTRACT

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Seven sugarcane (*Saccharum* interspecific hybrids) clones were inoculated in a containment greenhouse by hypodermic injection with *Ustilago scitaminea* teliospores obtained from Argentina, Florida, Hawaii, Taiwan, and Zimbabwe. Seven months after inoculation, six different isolates (races) could be differentiated on five of the clones under greenhouse conditions.

Smut of sugarcane (*Saccharum* interspecific hybrids) caused by *Ustilago scitaminea* H. & P. Syd. decreases the yield and quality of infected plants (8,16). The disease is characterized by a long unbranched whiplike structure that develops from the plant apex. The whip consists of a hard core of parenchyma and fibrovascular elements surrounded by masses of dark-colored spores encased in a thin silvery membranous sheath (1,11).

Sugarcane smut, first discovered in Natal, South Africa, in 1877 (14), was believed to be confined to the Eastern Hemisphere until it was found in Argentina in 1940 (1). The disease was first reported on the United States mainland in Florida in 1978 (17) and in Louisiana (9) and Texas (19) in 1981. The disease has been severe in nearly all sugarcane-growing areas of the world at one time or another (5) and can be sufficiently severe to threaten the agricultural economy of an area (1). Although several methods of control are available, the most satisfactory is use of smut-resistant clones (1,5).

In recent years, a number of clone/smut evaluations have been undertaken around the world with widely varying results (20). Factors responsible for the varying results include the presence of different pathogenic races, variation in clones due to location, and different inoculation techniques (1,7,11,20). Races have been reported in Hawaii (3), Taiwan (10), and Brazil (5).

The purpose of this research was to compare the pathogenicities of *U. scitaminea* isolates from different parts of the world by using a common environment, one set of sugarcane differentials, and one inoculation method to determine whether races of the fungus can be separated. Similarities and differences in pathogenicity of the various isolates on sugarcane clones used as differentials were noted and evaluated.

MATERIALS AND METHODS

Facility. This experiment was conducted at the Plant Disease Research Laboratory (PDRL), Frederick, MD, from October 1980 to May 1981. The *U. scitaminea* teliospores were received and tested for germinability there, all inoculations were made there, and the inoculated plants were grown within the confines of the containment facilities. All materials that left the facility were sterilized either by pressurized steam or ethylene oxide to prevent the escape of smut spores to the surrounding area or to the Beltsville Sugarcane Quarantine facility about 45 miles to the southeast.

Sugarcane clones. Seven commercial sugarcane clones were used as test hosts: F 134, H 50-7209, H 68-1158, and NCo 310 were chosen because they had previously been used as differential hosts (3,7,10,12); CP 63-588, CP 65-357, and CP 70-1133 were selected because of their importance to the U.S. sugarcane industry. Nine months before the experiment began, cuttings of all clones except F 134 were treated with hot water (51 C) for 2 hr. The treated cane was propagated as single-bud cuttings in the quarantine greenhouse at Beltsville, MD, to produce the seed cane necessary for the experiment at PDRL. Clone F 134 was shipped from Canal Point, FL, to Beltsville the week of the experiment; the 8-mo-old cane had been field-grown and treated with hot water for 45 min at 52 C to eradicate *U. scitaminea* contamination.

Isolates of *U. scitaminea*. Smut isolates were collected by Victor Hemsy in Tucuman, Argentina (Ar), J. L. Dean in Florida (F), J. C. Comstock in Hawaii (A and B), W. H. Hsieh in Tainan, Taiwan (T_1 and T_2), and K. E. Cackett in Chiredzi, Zimbabwe (Z). Smut whips were collected in the field and shaken vigorously to release the teliospores. These were dried over a desiccant, packed in airtight vials, and sent to PDRL. Upon receipt at PDRL and again just before inoculation, the spores were tested for viability on 1% sucrose agar. The germination percentage of teliospores was determined from plates held 6 hr at 21 C after inoculation. Spores were stored over a desiccant at 21 C until used for inoculations of cuttings.

Inoculation and planting procedure. Inoculations were done by a hypodermic

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