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OCCURRENCE OF *FUSARIUM* WILT AND NEMATODES ON RED CALYX ROSELLE (*HIBISCUS SABDARIFFA* L.) IN NORTHERN NIGERIA

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Abstract: This paper presents a preliminary report of *Fusarium* wilt of Roselle in the Nigerian savanna. Soil and plant samples were collected from eight experimental plots where plants showed Roselle wilt symptoms. Samples were analyzed for the presence of nematodes and wilt pathogens. The wilt causative organism *Fusarium oxysporum* was isolated together with nematodes of different genera. However, nematodes of the genus *Helicotylenchus, Scutellonema* and *Hoplolaimus* appeared to occur in higher densities than the others.

Key word: *Fusarium* wilt of Roselle, *Hibiscus sabdariffa, Fusarium oxysporum, Helicotylenchus, Scutellonema, Hoplolaimus*

INTRODUCTION

Red calyx roselle (*Hibiscus sabdariffa* L.) is a plant that is recently gaining popularity in the northern states of Nigeria and beyond, because of its usage for preparation of beverage of medicinal value. This species is cultivated in the north larf of the country. There are other species that are cultivated in the southwest of Nigeria, mainly as green vegetable. In spite of the growing popularity of this crop, not much work has been done on it. It is often considered in this region as one of the few crops that can be used in rotation to prevent the occurrence of diseases. *Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *lycopersici* is a major disease of tomato in the northern states of Nigeria and in most tomato producing regions of the world (Erinle 1979; Agbenin et al. 1999; Sidhu and Webster 1983). The disease has been recorded among the *Papilionaceae, Malvaceae* and *Solanaceae*. Among the *Malvaceae*, the disease has been reported on okra and cotton in Nigeria. However, there has been no report of roselle wilt in Nigeria. In other parts of the world, wilt resulting from infection by *F. solani* f.sp. *radicicola* and *F. oxysporum* have been reported (Raabe et al. 1981). Most of the ag-

ricultural land used by local farmers is infested with *F. oxysporum*. With roselle serving as a suitable host, control of the pathogen is made more complex and production of roselle will be drastically affected. This work presents a preliminary report on the occurrence of *Fusarium* wilt on roselle in Nigeria.

MATERIALS AND METHODS

Seeds of red-calyx roselle were sown on the Institute for Agricultural Research Farm on 2nd July, 2003 at a spacing of 50 cm apart on 75 cm ridges. There were eight plots. Each plot was 3 m (4 ridges) by 5 m. The first weeding was carried out three weeks after sowing, during which the seedlings were thinned down to 2 seedlings per stand. Fertilizer (NPK 15:15:15) was applied immediately after the first weeding. Two other weedings were carried out later. In September, wilt symptoms began to appear on some of the plants in different plots. By mid – October 2003, two samples, one of the soil and the other of plants were taken. In the field the plants were observed for disease symptoms such as chlorosis, wilting, rot, and vascular discoloration.

For the plant samples, five plants were randomly selected per plot. Each plant sample was carefully uprooted and taken to the laboratory for microbial analysis.

Laboratory analysis

Sampled plants were observed for bacterial exudates from stem, and were assessed for wilt using a modified version of 1–6 scale described by Marley and Hillocks (1996) where 1 – no symptoms; 2 – epinasty and wilting of primary branches; 3 – wilting of second and third branch; 4 – wilting above third branch, second and third branch may be lost; 5 – partial desiccation; 6 – complete death of the plant. Each plant was assessed for vascular discoloration using 1–9 scale described by Marly and Hillocks (1994), where 0 – no browning; 2 – browning only around stem base; 3 – faint or patchy browning but limited below the first stem node; 4 – strong browning but limited below the first stem node; 5 – browning visible and extending above the first stem node; 6 – browning visible above the first stem node and up to half the total number of nodes; 7 – browning visible in more than half the stem internode; 8 – strong vascular browning in all but uppermost internode; 9 – strong browning through the stem vascular tissue.

Discoloured stems were cut into pieces of 1–2 cm, surface sterilized in sodium hypochlorite for 3 minutes. This was repeated and the stem cuttings were rinsed in sterile water. They were plated on Potato Dextrose Agar +Streptomycin (PDAS). After 48 hours subcultures were made and the petri dishes incubated for 8 days at room temperature. Wet slides were prepared and the causative organism identified under the microscope.

Soil samples were collected from the rhizosphere of uprooted plants using a hand trowel. In the laboratory, roots were observed for nematode symptoms such as the presence of galls, lesions and canker. Nematode larvae were extracted from 500 cm^3 of soil using the modified Cobb's decanting and sieving technique (Baker 1985).

Roots were macerated in a warring blender and nematodes extracted from the filtrate using the Baymans tray method. This was allowed to stand for 24 hours. Filtrates were decanted and observed under the microscope for identification of nematodes. Sampling was repeated the following year.

RESULTS AND DISCUSSION

Plant samples showed above ground symptoms of wilt and vascular discoloration. There were no chlorosis on stem and exudates on it. Basal stem rot and canker were common. There was strong vascular browning but limited to the point of the first branch node only, with an index of 4 in the first year. In the second year vascular discoloration increased with a mean of 5. In some plots percentage of wilt was as high as 36 resulting in the death of over 60% of the wilted plants (Table 1). The second year sampling recorded an increase of wilt. The above symptoms suggested the presence of *Fusarium*. This causative organism was identified under the microscope as *Fusarium oxysporum* using the preparations of wet slides and the Booth's key for Fusarium identification.

Table 1. Percentage wilt for 2003 and 2004

% wilt 2003 n=20	% wilt 2004 n=10
23	32
36	44
36	41
33	39
29	26
25	37
29	42
30	43

In Nigeria *Fusarium* species are a major problem of tomato. In other parts of the world *Fusarium* wilt is a problem on cotton (Powell 1970); coffee (Bertrand et. al. 2000) and pigeon pea (Marly and Hillocks 1993). However, there has been no record of its occurrence in roselle in Nigeria.

Roots showed symptoms of necrosis and were stingly reduced, especially root hairs. There was no symptom of gall. In the soil several genera of nematodes were found (Table 2). However, *Helicotylenchus* sp. and *Scutellonema bradys* seemed to have the highest population. Very few larvae were extracted from the roots, namely *Helicotylencus*, *Scutellonema bradys*, *Criconemoides* sp. and *Pratylenchus* sp. (Table 3). Similar results were obtained in the second year, except that more genera were identified in the second year. Over the years, with constant cultivation a build up of the population of these migratory endoparasites may occur. Population build up may result in increased penetration of larvae into the root system. Host status of agricultural crops is dynamic. Over the years resistant host plants have become susceptible. Roselle was previously considered a non-host to. In the last decade the host status of Roselle has changed in Brazil to include *Meloidogyne incognita* race 3 (Da Silva 1994).

There exist several records of *Fusarium* wilt occurring in disease complex with nematodes. Synergistic relationships between root-knot nematode *Meloidogyne* spp. and *Fusarium* has been reported (Agbenin and Erinle 2001; Betrand et al. 2000; Sharma and Nene 1990). Other endoparasitic and migratory endoparasitic nematodes such as

Heterodera, *Hoplolaimus* and *Helicotylenchus* have been involved in disease complexes with *Fusarium* wilt. Root rot of peas occurs in the presence of Fusarium and both *Hoplolaimus uniformis* and *Belonolaimus longicaudatus*. The basal stem rot in this study may be associated with the presence of *Helicotylenchus*, *Scuttelonema* and *Hoplolaimus* all of which are migratory endoparasites. Migratory endoparasites through their movement create infection courts, which serve as points of entry for other pathogens. The constant trusting of stylet into root creates openings and weakens the host plant vigour. These contribute in predisposing plants to secondary pathogens such as *Fusarium*.

Table 2. Population densities of different genera of nematodes

Genus	Number of larvae / 500 g of soil in 2003	Number of larvae / 500 g of soil in 2004
Pratylenchus	240	218
Hoplolaimus	380	381
Scutellonema	220	115
Helicotylenchus	770	808
Aphelenchoides	220	158
Tylenchus	140	135
Xiphinema	70	31
Paratylenchus	30	0
Ditylenchus	40	0
Meloidogyne	130	100

Table 3. Population densities of different nematodes isolated from the root-system

Genus	Number of nematode / 10 g of root in 2003	Number of nematode / 10 g of root in 2004
Meloidogyne	50	45
Pratylenchus	20	23
Scutellonema	10	15
Criconemoides	10	8
Helicotylenchus	15	11

CONCLUSIONS

The occurrence of *Fusarium* wilt in roselle means the increase in host range of these fungi, thus making the control through crop rotation more difficult. There is the need of further investigation of the role of the nematodes in the occurrence of roselle wilt. A survey of roselle producing areas is necessary to establish the status of the wilt.

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POLISH SUMMARY

WYSTĘPOWANIE UWIĄDU FUZARYJNEGO I NICIENI NA KETMII SZCZAWIOWEJ (*HIBISCUS SABDARIFFA* L.) W PÓŁNOCNEJ NIGERII

Niniejsza praca jest wstępnym doniesieniem o występowaniu uwiądu fuzaryjnego na ketmii szczawiowej na nigeryskiej sawannie. Próby gleby i porażonych roślin przeznaczone do badania pobrano z ośmiu poletek doświadczalnych. Zebrany materiał badano pod kątem obecności czynnika sprawczego uwiądu, izolując grzyby oraz nicienie. Z chorych roślin izolowano na sztuczną pożywkę *Fusarium oxysporum*, grzyba patogenicznego wywołującego uwiąd. Z prób gleby wyosobniono licznie występujące nicienie, zaliczane do 20 rodzajów. Z korzeni otrzymano niewielką liczbę nicieni z pięciu rodzajów, wśród których dominował rodzaj *Meloidogyne*. Stwierdzono, że czynnikiem sprawczym uwiądu ketmii był izolowany gatunek *F. oxysporum*, sugerując jednocześnie, że rola nicieni wymaga prowadzenia dalszych badań.