Screening of Tomato Cultivars for Resistance to *Fusarium* Wilt in Eastern States of Nigeria

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A b s t r a c t

The causal organism of the out-break of wilt disease of tomato in the Imo and Rivers States of Nigeria was identified as *Fusarium pallidoroseum* (Berk and Rav) Booth and Sutton, and its pathogenicity was established. Experiments were designed to screen five tomato cultivars for resistance to *F. pallidoroseum*. Four methods were employed in the screening experiments. The results of all the methods used showed the cultivar IFe-1 as the most susceptible (65 %) while the Chef Cultivar was the most resistant with less than 10 % of the test plants wilting.

INTRODUCTION

Fusarium wilt is a most destructive disease. Entire fields of tomatoes have occasionally been known to be killed before the crop had been harvested with an estimated loss of more than ₦1000000 to commercial tomato growers, in addition to an uncalculated loss in home gardens (B o h n and T u c k e r, 1940).

The disease has been recorded in Nigeria for some time (B a i l e y, 1966). Its importance and distribution were not fully defined until E r i n l e (1977) showed that many of the flood plains along the stream in areas around Zaria which are irrigated during the dry season are heavily infested with *Fusarium* wilt pathogen. Erinle, like other workers in other parts of the world, implicated *Fusarium oxysporum* *schlecht lycopersici* as the causal agent of this disease. In this study however, *Fusarium pallidoroseum* (Berk and Rav) Booth and Sutton was consistently isolated from diseased plants. This is the first report of *F. pallidoroseum* being implicated as a serious wilt pathogen.

Investigations conducted in other parts of the world, especially the United States of America, have shown that *Fusarium* wilt is a classical example of a plant disease controlled by the use of resistant cultivars (Walker, 1971). In view of the economic importance of tomato production, and its increasing importance in the diet of most Nigerians, investigations were initiated into the screening of some agronomically desirable cultivars.

Erinle (1981) screened some tomato cultivars to wilt disease caused by *F. oxysporum* in the Northern part of Nigeria. No such screening exercise had been performed in Southern Nigeria. Moreover, there has been no screening of tomato cultivars for resistance to this relatively new wilt pathogen of tomato.

It is on this premise that five different cultivars of *Lycopersicum esculentum* (Mill) were collected from the National Horticultural Research Institute (NIHORT) Okigwe and the Horticultural Section of Institute for Agricultural Research, Ahmadu Bello University, Zaria for screening.

MATERIALS AND METHODS

The trials were carried out at the University of Port Harcourt, Botanical Garden in Rivers State and the Anambra Imo River Basin Development Authority premises at Agbala in Imo State.

The following tomato cultivars were used – Chef (A), Roma (B), Rossol (C), Enterpriser (D), and Ife-1 (E). Seeds were sown in heat-sterilised soil to which 14-28-14 compound fertiliser was added at the rate of 3 g/kg soil.

Four different methods were used in the screening for resistance to *F. pallidoroseum*. viz: Petri-plate/Blotter Method; Agar slant method, polythene bag method, and the open field trial. Each method had four replicates.

1. **Petri - plate / Blotter Method.** Seeds were sown in petri plates in which two filter papers moistened with Hoagland's culture solution were placed. The plates were kept moist throughout the two-week period of the experiment. Ten seeds were sown per plate and there were five plates for each of the cultivars. At seven days, seedlings in three of the five plates were inoculated with a 5 mm disc of the pathogen, while those in the remaining two plates served as controls. Daily observations were carried out for two weeks after inoculations.

2. **Agar Slant Method:** Potato dextrose agar (PDA) slants were made in wide mouthed test tubes plugged with cotton wool. Fifteen slants were used for each cultivar. Ten of the agar slants were each inoculated with a 5 mm disc of *F. pallidoroseum* and incubated for four days. Five other seedlings of the same age and size were also introduced into the five un-inoculated Agar slants for each cultivar to serve as controls. Observations were carried out daily for two weeks after inoculation.

3. **Polythene Bag Method.** Heat sterilized soil was used in raising the seedlings which were again transplanted into polythene bags containing sterile soil. The soil was planted out on PDA to ensure that it was *F. pallidoroseum* free. Twenty seedlings of each cultivar were used in the experiment. Inoculation of the seedling with a sporemycelium suspension of *F. pallidoroseum* was done using Welman's Technique. The sporemycelium suspension was prepared as follows: Three plates of a nine day-old culture of *F. pallidoroseum* were a Waring blender. Thirty millilitres of the suspension were diluted with 220 ml distilled water. The average spore concentration as determined with a levy corpuscle counting chamber was 9.0×10^6 spores/ml. Hyphal fragments were not counted. The test plants were then root-dipped for 30 seconds in the 250 ml of inoculum. The plants were then observed for wilt symptoms for four weeks after inoculation. This experiment was repeated three times. The cultures used originated from wilted tomato plants and had been maintained in soil tubes (Toussoun and Nelson, 1968) after single micro pore isolations were made. Black polythene bags were used to prevent algal growth, as well as other possible contaminants.

4. **Open Field Trial.** Seedlings were raised in wooden boxes of heat sterilized soil for four weeks. Twenty seedlings per cultivar were inoculated, while ten served as control per cultivar.

RESULTS

For the petri plate/Blotter method, IFe-1 cultivar recorded the highest incidence of wilt with 45% of the seedlings wilting at the end of the experiment. The Chef was least affected with less than 10 % wilt recorded. Enterpriser, Roma and Rossol cultivars were intermediate with wilting percentages of 20, 20 and 25 percent, respectively.

Results obtained from the Agar slant method showed that seedlings transplanted into un-inoculated slants (control) remained relatively free from infection – this was even true for IFe-1. In the inoculated slants, IFe-1 recorded the highest degree of infection (60 %). There was an increase in the degree of susceptibility of the other cultivars – see the table. In the case of the polythene bag method, disease incidence was highest and most severe for IFe-1 with 65 % of the test plants wilting; the Chef was found to be most resistant with only 5 % of the plants wilting. Roma and Rossol varieties showed an equal degree of resistance of 10 %. The controls were wilt symptom free. These results agree with those of the earlier techniques.

The appearance of wilt symptoms was delayed in the field, and lower percentages of wilted plants were recorded. For IFe-1, though still the highest, it was 45 %; Chef again recorded the lowest degree of infection 5 %, even though Rossol variety

also had 5 % of wilting. This result again agrees with earlier findings. Most of the plants used as controls did not wilt, but suffered crinkling and small degree of yellowing. (Table 1).

Table 1

Summary of various trials carried out to investigate resistance of 5 tomato cultivars to *F. pallidoroseum*

Tomato cultivars	Percent of test plants wilted by the indicated method			
	Blotter	Agar-slants	Polythene bags	Open field
Chef	8	15	5	5
Roma	20	35	20	5
Rossol	25	30	20	20
Enterpriser	20	25	10	20
IFe-1	35	60	65	45

DISCUSSION

The most successful practical means of controlling *Fusarium* wilt of tomato is the use of resistant varieties or cultivars. In Nigeria there are research reports on the collection and assessment of local and exotic cultivars for disease reaction. According to various reports, the following are promising – Roma, Rossol and Enterpriser, in the Northern region of Nigeria (Q u i n n, 1980). From the results of all of the methods used in this study, cultivar IFe-1 was consistently found to be most susceptible of the five cultivars screened. The exotic cultivars i.e. Roma, Rossol and Enterpriser were found to be comparatively tolerant, this agrees with earlier findings in Northern Nigeria (Q u i n n, 1980, E r i n l e, 1981). The Chef cultivar was most resistant to attack by *F. pallidoroseum*. However the screening of more tomato cultivars should be continued.

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Porównanie odporności odmian pomidora na uwiąd fuzaryjny we wschodnich rejonach Nigerii

S t r e s z c z e n i e

W rejonach Imo i Rivers w Nigerii stwierdzono, że przyczyną uwiadu pomidora jest *Fusarium pallidoseum* (Berk and Rav) Booth and Sutton. Ustalono także jego patogeniczność. Przeprowadzono eksperymenty polegające na badaniu odporności 5 odmian pomidora na *F. pallidoseum* 4 metodami. Wyniki wszystkich zastosowanych metod zgodnie wskazują, że najmniej odporną odmianą jest IFe-1 (65 %), zaś najodporniejszą – Chef z mniej niż 10 % zwiędłych roślin poddanych testowaniu.