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Short Communication

Prophylactic effect of paw-paw leaf and bitter leaf extracts on the incidence of foliar myco-pathogens of groundnut (*Arachis hypogaea* L.) in Ishiagu, Nigeria

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The aqueous extracts of the leaves of paw-paw (*Carica papaya*) and bitter leaf (*Vernonia amygdalina*) were used to investigate their prophylactic effects on the incidence of myco-pathogens of groundnut in Ishiagu, south eastern Nigeria. Two field experiments were conducted: pre-soaking of the seeds before sowing and post-germination spraying. Both experiments had significant effects ($P < 0.05$) on the disease incidence of the pathogens. In the pre-soaking experiment, the incidence was drastically reduced to 2.17% (for PL15–BL20 treatment combination) being the lowest disease incidence. Post-germination spraying proved efficacious on the disease incidence by reducing the disease incidence to as low as 2.20% for PL25–BL25 treatment combination. It is therefore recommended that both methods be used at the sowing and germinated stages respectively for better effective results.

Key words: Prophylactic effect, Plant extracts, Disease incidence, Myco-pathogens.

INTRODUCTION

Groundnut (*Arachis hypogaea* L) is a leguminous crop of South American origin. Its values in human nutrition as well as in industries are of great importance. It belongs to the family Fabaceae. Agriculturally, the ability of the roots to extract and fix nitrogen from the soil atmosphere due to the activity of bacteria of the *Rhizobium* genus which live in symbiosis within the root provides an advantageous mechanism for the establishment of leguminous crop on soils which have new nitrogenous reserves (Tindall, 1988). Groundnut is an annual herb that grows up to 60 cm in height, the cultivars are mainly grouped in two sections “Erect” and “Running”; the leaves are spirally arranged and the flowers are borne in axils of foliage leaves mainly from the lower nodes singly or in clusters. The pods are borne at the tip of the elongating carpophore containing 1 - 6 seeds and the seeds are cylindrical or ovoid, 1 – 2 cm x 0.5 – 1 cm varying in sizes, shape and colour of testa, containing 2 cotyledons (Tindall, 1988).

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The groundnut pods consist of 20 - 30% shell and 70 - 80% nut, which may easily be separated. The kennel consists of two cotyledons and the germ. Groundnuts are composed of approximately equal weights of fatty and non-fatty constituents. The kernel contains 35.8 - 54.2% lipids and 21.0 - 36.4% protein (Enwere, 1998). Groundnuts are very high in calories because of their high fat and protein contents. 0.45 kg of groundnut brittle, salted groundnut or groundnut butter contains about 2800 calories (Enwere, 1998). Groundnuts are generally low in carbohydrate content, which is about 11.7% (Purseglove, 1991).

In Nigeria, groundnuts are industrially used to produce groundnut oil and cake. The cake is used mainly for formulating animal feed or as a snack called *Kuli -Kuli* by Hausas while the oil is used for home cooking or processed into products such as margarine and baking fats.

Groundnut is being attacked by some plant pathogenic micro-organisms like other food crops in the tropics thereby limiting the production of this important crop. Amongst the fungal disease, three are of particular importance, effectively occurring wherever groundnuts are cultivated; these are the two cercospora leaf spots and rust (Allen, 1983). Other diseases are web blight

caused by *Phoma arachidicola* that results in severe defoliation, botrytis blight (*Botrytis cinerea)* that causes blighting of the stem and leave and pepper spot (*Leptosphearrulina crassiaca)* which causes pinpoint black spots on leaves. These are foliar fungal pathogens. Aflatoxin is produced by the fungus *Aspergillus flavus* which attacks stored grains. Leaf spot disease is the major foliar disease reducing groundnut yields wherever they are grown (Surbrahmayan et al., 1980). Yield losses from rust caused by *Puccinia arachidis* can be substantial particularly where the cercospora leaf spots are also involved. In India, the extent of crop loss has been estimated to be about 27% from rust infection alone and up to 50% when leaf spot is also present (Nevill, 1980). Fungal diseases especially leaf spots and rust are prevalent in Ishiagu agro-ecological zone but no detailed/standard reports on their incidence have been documented.

These foliar fungal diseases of groundnut have been effectively controlled with synthetic systemic fungicides especially Benomly, Dithane M45, and Baycor 300 EC. This adds to the production cost of groundnuts. For local farmers who cannot afford the cost of synthetic fungicide application, the crop is lost to diseases. The use of synthetic chemicals in disease control is eliciting much concern owing to the undesirable side effects emanating from their use (Tovignan et al., 2001). Residual effects of some of the fungicides sometimes pose problems to the human environment. Emphasis in recent times has been laid on non-chemical strategies to protect agricultural crops and human environment. This is rekindling a renewed interest in the use of natural products from higher plants in the disease management scheme (Salako, 2002). This necessitated the need to evolve control measures that are cheap, ecologically sound and environmentally safe to eliminate or reduce the incidence of these economic important pathogens. Therefore, the objective of this research is to evaluate the effects of aqueous extracts of paw-paw leaf and bitter leaf on these fungi on groundnut.

MATERIALS AND METHODS

The research was carried out in the Plant Pathology Laboratory and Research and Teaching Farm of the Federal College of Agriculture Ishiagu, Ebonyi State, Nigeria. The seeds of erect Ishiagu local variety (ISI-4) were obtained from the seed unit of the College and leaves of paw-paw (*Carica papaya* Var. Solo) and bitter leaf (*Vernonia amygdalina)* obtained from the College farm. ISI-4 is highly susceptible to major foliar fungal diseases of groundnut (Chukwu, 1993).

Viability study was carried out on the seeds in the laboratory. 400 seeds were selected at random from the seed lot. Blotter test method was employed by using pieces of No.1 Whatman filter papers moistened with 10 ml of tap water and packed in threes in sterilized petri-dishes (Iloba, 1980). 10 seeds were aseptically and equidistantly placed in each plate, and incubated at 25 ± 2°C for eight days.

The aqueous extracts of the paw-paw leaf and bitter leaf were obtained by drying fresh leaves of paw-paw and bitter leaf in an oven at 45 ± 2°C to make them brittle. The dried leaves were ground to powder in a mortar, sieved with a 2 mm and measured out into various weights of 150, 200, and 250 g. The powders were each diluted with one litre of distilled water to give 15% (w/v), 20% (w/v) and 25% (w/v) concentrations of the treatments. The mixtures were left for 12 h after which, they were filtered with clean cheese-cloth and the filtrates collected in clean plastic containers. The filtrates became the paw-paw leaf and bitter leaf aqueous extracts.

Two field experiments were conducted on two portions of land measuring 49 x 10 m (490 m^2). The experiments were: Pre-soaking the seeds in the extract before sowing and post-germination spraying of the extract. The fields were cleared, ploughed, harrowed and marked into three blocks of 48 x 2 m each. Individual blocks were divided into 16 plots of 2 x 2 m. A distance of 0.5 m was allowed between plots and blocks. Each portion was used for one experiment. The experimental design was a factorial in Randomized Complete Block Design (RCBD).

In experiment 1, the seeds were soaked in the various concentrations of the treatment for three hours and air-dried before sowing. Paw-paw leaf and bitter leaf extracts had been used as a fungicidal seed treatment in African yam bean (Nwachukwu and Umechuruba, 2001). The treated seeds were randomized in the blocks. The untreated seeds served as control. Each plot was seeded 2 seeds per hole, at a spacing distance of 0.3 m along the row and 0.6 m between rows, later thinned down to one, 3 weeks after emergence (WAE), giving 22 plants per plot, 352 plants per block and 1068 plants in the whole portion. The plots were fertilized with 15: 15: 15 compound fertilizer at the rate of 30 g/plant by ring method 4 WAE.

In experiment 2, the same operations as in experiment 1 were performed excepting that the treatments were sprayed on the leaves 4 WAE instead of pre-soaking.

The data obtained were subjected to Analysis of Variance (ANOVA) and significant means separated using FLSD = LSD procedure as outlined in Obi (2002).

RESULTS AND DISCUSSION

In pre-soaking, paw-paw leaf (PL) extract had no significant effect ($P > 0.05$) on the disease incidence at 50% anthesis. Bitter leaf (BL) extract had a high significant effect ($P < 0.01$) on the disease incidence. The control differed statistically from BL15, BL20, and BL250. The interaction of PL and BL at various levels had significant effect ($P < 0.05$) on disease incidence at 50% anthesis. The control produced higher disease incidence (70.67%), while lower disease incidence (2.17%) was produced at PL15 – BL20 treatment combination as recorded in Table 1.

Post-germination spraying, PL had a high significant effect ($P < 0.01$) on the disease incidence BL had a high significant (Table 2). There was no significant effect ($P > 0.05$) on the interaction of PL x BL across all levels on the incidence of disease. Also, the highest disease incidence (74.74%) was recorded in the control. The lowest incidence of disease (2.20%) was recorded PL25 – BL25 treatment combinations. The control differed significantly ($P < 0.05$) from the means of other treatments.

These plant extracts revealed that they can be used as

Table 1. Pre-soaking effect of plant extracts on disease incidence (%) at 50% anthesis.

	PL0	PL15	PL20	PL25
BL0	70.67	12.67	6.21	7.15
BL15	10.31	2.77	0.00	0.00
BL20	10.35	2.17	6.54*	6.78*
BL25	13.99	3.73	4.04	0.00

BL0-PL0 = Water (control); PL15 = paw-paw leaf aqueous extract at 15% (w/v); PL20 = paw-paw leaf aqueous extract at 20% (w/v); PL25 = paw-paw leaf aqueous extract at 25% (w/v); BL15 = bitter leaf aqueous extract at 15% (w/v); BL20 = bitter leaf aqueous extract at 20% (w/v); and BL25 = bitter leaf aqueous extract at 25% (w/v).
$F\text{-}LSD_{.05}$ for comparing PL Effect = NS.
$F\text{-}LSD_{.05\ for}$ comparing BL Effect = 8.78.
$F\text{-}LSD_{.05}$ for comparing PL x BL Effect = 2.89.

Table 2. Post-germination spraying effect of plant extracts on disease incidence (%) at 50% anthesis.

	PL0	PL15	PL20	PL25
BL0	74.74*	13.55	9.07	8.94
BL15	10.18	7.44	4.94	7.38
BL20	7.14	7.78	4.80	3.46
BL25	7.79	3.51	3.07	2.20

BL0-PL0 = Water (control); PL15 = paw-paw leaf aqueous extract at 15% (w/v); PL20 = paw-paw leaf aqueous extract at 20% (w/v); PL25 = paw-paw leaf aqueous extract at 25% (w/v); BL15 = bitter leaf aqueous extract at 15% (w/v); BL20 = bitter leaf aqueous extract at 20% (w/v); and BL25 = bitter leaf aqueous extract at 25% (w/v).
$F\text{-}LSD_{.05}$ for comparing PL Effects = 6.67.
$F\text{-}LSD_{.05}$ for comparing BL Effects= 13.64.
$F\text{-}LSD_{.05}$ for comparing PL x BL Effects = NS.

bio-fungicides against foliar fungal pathogens of groundnut. The incidences of the pathogens were reduced when compared with the control. Their effects on disease incidence varied with the concentrations of the extracts and their combinations. In the pre-soaking experiment, the incidence was drastically reduced at PL15 – BL20 (2.17%) treatment combination being the lowest disease incidence, while the highest disease incidence (70.67%) was obtained at the control. However, PL20 – BL15, PL25 – BL15 and PL25 – BL25 combinations exerted deleterious effects on the seeds thereby inhibiting germination of the seeds absolutely. The combinations of the extracts at these concentrations of the plant extracts were toxic to the seeds of groundnut. These therefore exerted lethal effects on the seeds. Such concentrations and combinations should therefore be avoided.

Post-germination spraying proved efficacious on the disease incidence by reducing the disease incidence to as low as 2.20% at PL25 – BL25 treatment combinations as opposed to 74.74% obtained in the control. The combination of the plant extracts at equal concentration of 25% (w/v) which was lethal in the pre-soaking experiment proved best in the post-germination spraying experiment. This therefore suggests the use of the combination when the latter method is to be adopted by farmers.

The research revealed that these extracts have systemic qualities. They can be used to protect groundnut from the menace of foliar-fungal pathogens especially the pre-soaking method thereby supporting the work of Maude (1996). The employment of these extracts in the management of foliar fungal diseases of groundnut will encourage cost reduction in the production of the crop. It is therefore recommended that both methods be used at the sowing and germinated stages respectively for better effective results.

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