Basal Node Rot of Rice Caused by *Fusarium oxysporum* in Brazil

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ABSTRACT

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A new disease called "basal node rot" of rice (*Oryza sativa*) characterized by retarded growth, poor tillering, dull green color of leaves, and black discoloration of the underground basal node was found to be caused by *Fusarium oxysporum*. The disease is common in savannas in fields where upland rice is grown in rotation with pasture grass in Brazil.

Additional key words: pathogenicity, symptoms

Basal node rot ("Mal do colo") of rice (*Oryza sativa* L.) was first observed in Brazil during 1979 and 1980 under upland conditions in the states of Goiás, Mato Grosso, and Mato Grosso do Sul (1). This disease was also found in the experimental fields of the National Rice and Bean Research Center in Goiânia. The consistent association of *Fusarium* sp. with the underground basal nodes of affected plants led to further investigations of the causal nature of the prevalent rice disease in savannas. This paper reports the symptoms and etiology of the disease.

MATERIALS AND METHODS

Diseased plants were obtained from farmers' fields in the states of Goiás, Mato Grosso do Sul, and Mato Grosso. Isolations were made from the underground basal node, which was showing black discoloration. Cultures were purified and maintained on potato-dextrose agar.

To test pathogenicity, each of 10 *Fusarium* species isolates was cultured separately in 100 g of oatmeal/sand medium (1:20) in 250-ml flasks at room temperature 25 ± 2 C. Two-week-old cultures from each flask were mixed with 1 kg of steam-sterilized soil/sand mixture (1:1, v/v) in 1-L plastic pots. Seeds of the rice cultivar IAC 47 were surface-disinfected with 0.1% $HgCl_2$ solution, rinsed in sterile water, and planted (10 seeds per pot). All pots were irrigated regularly with an equal volume of water to maintain soil moisture. Three pots were inoculated for each isolate tested. Observations of underground nodal infection were recorded 30 days after planting. Reisolations were made from the basal nodes of infected plants. The experiment was repeated once, using six of the reisolates as inoculum.

Evaluation of natural incidence of the disease in the field was made in 900-m^2 plots of 12 upland rice cultivars. Sampling was done at 15 random locations in each plot. All of the plants in

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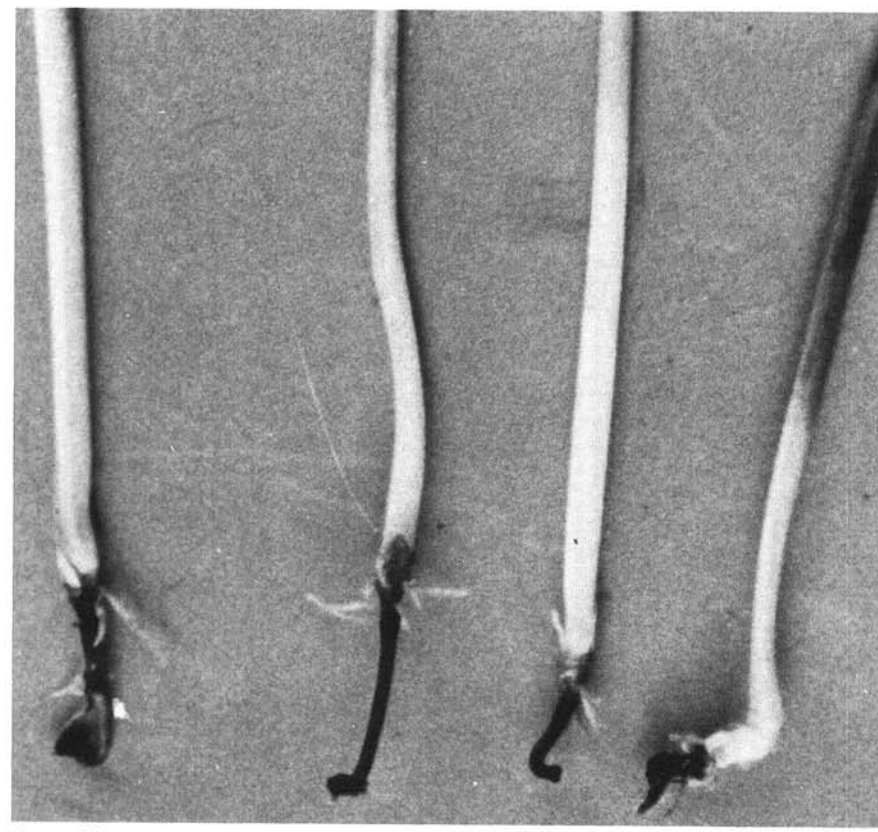

Fig. 1. Field symptoms of basal node rot caused by *Fusarium oxysporum* in rice plants. Adventitious roots have been removed to show the black discoloration at the underground basal node and mesocotyl.

each location (1 m^2) were carefully uprooted and the roots washed in tap water. Plants with black discoloration of the tissue when the basal node was cut crosswise were recorded as diseased.

RESULTS AND DISCUSSION

The characteristic symptoms of the aboveground rice plant parts in the field were retarded growth and dull green leaf color. These symptoms were first evident about 25 days after planting, and the difference in height between normal and diseased plants in the same row increased with time. The affected fields contained patches of dull green plants with delayed growth similar to some nutritional disorder, but when plants showing such symptoms were examined, a black discoloration was seen at the underground basal node where adventitious roots are initiated (Fig. 1). This black discoloration often extended to the mesocotyl and sometimes to the adventitious roots. Severely affected plants had poorly developed roots and few tillers. Death of affected plants, however, was rare.

Isolations made from basal node tissue of affected plants consistently yielded a similar *Fusarium* sp. Pathogenicity tests in the greenhouse using 10 different isolates (F 17380, F 18380, F 19380, F 22380, F 13180, F 02180, F 26480, F 25480, and F 26580) showed that F 17380, F 18380, F 19380, and F 26580 were pathogenic. Typical symptoms resembling those on young plants in heavily affected fields were evident 1 mo after inoculation. The pathogen that was reisolated was identical to the wild type, and pathogenicity was confirmed by repeating the test. Cortical tissues were blackened but the mycelium was not found in the vascular tissues.

Both pathogenic (F 19380 and F 26580) and saprophytic isolates (F 25480) were identified as *Fusarium oxysporum* Schlecht. emend. Snyd. & Hans. We prefer to describe the causal organism as *F. oxysporum* until further host-range tests are conducted to determine the forma specialis. All the isolates produced abundant microconidia and chlamydospores. Differences among the isolates were also observed, however, in relation to the less abundant macroconidia production.

Table 1. Incidence of *Fusarium oxysporum* in 12 rice cultivars under upland field conditions in Brazil during 1979–1980

Cultivar	Total no. of plants[a]	Infected plants (%)[b]
Early maturing		
Pratão Precoce (standard check)	518	93.7
Dourado Precoce	402	81.8**
IAC 25	303	66.8**
Medium duration		
IAC 47 (standard check)	365	69.9
Pratão	434	56.3**
IAC 1246	385	53.2**
Iguape Redondo	428	46.9**
Fernandes	294	43.2**
Amarelão	270	37.2**
IAC 5544	312	32.3**
IRAT 13	261	31.6**
Bico Ganga	305	29.7**

[a] Based on plants sampled at 15 random locations in 900-m^2 plots.
[b] Mean percentages marked with double asterisks are significantly different from the standard checks as judged by the *t* test at the 1% level of probability.

Preliminary evaluation of the field incidence of basal node rot in 12 upland rice cultivars had shown significant ($P = 0.01$) differences among the cultivars in relation to the percentage of plants affected with root infection caused by *F. oxysporum* (Table 1). Both early-maturing cultivars and those of medium duration differed from the controls.

F. oxysporum has been reported to be weakly parasitic or saprophytic on other cereals and grasses (2), but *F. oxysporum* causing the basal node rot constitutes the first report of its occurrence on rice. The nonvascular pathogenic rice-infecting *F. oxysporum* is assuming greater importance in Brazil. Basal node rot has been found mainly in fields where rice is grown in rotation with pasture grass and also in second and third years of successive rice cultivation in savannas. The parasitic ability of *F. oxysporum* affecting rice and other related grasses has to be studied further before effective crop rotation and other appropriate control measures can be developed.

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