Identification of Fusarium oxysporum f. sp. cubense Race 4 from Soil or Host Tissue by Cultural Characters

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ABSTRACT


Fusarium oxysporum f. sp. cubense race 4 formed laciniate colonies distinct from those of races 1 and 2 on modified Komada’s medium (K2 medium) but not on potato-dextrose agar, PCNB agar, Martin’s medium, or surfactant agar. Race 4 was detectable by the laciniate colonies recovered from infected host tissue, and also directly from soil on dilution plates. All isolates of F. oxysporum obtained from 55 wilted Cavendish banana trees susceptible only to race 4 formed laciniate colonies on K2 medium. None of the isolates obtained from 16 wilted Latundan banana trees susceptible only to race 1 formed laciniate colonies on the same medium. Six formae speciale of F. oxysporum, one apothecial F. oxysporum and three other species of Fusarium tested did not form laciniate colonies on K2 medium. The recovery of race 4 from experimentally infected soil was about 90% using K2 medium. The population of race 4 in naturally infested soil, determined with K2 medium, ranged from 50 to 650 propagules per gram of air-dried soil.

Previously there were only two races (races 1 and 2) of Fusarium oxysporum f. sp. cubense (E. F. Sm.) Snyder & Hans. that caused wilt of Musa species (6). The ‘Cavendish’ banana cultivars grown commercially in Taiwan are highly resistant to these two races. Race 3 of the fungus causes wilt of wild Heliconia spp. in Central America (9). In 1967 a new race (race 4) of F. oxysporum f. sp. cubense capable of attacking Cavendish cultivars was found in the southern part of Taiwan (7). Currently, the wilt is affecting more than 2,300 hectares of banana plantations.

Many selective media are available for isolation of F. oxysporum f. sp. cubense (8). However, none is suitable for selective isolation of F. oxysporum f. sp. cubense because its identification depends on pathogenicity tests conducted in the fields or tanks (10). A rapid pathogenicity test using small seedlings of Musa balbisiana was developed by Stover (5). It was useful for rapid identification of F. oxysporum f. sp. cubense, but not races of this fungus. We report herein a method for identification of F. oxysporum f. sp. cubense race 4, isolated from both infected tissue and soil, by cultural characters on an agar medium.

MATERIALS AND METHODS

Two isolates (T and L) of F. oxysporum f. sp. cubense were isolated from pseudostems of wilted Cavendish and Latundan banana trees, respectively. Their pathogenicity was demonstrated using banana plantlets derived from tissue cultures of differential cultivars (E. J. Sun and H. J. Su, unpublished). Isolates T and L were identified as races 4 and 1, respectively. Races 1 and 2 of F. oxysporum f. sp. cubense supplied by R. H. Stover also were used.

RESULTS AND DISCUSSION

Fusarium oxysporum f. sp. cubense race 4 formed laciniate radial colonies on K2 medium that were distinct from those of isolate L and race 1 and 2 (Fig. 1). The number of rays produced per colony ranged from eight to 30. The colonies appeared yellowish when observed from the bottom. The color also was different from other races. On Komada’s original medium the growth of race 4 was retarded and the laciniate appearance of the colony was present but not as distinct. The race 4 isolate did not produce laciniate colonies on potato-dextrose agar, PCNB agar (3), Martin’s medium (2), or surfactant agar (4), and its colonies were almost indistinguishable from other races. None of the following
Fusarium spp. that were tested produced laciniated colonies on K2 medium: *F. oxysporum* f. sp. *lini*, *F. oxysporum* f. sp. *niveum*, *F. oxysporum* f. sp. *batatas*, *F. oxysporum* f. sp. *lycopersici*, *F. oxysporum* f. sp. *asparagi*, a saprophytic *F. oxysporum*, *F. moniliforme*, *F. roseum*, and *F. solani*. This indicates that the laciniate appearance of the colony on K2 medium is a specific characteristic of *F. oxysporum* f. sp. *cubense* race 4. Cavendish banana cultivars are susceptible only to race 4 (7) and Latundan cultivars are susceptible only to race 1 (6). All isolates of *F. oxysporum* obtained from 55 wilted Cavendish banana trees formed laciniated colonies on K2 medium. However, none of the isolates of *F. oxysporum* obtained from 16 wilted Latundan banana trees formed laciniated colonies on the same medium. These results further support the reliability of the method for identification of *F. oxysporum* f. sp. *cubense* race 4, at least for the isolates known in Taiwan at this time.

The K2 medium also was used to determine population of *F. oxysporum* f. sp. *cubense* race 4 in soil. Conidia of race 4 germinated about 98% on this medium, and the recovery of conidia from experimentally infested soil was about 90% (Fig. 2). When this medium was used to determine race 4 in naturally infested soil, the population of this fungus in 10 soil samples collected from three diseased areas was 55 to 650 propagules per gram of air-dried soil. Race 4 was not detected from any of the 50 soil samples collected from 10 disease-free areas.

All isolates of race 4 of *F. oxysporum* f. sp. *cubense* obtained from wilted Cavendish banana trees were identical in colony morphology. This may reflect the short history of the fungus in Taiwan (7). All of them probably originated from a single mutation. This also may account for the present success of using morphological characteristics for identification of the race. It is possible that a clone of race 4 without laciniated colonies may be found in the future.

**LITERATURE CITED**