Occurrence of Sweetpotato Chlorotic Leaf Distortion Caused by *Fusarium lateritium* in Kenya

A. W. KIHURANI, National Agricultural Research Laboratories, P.O. Box 14733, Nairobi, Kenya; L. G. SKOGLUND, International Potato Center, P.O. Box 25171, Nairobi, Kenya; and R. W. GATUMBI, National Agricultural Research Laboratories, P.O. Box 14733, Nairobi, Kenya

ABSTRACT

Kihurani, A. W., Skoglund, L. G., and Gatumbi, R. W. 1993. Occurrence of sweetpotato chlorotic leaf distortion caused by *Fusarium lateritium* in Kenya. Plant Dis. 77:1260-1261.

Signs and symptoms of chlorotic leaf distortion were observed on sweetpotato (*Ipomoea batatas*) in the South Nyanza district of Kenya during 1990 and 1991. These included epiphytic mycelium, chlorosis, and stunting. *Fusarium lateritium* was isolated and pathogenicity tests were conducted. Symptoms of chlorosis, stunting, and distortion did not develop, but hyphae and conidia were observed on newly expanding leaves. *F. lateritium* was reisolated from 32–41% of the inoculated plants after 4 mo and was found growing epiphytically on 83–94% of plants after 11 mo. This is the first report of chlorotic leaf distortion in Kenya and in Africa.

Chlorotic leaf distortion of sweetpotato (*Ipomoea batatas* (L.) Lam.) was first described in 1990 to be caused by *Fusarium lateritium* Nees:Fr. (4). Previously, it was believed that the condition was the result of a virus or viruslike agent (3,7). Clark et al (4) described the signs of the disease as beginning with white superficial growth on young leaves that consisted of hyphae and sporodochia of the fungus. Symptoms included chlorosis, stunting, and distortion. These symptoms were present under hot and sunny conditions in the field and were difficult to reproduce in the greenhouse (1,4).

In 1990, we started a survey of sweetpotato diseases occurring in Kenya during which we observed a whitish, waxy substance on newly expanding leaves of sweetpotato vines in the South Nyanza district in western Kenya. Leaf samples were examined under a light microscope at the National Agricultural Research Laboratories in Nairobi. Hyphae and macroconidia of a *Fusarium* sp. were observed. During further surveys in the area in 1991, these signs, along with chlorosis, purpling, and stunting, were observed. Samples of leaves and seeds were taken for further examination and isolation. The object of this study was to conduct pathogenicity tests and to confirm the occurrence of chlorotic leaf distortion, caused by *F. lateritium*, in Kenya.

Accepted for publication 13 August 1993.

MATERIALS AND METHODS

Isolations. Initial isolates were made from symptomatic plants from farmers' fields in South Nyanza in August 1991. Apical stem sections and leaves with white mycelial growth were plated on Komada's medium (6) without being surface-disinfested. No special conditions of light and temperature were provided while the cultures were transported from western Kenya to the laboratory in Nairobi. The predominant *Fusarium* sp. from each plate was transferred to potato-sucrose agar (PSA) and incubated in the dark at 25 C. We made a preliminary identification based on descriptions by Nelson et al (8). Single-conidium cultures were made on slants of potato-dextrose agar (PDA) and PSA. Cultures on PDA were sent to the Fusarium Research Center, Pennsylvania State University, and positively identified (P. E. Nelson, *personal communication*). Three different isolates were used in the subsequent pathogenicity tests.

Pathogenicity tests. Inoculum was produced on PDA plates incubated at 25 C in the dark. Conidia were washed from 7-day-old cultures with 100 ml of sterile distilled water and suspended in distilled water at concentrations of $2.4–3.6 \times 10^6$ conidia per milliliter.

Vine tip cuttings from two cultivars (KEMB 19 and KSP 36) were obtained from healthy plants located at the University of Nairobi, Kabete Campus (confirmed by culturing). The cuttings were trimmed to a uniform length of 25 cm, and the fully opened leaves were removed. The trimmed cuttings were washed in tap water, air-dried, and immersed in the inoculum for 1 min or, in the case of the controls, in sterile distilled water. Eighteen cuttings (15 of KEMB 19 and three of KSP 36) were treated with each of the three isolates of *F. lateritium*. Eight cuttings were used as controls.

After inoculation, each cutting was planted in moist potting mixture in a 20-cm-diameter plastic pot and placed in shaded greenhouses at the National Agricultural Research Laboratories for the duration of the study. All cuttings were covered with moistened transparent polyethylene bags to create a humid environment for the first 24 hr. For the next 7 days, the cuttings were misted with sterile distilled water at 4-hr intervals throughout the day and watered every other day or as needed until they were well established, after which watering was limited to once a week. Plants were sprayed with deltamethrin and dicofol as needed to control insects and mites.

When the plants were 4 mo old, apical vine tips measuring about 20 mm were detached, cut into small sections, and surface-disinfested in 0.1% NaOCl. These were placed on water agar plates and incubated in the dark at 25 C. After 3 days, mycelia were observed; hyphal tips were subcultured on PDA and incubated as above. These were subsequently identified according to Nelson et al (8).

At 11 mo, plants were examined for presence of fungal growth on leaf surfaces, chlorosis, and stunting characteristic of chlorotic leaf distortion. The fungal growth was examined microscopically to confirm the presence of *F. lateritium*.

RESULTS

At 4 mo of age, only a few of the potted plants showed external fungal growth on newly expanding leaves. Chlorosis, stunting, and distortion did not develop. *F. lateritium* was isolated from 33.3, 32.8, and 41.2% of plants inoculated with isolates FL1, FL2, and FL3, respectively. Two of the controls (25%) were also positive.

After 11 mo, most plants showed the characteristic hyphal growth on folded and newly unfolded leaves. When plants were examined microscopically, *F. lateritium* was observed on 83.3, 94.1, and 88.2% of those inoculated with

isolates FL1, FL2, and FL3, respectively. None of the plants exhibited noticeable chlorosis or stunting when compared with the controls. The two controls that were positive after 4 mo also had *F. lateritium* growing on the leaves.

DISCUSSION

Signs of chlorotic leaf distortion were observed during a survey of sweetpotato diseases in the South Nyanza, Machakos, Kakamega, and Kiambu districts of Kenya (*unpublished*). The pathogenicity of three selected isolates of *F. lateritium* from South Nyanza was demonstrated in the greenhouse test in which the pathogen was either reisolated from stem and leaf tissues (32.8–41.2% of plants after 4 mo) or identified in its epiphytic state (83.3–94.1% of plants after 11 mo). As stated by Clark et al (1,4), chlorosis, stunting, and distortion appear under sunny conditions only. Such conducive conditions were not prevalent at the testing location but were present in the area from which the isolates were obtained.

Recently, Clark (1) discussed the role of *F. lateritium* as an exopathogen that does not penetrate the plant but grows within mucilage on apical meristems, leaf primordia, and unfolded leaves. However, it can be isolated from surface-disinfested tissue of symptomatic plants. In this study, 4-mo-old plants did not show symptoms. This would partly explain our low rate of success in isolating from surface-disinfested tissue.

Infection of control plants may have been due to cross-contamination during mistings rather than the use of infected cuttings. Because of space constraints, control plants were located close to one of the treatments. Inoculum could have spread through air or water.

F. lateritium was isolated from sweetpotato seeds from the fields in which symptoms were noted and isolates were collected. Isolations were carried out at Louisiana State University as part of a collaborative project. Some of the isolates induced symptoms of chlorotic leaf distortion, whereas others had epiphytic mycelial growth only (2,5). This supports the occurrence of *F. lateritium* in Kenya and the pathogenicity to sweetpotato. It implies that the pathogen may be seed-transmitted.

Transmission of the pathogen through cuttings is an important mode of spread in East Africa because farmers frequently exchange vegetative material. A more important mode of spread is the exchange of sweetpotato seed between countries by researchers. An awareness of the potential threat to sweetpotato production imposed by chlorotic leaf distortion and distribution of the disease is essential to the continued exchange of germ plasm for crop improvement. Signs of chlorotic leaf distortion have been observed in Ghana, Zambia, Burundi, Rwanda, Tanzania, and Uganda (*unpublished*) and require isolations and identification for confirmation. Direct effects on yield and subsequent economic impact are unknown. Indirect effects through mycotoxin production also are unknown but could be of concern where foliage is used as a vegetable for human consumption and feed for livestock.

ACKNOWLEDGMENTS

We thank the director of the Kenya Agricultural Research Institute for supporting this research. We also thank James Kinyua for assistance in the greenhouses and laboratory.

LITERATURE CITED

1. Clark, C. A. 1992. Histological evidence that *Fusarium lateritium* is an exopathogen on sweetpotato with chlorotic leaf distortion. Phytopathology 82:656-663.
2. Clark, C. A., Hoy, M. W., and Stine, B. S. 1992. Isolation of *Fusarium lateritium* from sweetpotato true seed from different countries. (Abstr.) Phytopathology 82:1073.
3. Clark, C. A., and Moyer, J. W. 1988. Compendium of Sweet Potato Diseases. American Phytopathological Society, St. Paul, MN.
4. Clark, C. A., Valverde, R. A., Wilder-Ayers, J. A., and Nelson, P. E. 1990. *Fusarium lateritium*, causal agent of sweetpotato chlorotic leaf distortion. Phytopathology 80:741-744.
5. International Potato Center. 1992. Annual report. Lima, Peru.
6. Komada, H. 1975. Development of a selective medium for quantitative isolation of *Fusarium oxysporum* from natural soil. Rev. Plant Prot. Res. 8:114-125.
7. Moyer, J. W., and Salazar, L. F. 1989. Viruses and viruslike diseases of sweet potato. Plant Dis. 73:451-455.
8. Nelson, P. E., Toussoun, T. A., and Marasas, W. F. O. 1983. *Fusarium* Species: An Illustrated Manual for Identification. Pennsylvania State University Press, University Park.