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Full Length Research Paper

The effects of some cryptogamic extracts on the primary productivity of *Vigna unguiculata* L. Walp

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The effect of hot and cold aqueous extracts of *Barbula lambarenensis, Dryopteris flix-max; Nephrolepis davalloides, Phymatodes scolopenta,* Platycerium angolense and *Azadrachta indica* and Karate 2.5EC (chemical) on the primary productivity of cowpea were investigated. The extracts of the plant materials and the chemical were appropriately used to irrigate the cowpea twice a week during flowering. The number of pods per plant, length of pods, number of seeds per pod, number of seeds per plant, filling potentials and the weight of seeds per plant were determined for each of the 14 regimes. It was found that all the treatments other than cold extracts of *B. lambarenensis*, extracts of *Dryopteris* and *Nephrolepis* showed better performance than the untreated in the measured variables. Cowpea treated with hot aqueous *B. lambarenensis* extracts, hot and cold extracts of *P. scolopenta, P. angolense and A. indica compared* favourably and even better than the one treated with Karate 2.5EC (Lambda – cyhalothrin), a universally used chemical. This shows that these plants can serve as good materials or alternatives to Karate and can therefore be integrated into use for the production of cowpea.

Key words: Productivity, cryptogamic*, Barbula lambarenensis Nephrolepis davalloides, Vigna unguiculata, Dryopteris flix-max.*

INTRODUCTION

Primary productivity is the rate at which energy is bound or organic materials created by photosynthesis per unit of the earth`s surface per unit time (Whittaker, 1975). The essence of cultivation is to have some yields/harvest and when harvested, is to satisfy ones food requirement and/or have some money or be economically empowered if sold. The primary productivity of a particular crop depends on soil fertility, soil type, climate, good farming management, adequate weeding, absence of pests and other plant pathogens. Adequate weeding is required as the weeds compete with crop for light (Singh and Rachie, 1985), nutrients (Enyi, 1973) and water (Moody, 1973). All these materials are essential raw materials for photosynthesis to take place.

Most of the foods that man consumes in Nigeria is carbohydrate and less of protein thus, resulting to mal-nutrition and kwashiorkor (protein deficiency) in children.

The cheapest source of protein is cowpea and other legumes. Cowpea contributes 24% crude protein (Bressani, 1985) or 24.8% crude protein (Davis et al., 1991), unfortunately many people care less about its consumption as they cannot afford it or due to lack of interest. Cowpea, *Vigna unguiculata* is one of the most ancient human food source and has probably been used as a crop plant since Neolithic time (Summerfield et al., 1985). Cowpea was reported to have originated in Africa, Asia and South America (Johnson, 1970; NgN and Marechal, 1985; Summerfield et al., 1985). Cowpea is chiefly used as a grain crop for many feeders or as vegetable. Cowpea seed is valued as a nutritious supplement to cereals and an extender of nutrient.

The productivity of this crop is usually challenged by a wide range of pests and pathogens that attack the crop at all stages of its growth (Davis et al., 1991; Drees and Jackman, 1999). These include bacteria, viruses, fungi and insects. Many insects have been indicted in reducing the yields of cowpea such as cowpea curculio, Mexican bean beetles, aphids, bean leaf beetles, green stink bugs

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and lesser cornstalk borer (Davis et al., 1991; TJAI, 2004). Due to the great importance of cowpea and its usages, its productivity needs to be well managed so as to optimize its production. In order to do this, all the pests and the pathogens must be checkmated, thus, removing or reducing their limiting effects on the productivity of cowpea.

Generally, plants are reservoirs of secondary metabolites, the active principles (Belandrin et al., 1985; Fatoba et al., 2003; Jacobson, 1989) are the raw materials for medicine. Moreover, the natural products of some plants offer a great potential for the development of some new pesticides and fungicides. There is an immense documentation on the use of neem products as pesticides and fungicides (TJAI, 2004) . Antimicrobial potentials of some cryptogams have also been reported. In spite of this, there seems to be a rather limited documentation in Africa on how it should be used in practical crop protection with regards to methods of application, dosage and target pest. These potentials could be harnessed in boosting food production.

This study was therefore designed to investigate the effects of some aqueous cryptogamic extracts on the primary productivity of *Vigna unguiculata*.

MATERIALS AND METHODS

The effects of some plants` extracts were investigated on the primary productivity of cowpea. Seeds of *V. unguiculata* (L.) Walp (Ife brown variety) were purchased from the Kwara State Ministry of Agriculture, Ilorin, Nigeria. Four pteridophytic plants: *Dryopteris flix-max* (L.) Schott. (leaves); *Nephrolepis davalloides (*Sw) Kunze *(*leaves); *Phymatodes scolopenta (*whole plant) and *Platycerium angolense* Welw., Bak. (shoots*)* were collected from their natural populations in Adeyemi College of Education Campus, Ondo, Nigeria (07°C 05´N, 04°55´E) and *Barbula lambarenensis* C. Mull. (Moss) (whole plant) and twigs of *Azadrachta indica* A. Juss (Angiosperm) were also collected from the University of Ilorin permanent site, Ilorin, Kwara State (08°30´N 08´E) and Karate, an insecticide commonly used in Kwara state for cowpea production was bought in the Agro-chemical store in Ilorin, Kwara state.

The cowpea seeds were subjected to viability test, using floatation method. The viable seeds used for planting Twenty eight different ridges were made, two per treatment, with each of them accommodating twenty stands of *V*. *unguiculata* planted at 30cm apart with 1 m space in between ridges to exclude interference. A Complete Randomnized Block Design (CRBD) was used for the experiment. The experiment was replicated twice. Planting was done on August 13th, 2005 and weeding was carried out twice within the first five weeks of planting.

8 g of each of the air-dried plant materials was squeezed and cut into pieces into 1 L of distilled water (cold extracts) and boiled (hot extract). Each extract was decanted and used to irrigate the cowpea appropriately twice a week during flowering. Two different controls: Untreated and the other one was irrigated with karate.

The treated and untreated plants were monitored and the productivity variables were measured as follows: The numbers of pods per plant were counted for ten stands and the mean value calculated. The mean length of pod was calculated from the measurements of twenty matured pods with metre rule, that is, two matured pods from each stand. The number of seeds per pod was taken by counting the seeds in 2 pods each from the ten randomly selected stands per treatment and the mean values calculated. The filling potential of the cowpea was calculated with the formula:

$$\text{Filling potential} = \frac{\text{Length of pod (cm)}}{\text{Number of seeds in the pod}}$$

The mean number of seeds per plant was calculated as the product of the mean number of seeds per pod and mean number of pods per plant. Three stands per treatment were randomly selected and the weight of the seeds of each plant taken separately. The mean value was thereafter calculated.

The data generated from the study were compared with the controls using Paired Student’s t- test. These were further subjected to Analysis of Variance to show whether there were significant differences among the treatments.

OBSERVATIONS AND RESULTS

Table 1 shows the effects of the different treatments on the measured variables of the pods of *V. unguiculata*. Table 1 further shows that all the selected plants are assumed to have insecticidal and fungicidal properties except the cold extract of *B. lambarenesis* and the two extracts of *D. flix-max*. This is because of the exclusion of pests from the treated stands resulting into better yields. Their effects are better appreciated when compared with the 2 controls as the entire twelve treatments showed positive effects (Tables 1 and 2) . The highest number of pods per plant was recorded in the regime treated with hot extract of *A. indica* (9.3) followed by its cold extract (Table 1).

Table 1 further shows that the pteridophytic extracts - treated plants produced higher numbers of pods though less than those of Neem. The hot extracts of *B*. *lambarenensis*, *P*. s *colopenta* and the two extracts of *P*. *angolense* and *A. indica* and Karate, facilitate the production of higher number of pods than the untreated (Table 1) . Their values are significantly higher than untreated at 0.05% level of probability. Furthermore, the plant extracts were better off than the chemical (karate) (Tables 1 and 2)

The length of pods of the different regimes showed that the cryptogamic extracts (moss and pteridophytes) had longer pods than those of neem and the chemical (Table 1). Table 2 shows the effects of the different extracts on the production of seeds in *V*. u*nguiculata*. Plants irrigated with cryptogamic extracts had greater number of seeds per pod than neem -treated and the controls. However, there were no significant differences in their pods lengths. The number of seeds per pods in the treated cowpea was better and significantly higher than untreated (Table 2). This study showed that plant extracts are better than karate in boosting the primary productivity of cowpea. This statement is further supported by the number of seeds per plant (Table 2).

The highest number of seeds per plant was recorded in regime treated with cold extract of Neem (c 82) followed by cold extract of *P. angolense* (75), then the hot extract

Table 1. Effects of some plant extracts on the production of pods in *V. unguiculata.*

Extract	Mean number of pod/plant ± SD	Mean length of pod/plant ± SD of pod/plant ± SD
Moss		
B. lambareensis (hot)	^{b}5.3 ± 1.5*	^{a}15.7 ± 6.8
B. lambareensis (cold)	^{e}1.0 ± 0.0	^{c}4.8 ± 0.0
Pteridophytes		
D. flix-max (hot)	^{e}1.0 ± 0.0	^{b}8.0 ± 0.0
D. flix-max (cold)	^{e}1.0 ± 0.0	^{b}7.9 ± 0.0
N. davalloides (hot)	^{e}1.6 ± 0.8	^{a}12.7 ± 0.0
N. davalloides (cold)	^{d}2.6 ± 1.5	^{a}14.0 ± 0.0
P. scolopenta (hot)	^{c}4.0 ± 2.3*	^{a}16.5 ± 1.9
P. scolopenta (cold)	^{e}1.6 ± 1.1	^{a}14.9 ± 4.0
P. angolense (hot)	^{bc}5.0 ± 3.3*	^{a}15.2 ± 0.3
P. angolense (cold)	^{b}6.5 ± 3.8*	^{a}14.7 ± 1.0
Angiosperm		
A. indica (hot)	^{a}9.3 ± 4.7*	^{a}14.2 ± 2.5
A. indica (cold)	^{a}8.5 ± 4.7*	^{a}13.4 ± 4.2
Controls		
Karate (chemical)	^{c}3.8 ± 1.8*	^{a}13.3 ± 2.4
No treatment	^{d}2.8 ± 1.3	^{a}13.5 ± 2.4
N	20	20

Values with asterisks are significantly higher than no treatment. Values with same alphabet in the same column are the same statistically.

Table 2. Effects of some plant extracts on the production of seeds in *V. unguiculata.*

Extract	Mean number of seeds/pod ± SD	Filling potential	Mean number of seed/plant	Mean weight of seeds/plant ± SD
Moss				
B. lambareensis (hot)	^{c}7.6 ± 0.5*	2.0	^{c}40.28	^{a}16.5 ± 1.0*
B. lambareensis (cold)	0.0± 0.0	0	0	^{e}2.1 ± 1.3
Pteridophytes				
D. flix-max (hot)	0.0± 0.0	0	0	^{e}2.0 ± 1.1
D. flex-max (cold)	0.0± 0.0	0	0	^{e}1.6 ± 0.8
N. davalloides (hot)	^{c}6.0 ± 0.0*	2.11	^{e}9.6	^{bc}11.5 ± 0..0*
N. davalloides (cold)	b8.5 ± 0.7*	1.64	^{d}22	^{a}16.5 ± 1..0*
P. scolopenta (hot)	^{a}11.5 ± 0.7*	1.43	b46	^{b}13.3 ± 2..0*
P. scolopenta (cold)	^{a}9.5± 2.6*	1.56	^{e}15.2	^{ab}14.7 ± 1.0*
P. angolense (hot)	^{a}10.3 ± 1.5*	1.47	^{b}51.5	^{b}12.7 ± 0.9*
P. angolense (cold)	^{a}11.5 ± 3.6*	1.27	^{a}74.75	^{c}10.3 ± 1.5*
Angiosperm				
A. indica (hot)	^{b}7.8± 4.3*	1.82	^{a}72.54	^{a}17.1 ± 2.1*
A. indica (cold)	^{a}9.6± 3.2*	1.39	^{a}81.6	^{a}15.2 ± 1.7*

Table 2. Cont'd.

Controls				
Karate (chemical)	b6.3 ± 3.3*	2.11	d23.94	ab14.3 ± 1.1*
No treatment	d4.9 ± 0.7	1.82	e13.92	d.5 ± 0.6
N	20	20	20	20

Values with asterisks are significantly higher than no treatment. Values with same alphabet in the same column are statistically same.

of neem (73), hot extract of *P*. *angolense* (52), hot extract of *P. scolopenta* (46) and hot extract of *B. lambarenensis* (46), all these were significantly higher than the cowpea treated with karate and the untreated (Table 2). This confirmed the relevance of these plants extracts in boosting the production of cowpea. The weight of seeds produced per plant treated was significantly higher than the untreated at 0.05% even most of those treated with plant extracts were better than those treated with karate (Table 2).

DISCUSSION

The uses of bryophytes and pteridophytes in Medicare have since been identified, while their medicinal potentials have been documented by Fatoba et al. (2003) and Wilson and Loomis (1987). Natural products from some plants offer a great potential for the development of some new pesticides and fungicides .This is based on the noticeable resistance of some plants to fungi or some killing or repelling insects. The use of *A. indica*, neem has been on increase since the discovery of its fungicidal and insecticidal potential. Busungo and Mushobozy (1999) reported that the leaf powder of neem mixed with the beans at 5% concentration was effective against Mexican bean weevils. The water extracts of fresh leaves of neem gave a good control of the stem borers in maize, Chlopertellus, when applied into the plant whorls in Mozambique (Segeren, 1993). Generally, neem has been found to exhibit antifecdant, insect repellent and insect sterilization properties. Furthermore, extracts of neem as low as 1 ppm will totally repel certain insects (Jacobson, 1989; Segeren, 1993). This extract interferes with ecdysome, the insect molting hormone and prevents larval and pupae from completing the molting process.

Since the extracts of some of the selected cryptogams specifically *B. lambarenensis*, *P. scolopenta* and *P. angolense* gave comparative effects in respect of the number of pods per plant, number of seeds per pod and subsequently per plant, length of pods and weight of seed per plants with *A. indica* extracts. One could infer that these plants are presumably fungicidal and insect-cidal like neem. This is further supported by their better performances in the primary productivity parameters than the generally acclaimed chemical, karate. Therefore, extracts of *B*. *lambarenensis*, *P*. *scolopenta* and *P*. *angolense* can be recommended for use in boosting the production of cowpea. These plants` extracts are deemed to be better than the chemical as they are natural, more effective, non-toxic, environmental friendly free and non polluting unlike the chemical karate.

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