Fungitoxic Activity of Neem and Pawpaw Leaves Extracts on \textit{Alternaria Solani}, Causal Organism of Yam Rots

Suleiman, M.N.

Department of Biological Science Faculty of Natural Sciences Kogi State University, P.M.B 1008, Anyigba, Nigeria. Phone: 08050622702, 08038956612


ABSTRACT

The in vitro fungitoxic activity of crude extracts of neem (\textit{Azadirachta indica}) (A.) Juss) and pawpaw (\textit{Carica papaya}) (L.) on \textit{Alternaria solani}, isolated from rotting yam tubers whose pathogenicity has been proven and assessed. The organic solvent (methanol) extracts of leaves of neem and pawpaw at 20\%, 40\%, 60\% and 80\% concentrations were tested on potato dextrose agar (PDA) for activity against the mycelia growth were determined. The replicated plates were incubated for 5 days at 27±2°C. The results showed that the extracts had fungitoxic components that retarded the mycelia growth and of course the disease incidence. The mean percentage inhibition of mycelia growth was highest in plates containing extract of pawpaw leaves at various concentrations tested, with the mean percentage inhibition value significantly (P<0.05) higher than in plates containing extract of neem. The inhibitory action of the extracts on mycelia growth increased with increase in concentration.

Key words: Extracts, mycelia growth, neem, pawpaw, \textit{Alternaria solani}, concentration, inhibition.

Introduction

Yam tuber is one of the most important groups of staple foods in the tropical world [15]. It accounts for over 50\% of the total daily carbohydrate consumption of the average Nigerian population [3]. They need a high tropical rainfall. The yam itself is a swollen tuber of a climbing vive, and contains little food material except starch. Yams like other tropical food crops are attacked by many pathogens. These agents may attack the underground or the aerial parts of the plant [14]. The degree of damage varies from cultivar to cultivar, depending on their physiology and resistance. Among the yam rotting fungi associated with yam tuber are \textit{Penicillium}, \textit{Rhizopus} [11], \textit{Botryodiplodia theobromae} and \textit{Aspergillus niger} [5], among other 17 fungi as pathogens associated with yam tuber rot.

Neem (\textit{Azadirachta indica}) and pawpaw (\textit{Carica papaya}) in the families meliaceae and caricaceae respectively are widely grown and used in different parts of Nigeria mainly for food, ornamental and in traditional health care services [13,6]. Recent reports shows that there is an increase in the use of plant parts (leaf, root, stem and bark) in the control of fungal disease contrary to their ancient use in healing ailments by traditional medicine practitioners in Nigeria and other African countries [2]. Wee Yeow Chin, [17] stated that those plants have effective broad-spectrum anti-fungal activities in laboratory studies over the years. The effectiveness has been confirmed by modern scientific studies. \textit{Azadirachta indica} A. Juss has been under intensive study for the past decade [12]. It is a common tropical tree, widely distributed in Africa and Asia. It’s medicinal and shade uses have been known for several centuries.
Fungicidal properties of neem extracts are promising. Lal et al. [7] showed that neem oil and neem seed cake extracts significantly reduced conidial germination in several fungi, especially *Sclerospora sacchari*, isolated from maize. Due to identifiable problems (e.g. chemical residues, biodegradation, phytotoxicity, pollution, etc) associated with chemical control strategies; alternative control methods are employed. Also, since *Alternaria* survives adverse environmental conditions and develops adaptive resistance to fungicides which are used for its control. It is also attempts do find cheaper, environment friendly means of controlling the rot fungus using some medicinal plants. This could add to methods of control used by farmers, thereby reducing reliance on fungicides that are reported to predicate long term harmful consequences on environment, man and other wildlife.

Materials and methods

Based on previous biological activities, leaves of *Azadirachta indica* (neem) and *Carica papaya* (pawpaw) were used. Fresh samples of each were used for the organic solvent (methanol) extractions according to [4,9,1]. Each of the plant leaf samples were washed thoroughly in cold running tap water, sun – dried for seven days. 500g of each was homogenized using warring blender, and each of them placed in 1000ml flasks containing 500ml methanol and thoroughly mixed together using glass rod and left for 24 hours to allow for extraction of the active ingredients as cold extraction before filtered into a fresh 500ml flask using four – fold cheese cloth as described by Wokocha and Okereke, [18]. On the other hand, hot organic solvent extraction was carried out by weighing the same quantity of samples (500g), washed and soaked in 500mls of methanol in a 1000ml conical flask. They were then placed in pots of water and heated on the electric cooker at 100°C. The filtrates was concentrated using the vacuum evaporator so as to regenerate the methanol. It was filtered using Buckner funnel and dried solidified extracts weighed. Percentage yield of extracts in percentage (%) was determined using the formula:

\[
\text{Percentage yield of extracts in percentage} = \frac{\text{solid extracts}}{\text{samples}} \times 100\%
\]

From the crystal appropriate samples were weighed separately and dissolved in 50ml distilled water to give the final concentrations of 20%, 40%, 60% and 80%, a modified method of [4,9].

Thirty-nine grams (39g) of Potato Dextrose agar was dissolved in one liter of distilled water and the medium was autoclaved at 1.02 kg / cm3 pressure for 15 minutes. Six milliliters (0.1%) of streptomycin was added to the 1 litre of the sterilized media just, before pouring into Petri-dishes, to prevent the growth of bacteria and allowed to cool and solidify, The fungicidal properties of each plant extract were tested on the mycelia growth of the isolated fungus by growing it on the PDA medium containing 1 ml of 20% 40%, 60% and 80% of each plant extract separately spread on the surface of the solidified PDA Petri-dishes. A disc of 4 mm diameter (using a sterile cork-borer) of each pure culture of the isolated fungi was placed on the thin film formed on the PDA just at point of intersection of two lines at the bottom of each Petri-dish. Three plates were treated with extract of each plant. The control experiments had distilled water in place of plant extracts respectively; the treatments and control were incubated for five days at room temperature (27 ± 2°C). As soon as the control plates are filled up, the results were collated and analyzed.

**Results and discussions**

From the results, it was observed that the two aqueous leaf extracts used for the study only recorded retardation of mycelia growth of *Alternaria solani in vitro*. Sofowora [13], reported the water-soluble antifungal principles in some plants as being responsible for the anti-fungal activities; also, Olufolaji. [10] used aqueous plant extracts in the control of wet rot of *Amaranthus* sp. caused by *Choanephora cucurbitarum*. Looking at the tables 1 and 2, there is only a partial variation in the level of radial mycelia growth inhibition values of *Alternaria solani of pawpaw leaf extract* and that of neem leaf extract at all the concentrations. There was a significant difference in statistical test at (p<0.05) between mycelia radial growths values recorded on the various plant extracts concentrations used compared with the control. These suggest that there is difference in the water soluble antifungal element in the respective leaves extracts as reported by Iwu, [6] and Sofowora, [13]. From the foregoing, pawpaw leaf, *Carica papaya* and neem, *Azadirachta indica* possess antifungal elements that inhibit *Alternaria* mycelia growth at various concentrations.

Neem leaf extract (*A. indica*) was used for the study of control of plant diseases being ecologically friendly [1]. Study shown that the neem, *A. indica* as a medicinal plant posses’ potent antifungal properties in the leaves which inhibit mycelia growth. It contains phytochemical compounds such as azadirachtin, betasiterol, 6-desacetyl nimbinene and 3-desiacetyl alamine which show antifungal properties. The ability of neem leaf extract to reduce the mycelia growth of *Curvularia lunata* isolated from neem itself, it’s own endophytic mycoflora also proved that, neem has high antifungal properties [16]. This is in agreement with the present results on *Alternaria solani*. 

Pawpaw leaves extract (C. papaya) equally used for the control of plant diseases in the present study proved that mycelia growth was inhibited at higher concentrations. Pawpaw leaf extract has also been reported as being used as fungicidal in seed treatment of African yam bean. Pawpaw leaf extracts had been used to control incidence of foliar myco-pathogens of groundnut (Arachis hypogea) due to its prophatic effect [8]. In view of this remarkable report, one could confidently suggest that neem (Azadirachta indica) and pawpaw (Carica papaya) used as medicinal plants in the controlling of certain microbial causative agents.

Conclusion:

This study has revealed the potential of botanicals in the control of yam rotting fungus, Alternaria solani. This has gone a long way in providing better alternative to the over dependency on synthetic fungicides. The use of plant products in integrated pest management could reduce over reliance on one source of agricultural chemical to the farmer, as well as cut down cost production. The facts that neem and pawpaw leaves used in this study are easily available, with easy method of extraction; it can be exploited in the control of yam rotting disease.

References