PROPHYLACTIC EFFECT OF PAW-PAW AND BITTER LEAVES EXTRACTS ON THE SEVERITY OF FOLIAR FUNGAL DISEASES OF GROUNDNUT (*ARACHIS HYPOGAEA* L.) IN ISHIAGU, SOUTHEAST NIGERIA.

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ABSTRACT

The aqueous extracts of the leaves of paw-paw (*Carica papaya* L.) and bitter leaf (*Vernonia amygdalina* L.) were used to investigate their prophylactic effects on the severity of foliar fungal diseases of groundnut in Ishiagu, S. E. Nigeria. Two field experiments were conducted : pre-soaking of the seeds before sowing and post-germination spraying. Results shows that both experiments had significant effects ($P<0.01$) on the severity of the foliar fungal diseases, as the extracts lowered significantly the disease severity, thereby showing their systemic efficacies. The aqueous extracts of leaves of paw-paw and bitter leaf can be used as bio-fungicides against foliar fungal diseases of groundnut.

Key words: Prophylactic, Plant extracts, fungal Diseases Pawpaw, Bitter leaf, Groundnut.

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 (Tindall, 1988). 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 and for the establishment of leguminous crop on soils which have new nitrogenous reserves

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 attacked by some plant pathogenic micro-organisms like other food crops in the tropics thereby limiting the production of this important crop. Schilling (2002), stated that groundnut leaf spots are caused by *Cercospora* spp. Two leaf spots are important, early and late. Early leaf spot caused by *Cercospora arachidicola* produces sub-circular, brown lesions. Late leaf spot caused by *C. personatum* produces lesions on the lower leaf surface that are meanly circular, slightly rough and darker than in early leaf spot. ICRISAT (2005), reported that yield losses in Africa due to Cercospora leaf spot are more than 50%.

Barbara (2005), noted that botrytis blight caused by the fungus *Botrytis cinerea* produces massive numbers of gray to brown spores in leaves and stems, and black sclerotia could be found on the pods of groundnuts. Numerous spots are sometimes seen on the leaf tops. Although Botrytis blight does not cause serious losses, it can be alarming. *Botrytis cinerea* affects most vegetable and fruit crops, as well as large number of shrubs, trees, flowers and weeds. This fungus causes primarily blossom blights

and fruit rots but can also cause damping-off, leaf spots and root rots (Paulus, 2000).

Fungal foliar diseases especially leaf spots and rust are prevalent in Ishiagu agro-ecological zone but no detailed/standard reports on their incidence have been documented.

Management of these diseases is largely dependent upon multiple applications of various fungicides. These foliar fungal diseases of groundnut have been effectively controlled with synthetic systemic fungicides especially Benomly, Dithane M45, and Baycor 300 EC (Culbreath *et al.*, 2002). 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).

The objective of this research was to evaluate the prophylactic effect of the aqueous extracts of the leaves of paw-paw (*Carica papaya* L.) and bitter leaf (*Vernonia amygdalina* L.) on the severity of foliar diseases of groundnut in Ishiagu, Southeastern Nigeria.

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), which is highly susceptible to major foliar diseases, were used. The leaves of paw-paw and bitter leaf were obtained from the College farm. Viability test was conducted on the seeds to ascertain and ensure their viability in the laboratory.

Paw-paw leaf and bitter leaf extracts had been used as a fungicidal seed treatment in African yam bean (Nwachukwu and Umechuruba, 2001). 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^{oc} for six hours to make them brittle. The dried leaves were ground to powder in a mortar, sieved with a 2mm sieve and measured out into various weights of 150g, 200g, and 250g. The powders were each dissolved in 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 hours after which, they were filtered with clean cheesecloth and the filtrates collected in clean plastic containers.

Two field experiments were conducted on two portions of land measuring 49m x 10m (490m^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 48m x 2m each. Individual blocks were divided into 16 plots of 2m x 2m. A distance of 0.5m 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. 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 0.3m along the row and 0.6m 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 N:P:K 15: 15: 15 compound fertilizer at the rate of 30g/plant by ring method 4 WAE.

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

Disease severity was rated on the following scale at 50% anthesis:

Diseased leaves/plant	Rating
<10	less severe
11-20	moderately severe
21-50	very severe
>50	highly severe

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

RESULTS AND DISCUSSION

In the pre-soaking method, the aqueous extract of paw-paw leaf (PL) lowered significantly ($P<0.01$) the severity of the foliar diseases at 50% anthesis (Table 1). The aqueous extract of bitter leaf (BL) also lowered significantly ($P<0.01$) the severity of the foliar diseases at 50% anthesis. The interactions of the treatments across various levels of on the severity of the diseases were similar ($P>0.05$). The lowest disease severity (2.94%) was obtained in the PL150 x BL200 interaction, though not statistically different. The highest disease severity (79.84%) was obtained at the control, whose means differed significantly ($P<0.05$) from the means of other treatments. The results in this method showed that these extracts proved efficacious in the reduction of the severity of foliar fungal diseases of groundnut. The data obtained at the control buttressed the efficacy of these aqueous extracts of paw-paw leaf and bitter leaf.

Table 1: Pre-soaking Effect of Plant Extracts on Disease Severity (%) At 50% Anthesis.

	PL0	PL150	PL200	PL250	MEAN
BL0	69.84*	4.44	4.38	4.96	10.91
BL150	3.20	6.65	0.00	0.00	4.93
BL200	7.20	2.94	3.49	4.87	4.63
BL250	13.77*	5.86	6.56	0.00	8.73
MEAN	13.50	4.97	4.81	4.92	

F-$LSD_{.05}$ for comparing PL Effect = 6.61
F-$LSD_{.05}$ for comparing BL Effect = 7.87
F-$LSD_{.05}$ for comparing PL x BL Effect = NS

Note:
BL0-PL0= water (control)
PL150= paw-paw leaf aqueous extract at 150g/l (15%w/v)
PL200=paw-paw leaf aqueous extract at 200g/l (20%w/v)
PL250= paw-paw leaf aqueous extract at 250g/l (25%w/v)
BL150=bitter leaf aqueous extract at 150g/l (15%w/v)
BL200=bitter leaf aqueous extract at 200g/l (20% w/v)
BL250=bitter leaf aqueous extract at 250g/l (25% w/v)

In the post-germination method, the aqueous extracts of paw-paw leaf and bitter leaf lowered significantly ($P<0.01$) the severity of disease at 50% anthesis(Table 2).

The interactions of the treatments did not produce any significant effect ($P>0.05$) on the disease severity. Meanwhile, the lowest disease severity (0.35%) was obtained at the interaction of PL250 x BL250, though not statistically different. The control differed significantly ($P<0.01$) from the other treatments thereby showcasing the efficacy of the plant extracts across various levels. The highest severity (70.72%) was obtained at the control level.

Table 2: Post-germination Effect of Plant Extracts on Disease Severity(%) At 50% Anthesis.

	PL0	PL150	PL200	PL250	MEAN
BL0	70.72*	7.80	4.25	3.15	11.48
BL150	2.56	2.24	1.93	1.36	2.02
BL200	2.40	2.04	1.11	0.96	1.63
BL250	2.64	1.46	0.72	0.35	1.29
MEAN	9.58	3.39	2.00	1.46	

F-LSD$_{.05}$ for comparing PL Effects = 7.98
F-LSD$_{.05}$ for comparing BL Effects = 9.03
F-LSD$_{.05}$ for comparing PL x BL Effects = NS

CONCLUSION AND RECOMMENDATIONS

The results of the research indicated that the plant aqueous extracts (paw-paw leaf and bitter leaf) could be used as systemic bio-fungicides. The two methods of application in this research showed that either of them could produce good results. Treating the seeds with the plant extracts before sowing protected the seeds against foliar fungal pathogens.

It is therefore recommended that these extracts be used both as pre-soaking treatment and post-germination spraying to ensure maximum protection of groundnut against the attack of these foliar fungal pathogens.

It is suggested that farmers should establish more paw-paw and bitter leaf plants to ensure the availability of their leaves for use as bio-fungicides . More studies be done on these bio-fungicides (plant extracts) to evolve better combinations that should completely protect groundnut from the menace of these foliar fungal pathogens or find other synergistic component(s) that will increase their efficacy.

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 strongly advised that both methods be used at the sowing and germinated stages respectively for effective results.

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