Pak. J. Sci. Ind. Res. 2004 ***47****(3) 227-230*

ECO-PHYSIOLOGICAL AND CONSERVATION STUDIES ON *VERNONIA AMYGALINA IN* EKITI STATE, NIGERIA

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(Received November 15, 2002; accepted May 17, 2004)

The study examined some aspects of the ecology, physiology, utilization and conservation of *Vernonia amygalina*. The seeds were found to be positively photoplastic with a pre-exposure time of 20 min to illumination required for its optimum germination. The seeds thrive well in slightly acidic soils with low organic matter and high water holding capacity. These characteristics suggest that the species could easily be cultivated in the area studied. The ethnobotanical uses of the species were valued against some socio-economic features of respondents in the study area. These include household size, farm size holdings, educational and economic status of the communities. Results obtained revealed that these features were not regarded as pre-requisites to the consciousness of the respondents to the utilization of this plant. At present, households' homesteads and farms constituted the major primary and secondary sources of the species to the respondents, respectively. The relative abundance test carried out at these sources, however, indicated that the species were of rare occurrence in the locality, hence it is presently endangered in the study area. The need for its conservation was considered as inevitable. Strategies toward the attainment of this goal were proposed.

Key words*:* Eco-physiology, Conservation, *Vernonia amygalina*.

Introduction

Vernonia amygalina belongs to the genius *Vernonia* Schreb and the family Vernonieae (Ayodele 1994a). Species of this large and heterogeneous genus are present in a wide array of ecological habitats (Keeley and Turner 1990; Hidayat 1999). The species, *Vernonia amygalina*, is a popular shrub in Ekiti State of Nigeria, where it is presently being used for a variety of purposes. Despite the economic, medicinal and nutritional values, its cultivation is still unpopular in the study area. The recent alteration in the ecological habitats due to deforestation, burning, farming and construction activities, has also resulted in significant reduction in the population of this species.

The above problems are also complemented by dearth of literatures on the eco-physiology of the species in the study area. Apart from reports on its medicinal value (Ayensu 1978; Abimbola 1986; lgboechi and Anuforo 1986; Gill 1992) and reproductive (Ayodele 1994a & b, 1997, 1999 a & b, 2000) aspects, literature on its eco-physiology is grossly lacking. Consequently, this work is aimed at examining the possible germination requirements of this species and proposes sustainable strategies towards its conservation in the study area.

Materials and Methods

Ripe capitula of *Vernonia amygalina* were harvested. The fruits were separated from each capitulum by threshing. They were then winnowed thoroughly to separate the seeds from the chaffs of involucre bracts and detached pappi.

Germination experiments. Two hundred seeds of *V. amygalina* were surface sterilized with mercuric chloride solution for 5 sec. They were then rinsed in several changes of sterile distilled water. Nutrient solution containing $Ca(NO_3)_2$, KH_2PO_4, $MgSO_4$ and $FeCl_3$ was sterilized by autoclaving at 1.2 kg/cm^2 pressure for 15 min and was dispensed into sterile petridishes lined with sterile cotton wool.

Sterilized seeds were placed in the petridishes in quadruplicate, 35 seeds per dish, in order to test the effect of light on the germination, sowing was done in a dark room. Two of the four petridishes were wrapped with aluminum foil, while the remaining two were not wrapped. Similarly, petridishes in which sterile deionised water was used in place of nutrient solution were kept as control. All the petridishes were placed in a growth chamber under continuous illumination (800 lux). The temperature of the chamber varied between 25°C - 28°C.

Seeds of *V. amygalina* were allowed to imbibe sterile deionised water in the dark room for 24 h, after which they were divided into 4 portions. Each portion was then exposed to white light for 10, 15, 20 and 25 min. Seed (35) in each light exposure were planted in petridishes already lined with sterile cotton wool, in quadruplicate, with a pair wrapped with aluminum foil and the second pair left unwrapped. The plates were set up under light in growth chamber.

All the plates were opened for observation after 5 days of growth. Another set of seeds (420 seeds) similarly, pre-exposed to light was sown into nursery pots containing soils from two different sites; a fallow soil with a forest community and a degraded soil. Fallow soil had pH 6.98, organic matter 7.6% and moisture holding capacity 67.8%. The degraded soil had relatively lower pH 6.64, organic matter 5.4% and moisture holding capacity 60.1% These were set up under natural conditions in the nursery bed. The temperature of the nursery bed ranged from 28˚C - 30˚C, while light intensity was 600 lux. The rate of germination, also known as Coefficient of Velocity (Chaco and Singh 1966) in each soil sample was determined after 10 days, using the following formula:

$$C.O.V = \frac{A_1 + A_2 + A_3 + \ldots\ldots\ldots\ldots A_{10}}{A_1T_1 + A_2T_2 + A_3T_3 + \ldots. A_{10}T_{10}} \times 100$$

Where A is the number of seedlings that emerged on a particular day and T is the number of days.

Conservation tests. Five rural communities were selected from each of the three existing geopolitical zones of the state. The zones were Ekiti North, Ekiti South and Ekiti central. In each village, twenty households were randomly selected for a five year. The household heads were identified and interviewed with the aid of semi-structured matrix. The interviews were conducted with fairly open framework, hence they were conversational, focussed and two-way. The ethnobotanical utilization, cultivation and conservation of *V. amygalina* by the respondents were examined against their socio-economic features, which include household size, farm size, educational and economic status of the locality.

The relative abundance of the species at the various sources of collection utilized by the respondents was determined according to the method of Kayode (1999) as follows; less than 5 individuals as rare (R), 5 to 10 as occasional (O), 11 to 30 as frequent (F), 31 to 100 as abundant (A) and over 100 individuals as very abundant. (VA).

Results and Discussion

The seed germination of *V. amygalina* in different cultural treatments is shown in Table 1. Over 68% of the seeds germinated in the nutrient medium placed in the light whereas, no germination was recorded in the nutrient medium placed in the dark. This is a suggestive scenario that light might be a necessary pre-requisite segment in the breaking of dormancy in the seed of *V. amygalina*. Previous studies on some tropical seeds, such as Longman (1969) and Kayode (1999 and 2000) had revealed that their dormancy was easily broken by light.

Table 1
Percentage seed germination of *Vernonia amygalina* in different cultural treatments

Treatment	No. of replicate culture	No. of seeds per plate	Percentage germination
Nutrient medium (in dark)	2	35	0.0
Nutrient medium (in light)	2	35	68.2*
Control (distilled water in dark)	2	35	0.0
Control (distilled water in light)	2	35	27.5
Seeds pre-exposed for 10 min	2	35	46.2*
Seeds pre-exposed for 15 min	2	35	59.8*
Seeds pre-exposed for 20 min	2	35	82.3*
Seeds pre-exposed for 25 min	2	35	69.4*
Growth in fallow soil	2	35	68.2
Growth in degraded soil	2	35	65.1

*Figures significantly different (using T-test p> 0.005)

Growth was recorded in the control petridishes placed in the light, but the proportion of seeds germinated fell below that of the nutrient solution. This observation tends to support previous assertion by Spurr (1959) as well as Kayode and Akande (1998) that the nutrient elements present in the nutrient solution probably influenced enzymatic process during seed germination.

The pre-exposure of the seed to light also affected the proportion of seed germination in this plant. While seeds pre-exposed to light for 20 min gave the highest germination percentage, the least was observed in seeds pre-exposed for 10 min (Table 1). The photoperiodic stimulation has been found to act as trigger that enhances germination in some tropical seeds (Kayode and Akande 1998).

The test of the seed germination in fallow and degraded soil revealed that seeds of *V. amygalina* possess considerable potentials to germinate in a wide range of soils. Though the organic matter contents of the soils were low, their pH values were of little deviation from the pH value of 7.0 The pH of a soil is an index of availability of nutrients. At pH 7.0 all nutrients of minerals are sufficiently soluble to satisfy plant needs (Kayode and Akande 1998). The moisture holding capacity in both soil samples were above 60%. All these might be responsible for the high values of the coefficient of velocity observed, 74.2% in fallow and 65.8% in degraded soil.

Results from the conservation tests are presented in Tables 2-5. Household used in this study was defined by Mehl (1990) to mean the actual consumption and production unit, which differ, from the family unit. Thus, non family members living under the same roof were considered as a part of the household, while family members living elsewhere, even temporarily,

Table 2
Ethanobotanical utilization of *Vernonia amygalina* among household categories in rural communities of Ekiti State

		Proportion (%) of respondents utilizing *Vornonia amygalina*			
Feature	Description	North	South	Central	Average
Household	Small	85	95	92	91
category	Large	93	97	96	95
Educational	Literates	69	83	78	77
status	Illiterates	96	95	94	95
Land size	Landless	97	95	94	95
holdings	Small	93	97	88	93
	Medium	92	98	89	93
	Large	94	93	100	96
Economic	Low	94	96	95	94
class	Medium	84	100	96	93
	High	98	77	100	92

were not. Thus, households were classified into two categories; households of less than ten individuals were considered as being small and those consisting of more than ten individuals as being large. The use of *V. amygalina* cut across these two household categories (Table 2) as over 90% of each household category confirmed their utilization of the plant. These respondents consist of literates and illiterates rural dwellers. Table 2 revealed that literacy, like household size, is not a pre-requisite to the consciousness of the respondents to the ethnobotanical use of *V. amygalina.* Most respondents in each of the literacy status utilize the extract from this plant.

Farmland ownership and the size of the land holdings by the respondents were also considered. These features were used to classify the respondents to four groups; the landless, small-farm medium-farm and large-farm households. The landless households were those that neither owned nor farmed land. The small farm households were those with small-scale holdings either inadequate or just enough to meet their household consumption needs. The medium-farm households had enough land to meet their minimal needs and occasionally possess small surplus, while the large-farm households had significantly more than enough land to meet their needs (Mehl 1990). Similarly, ownership of farmland and the size of land holdings were not considered as pre-requisites to the utilization of *V. amygalina* by the respondents. Over 90% of the respondents in each land size categories utilize this species (Table 2).

The index of wealth varied from one village to another yet classification of the respondents could still be made. They were classified into three distinct economic classes (Table 2).

Table 3
Sources of *Vernonia amygalina* leaves utilized by respondents in rural communities of Ekiti State

Sources	Proportion (%) of respondents utilizing sources*			
	FR	CA	FM	HS
Primary	-	1	2	90
Secondary	-	9	82	2

*FR; Forest, CA; Common area, FM; Houshehold farm, HS; Household homestead.

Table 4
Relative abundance of *Vernonia amygaline* at sources utilized by respondents in rural communities of Ekiti State

	Proportion (%) of respondents utilizing *Vernonia amygalina**			
Sources	North	South	Central	Average
FR	R	R	R	R
CA	R	R	R	R
FM	R	R	R	R
HS	R	R	R	R

* R; Rare.

Results from this test revealed that the utilization of *V. amygalina* cut across the three economic strata. Thus, the economic status of a respondent does not constitute a pre-requisite to the utilization of the species. The sources of collection and the relative abundance of the plant at each source were evaluated. Household homesteads and farms constituted the major primary and secondary sources, respectively (Table 3). The relative abundance test (Table 4) revealed that *V. amygalina* was rare on the abundance scale at the various sources hence this was endangered species in the study area.

The wide use of *V. amygalina* in the area could be attributed to its nutritional and medicinal values. The leaves of this species are used in soup preparation, for treatment of stomachache (Gill 1992), diabetes and pneumonia (Abimbola- 1986). The roots are used as antipyretic and laxative. The main constituents of the extracts include vernodalin, vernomygdin and saponin (Gill 1992). Field observation revealed that the use of this plant is not likely to be discarded by the respondents in the nearest future. Thus, the conservation of this species to meet the needs of the present and future generations is now urgently required. Presently, less than 1% of the respondents have been involved in cultivating this plant. Less than 20 % of the respondents are willing to cultivate it (Table 5). Dependence may still be based on *V. amygalina* growing in the wild.

There is an urgent need for domestication of this species in the study area. Strategies that could achieve this include pub-

Table 5
Conservation ethics among respondents in rural communities of Ekiti State

Conservation ethics	Proportion (%) of respondents			
	North	South	Central	Average
Respondents involved in planting *Vernonia amygalina* Before the study	-	2	-	0.7
Respondents preserving *Vernonia amygalina* on their farm/household area	66	78	86	76.7
Respondents that express willingness to cultivate *Vernonia amygalina* after the study	14	26	18	19.3

lic awareness enhancement, protection of *V. amygalina* growing naturally as an *in-situ* method, cultivation of the species as an *ex-situ* device as the result of present studies had revealed that the plant species has high potentials to thrive in the study area.

Acknowledgement

The author wishes to acknowledge the assistance of Mrs. G.M. Kayode during the field study.

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