African Journal of Biotechnology Vol. 7 (24), pp. 4471-4474, 17 December, 2008
Available online at http://www.academicjournals.org/AJB
ISSN 1684–5315 © 2008 Academic Journals

Full Length Research Paper

Fungi associated with base rot disease of aloe vera (*Aloe barbadensis*)

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Accepted 20 October, 2008

Fungi associated with base rot disease of *Aloe vera* (syn. *Aloe barbadensis)* were investigated in Niger Delta Area of Nigeria. Fungi and their percentage frequency were *Aspergillus verocosa* 28.03%, *Fusarium oxysporium* 24.24%, *Plectosphaerella cucumerina 16.67%*, *Mammeria ehinobotryoides* 15.91% and *Torula herbarium* 15.15%. None of the fungi isolated have been previously reported on *Aloe vera* in Nigeria. In pathogenicity tests, the fungi isolated produced a variety of symptoms ranging from slowly progressive to rapidly progressive lesions leading to complete disintegration of the leaf bases of *A. vera* plants ten days after inoculation. *P. cucumerina* was the most aggressive rot –inducer which showed full base rot disease after 6 days of inoculation.

Key words: Fungi, base rot, *Aloe vera.*

INTRODUCTION

Aloe barbadensis Miller, popularly called *Aloe vera* is a phanerogame angiosperm which belongs to the family Liliaceae. The plant is a perennial drought resistant succulent plant (Figure 1). *Aloe vera* is believed to have originated in African continent specifically in Egypt (Daudu, 2000). The plant, being a cactus plant, contains 95 – 96% water and over 75 other constituents which include vitamins, minerals, enzymes, sugars, phenolic compounds, saponins, amino acids etc. (Joshi, 1998). Because of these constituents of the plant it is highly employed in professional medicine and cosmetics industries (Daodu, 2000; Hegger, 1996; Olusegun, 2000). Many people now grow *A. vera* plants at their backyard or around their houses. Many herbal drugs and drinks have been formulated from *A. vera* plants for the maintenance of good health (Davis and Moro, 1989). *A. vera* gel has been reported to be very effective for the treatment of sore and wounds, skin cancer, skin disease, cold and cough, constipation, pile, fungal infection etc. (Gill, 1992; Kafaru, 1994; Daodu, 2000; Djeraba and Quere, 2000; Olusegun, 2000). The use of *Aloe* plants in the treatment of other diseases such as asthma, ulcer and diabetes have also been reported (Davis and Moro, 1989). In cosmetic industries, Aloe is used in the production of soap for bathing, shampoo, hair wash, tooth paste and body creams (Daodu, 2000).

The noticeable disease of *A. vera* plant is the base rot disease which is very serious factor limiting the quantity and quality of leaves of *A. vera* plants. The disease is common and occurs in abundance when there is too much water in the soil. The infection appears at the base of older or mature leaves which show yellowish brown rot (Figure 2). Under severe infection, the leaves droop and fall. This may lead to partial or complete defoliation of the plant depending on the severity of infection. Sometimes severe infection may lead to premature death of the plant.

Considering the medicinal value of *A. vera* plants, little information is available on the fungi associated with the base rot disease of the plant in Nigeria. This study was carried out in order to provide information on the fungi associated with the disease and thus will help in formulating effective control measures for the disease.

MATERIALS AND METHODS

Samples of base rots of *A. vera* plants were collected from *A. vera* gardens in Abraka, Sapele and Warri in Niger Delta regions of

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Figure 1. Matured *Aloe vera* plant.

Figure 2. Leaves of *Aloe vera* plant showing base rot disease.

Nigeria. The samples were kept in sterile polythene bags and taken to laboratory for investigation.

Isolation of fungi from diseased plants

A total of twenty randomly selected diseased leaves were obtained from the three *A. vera* gardens. The symptoms on the leaves were noted before isolation of the pathogen (Figure 2). The affected leaves were cut into pieces (2 mm) and surface sterilized in 0.1% mercury chloride for 2 min and rinsed in three changes of sterile distilled water. These were then blotted between sterile filter papers and aseptically plated on potato dextrose agar (PDA). Four pieces were placed in a plate. The plates were incubated at room temperature (28+2°C) for five days in the laboratory. Mycelia growth which occurred three days after inoculation was transferred on to fresh PDA for pure culture. The pure cultures obtained for each plate were maintained on PDA for further study and identification. The isolates were identified on the basis of their morphological characteristics on plates, microscopic structures, types of spores produced and pigmentation using identification keys of Barnett and Hunter (1972), Barron (1968) and Domsch and Gams (1972).

Pathogenicity test of isolates

The leaves of twenty healthy *A. vera* plants were surface sterilized with 0.1% mercuric chloride for two minutes and the sterilized leaves were rinsed three times with sterile distilled water. Inoculation technique of Smith et al. (1976) was used in inoculating healthy sterilized leaves of *A. vera* plants. Four plants were used for each fungal isolate and each leaf on each plant received needle-jab puncture made in four different places on each older leaf on each plant of *A. vera*. A sterile inoculated needle was used to remove mycelia disc (2 mm) from pure culture and were individually inoculated into the wounded leaves. A set of four plants were similarly treated except that they were inoculated with ordinary sterile PDA and these served as control. The inoculated plants and the control plants were placed separately in their group of four on cleaned laboratory benches and properly labeled. The plants were examined daily for the development of symptom. The degree of rot caused by each fungal isolate was also assessed daily based on disease severity rating. At the end of the observation (seven days), base rot symptoms produced by artificial inoculation were compared with those observed on naturally infected leaves of *A. vera* collected from the *A. vera* gardens. The fungal isolates were re-isolated from the inoculated leaves of *A. vera* and plated on PDA plates. The morphology of each fungus was compared with that of original cultures.

RESULTS AND DISCUSSION

Five different fungal species namely *Plectosphaerella cucumerina, Mammeria echinobotryoides, Torula herbarium, Aspergillus verocosa* and *Fusarium oxysporium* were isolated. The fungi isolated with their percentage frequency are shown in Table 1. Pathogenicity tests with the isolated fungi showed initial disease symptoms three days after inoculation in the test plants (Table 2). Six days after inoculation, full blown base rot disease was noticed in plants inoculated with *P.cucumerina, F. oxysporium* and *T. herbarium*. Other fungi (*M. echinobotryoides* and *A. verocosa*) showed moderate symptoms 7 days after inoculation. No base rot symptoms were observed on the controls. Results of the pathogenicity tests are shown in Table 2. *P.cucumerina* was the most aggressive rot inducer which showed full base rot disease 6 days after inoculation. This was followed by *F. oxysporium* which showed full symptoms 7 days after inoculation. *T. herbarium* was almost as aggressive as *P. cucumerina. M. echinobotryoides* was a slow rot inducer which did not show full blown rot after 7 days of inoculation. *A. verocosa* was much slower than *M. echinobotryoides*. The base rot induced by *A. verocosa* was characterized by tiny lesions which showed greenish powdery mass of spores on the infected leaves. Five spe-

Table 1. Percentage frequency of the fungi isolated from the base rot disease of *Aloe vera*.

Fungi	Percentage frequency
Fusarium oxysporium	24.24
Plectosphaerella cucumerina	16.67
Mammeria echniobotryoides	15.91
Torula herbarium	15.15
Aspergillus verocosa	28.03

Table 2. Pathogenicity of isolated fungi showing disease severity rating Fungi Isolated

Fungus	Incubation periods (days)						
	1	2	3	4	5	6	7
Control	1	1	1	1	1	1	1
Fusarium oxysporium	1	1	2	2	3	3	4
Plectosphaeralla cucumerina	1	1	2	3	3	4	5
Mamaeria echinobotryoides	1	1	1	1	2	2	2
Torula herbarium	1	1	2	3	3	4	4
Aspergillus verocosa	1	1	1	1	1	1	2

Disease Rating: 1 = No infection 0%; 2= Mild infection 10 – 30%; 3 = Moderate infection 31 – 60%; 4= Severe infection 61 – 90%; 5 = Complete infection 100%.
Figures are means of four plants, each plant with 4 inoculation sites.

cies of fungus have been found to be associated with base rot disease of *A. vera*. This showed that the disease is largely caused by some fungal pathogens such as *P. cucumerina, T. herbarium* and *F. oxysporium*. The most aggressive fungus causing base rot disease was *P. cucumerina*. This was followed by *F. oxysporium* and *T. herbarium* in that order. From the best of our knowledge, this is the first time these fungi have been isolated from base rot disease of *A. vera* plants in Nigeria. These isolated fungi have been found to be soil inhabiting fungi which commonly attack plants at the soil surface (Johnson and Curl, 1972). Base rot infection of *A. vera* due to these fungi may be due to closeness of the older leaves to the soil surface. Sometimes, the older leaves are directly in contact with the soil surface. Water splash during rain fall or during watering in infected soil may carry the fungal spores to the base of the leaves which may consequently cause base rot infection in *A. vera* plants. *A. verocosa* which has the highest percentage frequency is part of the soil and atmospheric mycoflora (Calvo et al., 1980; Domsch and Gams, 1972). *Aspergillus* species have been reported to be secondary invaders that usually compete with pathogenic fungi in plants (Chiejina, 1994).

The presence of these fungi in *A. vera* plants is of public health importance since the plants are sometimes used in herbal recipes to treat many ailments in man (Hegger, 1996; Olusegun, 2000). Some fungal pathogens and non pathogens produce mycotoxins in their infected hosts and substrates on which they grow. Mycotoxins are hazardous to human and animal health (WHO, 1979). *Aspergillus* species for instance, produce aflatoxins B1, B2, G1, G2 on their substrates. Aflatoxin B1 is highly carcinogenic causing hepatoma in man (WHO, 1983). In view of the above, effort should be made to prevent and control the base rot disease of *A. vera* bearing in mind the economic and medicinal value of the plants to man.

REFERENCES

Barnett HL, Hunter BB (1972). Illustrated genera of imperfect fungi, Burgess Publishing Co., New York, p. 241.

Barron GI (1968). The genera of Hyphomycetes from soil. Robert and Krieger Publishing Co, New York, p. 364.

Calvo MA, Guarro J, Square G, Ramirez C (1980). Air borne fungi in the air of Barcellonia (Spain) III. The genus *Aspergillus Mycopathologia* 71(1):41-43.

Chiejina NV (1994). Post harvest fungal pathogens of pepper (*Capsicum annum. L)* at Nsukka. Niger. J. Plant Prot. 15: 44-51.

Daodu T (2000). Aloe vera, the miracle healing plant. Health Field Corporation, Lagos, p. 36.

Davis RH, Moro NP (1989). *Aloe vera* and gibbrellin, anti-inflammatory activity in diabetes. J. Am. Paediatr. Med. Assoc. 79(1): 24-26.

Djeraba A, Quere P (2000). *In vivo* macrophage activation in Chicken with acemannan, a complex carbohydrates extracted from *Aloe vera.* Int. J. Immunopharmacol. 22(5): 365-372.

Domsch KH, Gams W (1972). Fungi in agricultural soils. Longman Publisher, London, p. 291.

Gill LS (1992). Ethnomedical uses of plants in Nigeria. University of Benin Press, Benin City, p. 276.

Hegger JP (1996). Beneficial effect of Aloe on wounds healing in an excisional wound healing. Model J. Altern. Complement. Med. 20(2): 271-277.

Johnson LF, Curl EA (1972). Methods for research on the ecology of

soil borne plant pathogens. Burgess publishing co. Minnersota, p. 247.
Kafaru E (1994). Immense help from nature's work shop. Elikaf Health Service Limited, Lagos, p. 212.
Olusegun A (2000). One hundred medicinal uses of *Aloe vera*. Good health Inc. Lagos, p. 76.
Smith WT, Moline HE, Johnson KS (1979). Studies with Mucor species causing post harvest decay of fresh produce. Phytopathologia, 69: 865-869.
World Health Organization (WHO) (1979). Mycotoxins, Environment Health Criteria No. 11, Geneva.
World Health Organization (WHO) (1983). Prevention of liver cancer. Technical Report No. 691. Geneva.