

# Effect of Neem (*Azadirachta indica* A. Juss) on Seed Germination of *Senna sophera* L. Roxb and *Crotalaria ochroleuca* G. Don.

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## ABSTRACT

*Azadirachta indica* A. Juss leaf litter and root extract were evaluated for its allelopathic activity against *Senna sophera* L. Roxb and *Crotalaria ochroleuca* G. Don seeds in the Laboratory and Screen House of the Department of Crop Protection and Environmental Biology, University of Ibadan Ibadan, Nigeria. *C. ochroleuca* germination was not significantly ( $P < 0.05$ ) affected by neem leaf litter and root extract. Extract of leaf litter and root significantly lowered *S. sophera* germination at early days of planting. The results from the screen house experiment showed that there were no conspicuous negative effect on the germination and seedling growth of both seeds when compared with the control.

**Keywords:** allelopathy, root extract, leaf litter extract, leguminous crop

## INTRODUCTION

Neem (*Azadirachta indica* A. Juss) belongs to the family Meliaceae. *Azadirachta*, known as Dongoyaro<sup>TM</sup> in Nigeria, grows wild in Asia (Ketkar 1976). Neem tree is hardy and quite easy to grow. It requires virtually no care by the farmer. Active components isolated from neem include triterpenoids and azadirachtin (NRC 1992). It is far more than a tough tree than grows vigorously in different sites. Among its many benefits, is the use in control of farm and household pests. Neem tree has been shown to inhibit germination of specific crop such as carrot, rice sesame and some weeds *Echinochloa crusgalli* (Xuan *et al.* 2004). Olaifa (1986) reported that neem can be used as a fertilizer. Neem tree has been planted near Mecca to provide shelter for pilgrims (Ganguli 2002). Also extract from neem tree offer a safe alternative to conventional insecticides for managing insect pests of cowpea. Neem leaf has been shown to possess up to 15% protein content, making it compatible with leguminous leaves. In addition to nematode repellent effects (Maydell 1986). Reports have shown that it has been used on degraded agricultural lands for soil amelioration like improvement of soil pH, shelterbelt establishment in the control of desert encroachment (NRC 1992). Observations revealed that where neem tree grows, the growth of other plant growing under the tree is hampered (NRC 1992) which suggests an allelopathic trait of the tree. It has been reported that neem seed and leaf powder inhibit growth of *Striga ermonthica* (Paul *et al.* 2004). Also, it inhibits the growth of *Monochoria vaginalis*, *Aeschnomene indica* and alfalfa (*Medicago sativa* L.) (Xuan *et al.* 2004). It reduces the germination of wheat and its weeds (Shahid and Horoon 2006).

According to Rice (1979), allelopathy refers to detrimental effect of higher plant of one species on germination, growth or development of another. Allelopathic inhibition is a complex phenomenon involving a variety of inter-relationship among plants (Kohli 1998). Different classes of chemicals like phenolic compounds, flavonoids, terpenoids, alkaloids, steroids, carbohydrates and amino acids with mixtures of different compounds sometimes have greater

allelopathic effect than individual compounds alone (Adedire and Akinneye 2004; Ilori *et al.* 2007). Allelopathic chemicals can also persist in soil, affect both neighbouring plants as well as those planted in succession (Tanveer *et al.* 2010). The objective of this work, therefore, is to determine the allelopathic effect of neem on germination and seedling growth of *Senna sophera* and *Crotalaria ochroleuca*. These two seeds are legumes which play an important role in the maintenance and improvement of soil fertility in tropical areas. *C. ochroleuca* is a widespread legume in the tropical regions and includes about 550 species in Africa and Madagascar (Polhill 1982) most of the species are either annuals, semi-perennial, Perennials, herbs or shrub (Martin and Leonard 1970). It is used in soil fertility management. *C. ochroleuca* are active in fixing nitrogen through the nodules they form on their roots in association with *Rhizobia*. *S. sophera* belong to pea family, they are herbs, shrubs or tree. Leaves are alternate; flowers are perfect and complete while the seeds are often with hard seed coats (testa) and capable of long dormancy in soil. Germination often requires some sort of scarification either physical "nicking" or chemical erosion.

## MATERIALS AND METHODS

### Laboratory experiment

laboratory experiment was carried out in the Ecology Research Laboratory of the Department of Crop Protection and Environmental Biology University of Ibadan, Ibadan [7° 24 N, 34 E, altitude 234 m above sea level] Southwestern Nigeria. *S. sophera* seeds were obtained from the Department of Crop Protection and Environmental Biology, University of Ibadan, Ibadan. *C. ochroleuca* was obtained from International Institute of Tropical Agriculture (IITA), Ibadan.

Neem leaf litter and root extract were collected from the premises of the University of Ibadan and air dried. The dried leaves and root were milled and weighed. The milled plant materials were soaked in water separately for 96 hrs (100 g in 1000 ml of water) to remove water soluble allelochemicals following (Bhowmik and Doll 1982; Reigosa *et al.* 1999). The extracts from

sieved mixture were then used. Five ml of leaf and root extract were introduced to twenty seeds each of *S. sophera* and *C. ochroleuca* on Petri dishes lined with Whatman No 1 filter paper. The Petri dishes were arranged on laboratory tables in a completely randomized block design. Each treatment was replicated four times. Each of the Petri dishes was irrigated with the corresponding concentration. Irrigation was repeated every other day. Data on germination was taking 7 days after planting. Germination was accessed by emergence of the radicle and plumule.

### Screen house experiment

The screen house experiment was carried out in the screen house, at the roof top of the Department of Crop Protection and Environmental Biology University of Ibadan, Ibadan, Nigeria. The seeds used were the same as those used for the laboratory experiment. 10 ml of both extract used in the laboratory, 100 ml of the extract were used in the screen house to cater for the bigger soil weight of 5 kg. Natural soil + water (control), natural soil + extract (treatment) were arranged in completely randomized design. Pots were watered twice every week with neem extract. Record of germination was taken for each seed after one week. Plant height and number of leaves were taken weekly.

### Data analysis

Data collected were statistically analyzed with the aid of follow SAS software (SAS 2002) means were separated using least significant difference (LSD) at the 5% probability level.

## RESULTS

The allelopathic effect of *A. indica* on the germination of *S. sophera* and *C. ochroleuca* is presented in **Table 1**. Germination of *C. ochroleuca* seeds was not significantly ( $P > 0.05$ ) affected by neem extract in the laboratory. However, neem extract affected the germination of *S. sophera* seeds at 6 days after planting.

Results from the screen house experiment showed that there was no significant difference in the germination of *C. ochroleuca* and *S. sophera* seeds watered with neem extract when compared with control (**Table 2**). Also from (**Table 3**) no conspicuous negative effect was recorded with growth parameters taken when compared with the control.

## DISCUSSION

The neem (*Azadirachta indica*, A. Juss) tree has been shown to strongly inhibit germination and growth of several specific crops: alfalfa (*Medicago sativa* L.), bean (*Vigna angularis*), carrot (*Daucus carota* L.), radish (*Raphanus sativus* L.), rice (*Oryza sativa* L.), and sesame (*Sesamum indicum* L.) and weeds: *Echinochloa crus-galli*, *Monochoria vaginalis*, and *Aeschynomene indica* L. (Xuan 2004). It is generally accepted that the compound responsible for the majority of biological effects observed in organisms exposed to neem is azadirachtin (Mordue and Blackwell 1993; Verkerk and Wright 1993). Biological activities of neem are reported with the crude extracts and their different fractions from leaf, bark root, seed and oil. However, crude extracts of different part of neem have been used as traditional medicine for the treatment of various diseases (Isman *et al.* 1990).

The results shows that application of neem extract (leaf litter and root extract) to *S. sophera* seeds grown on filter paper inhibited *S. sophera* germination. Therefore, the composition of the extract contains inhibiting agents that suppressed the germination of seeds and the growth of the plant. This is in agreement with report of Fujii *et al.* (1992) who confirmed that plant allelopathy has the ability to reduce or cause depression in the germination and growth of such plant. Germination of *C. ochroleuca* showed that the concentration of neem extract was low to cause inhibition. This is in agreement with Putma (1988) who stated that if allelopathic chemicals are present in sufficiently low concentrations, they may stimulate instead of inhibit growth. Xuan (2004) suggest that the dose and greater number of allelochemicals result in the stronger allelopathic activity of neem's bark than the leaves (**Table 1**). Under screen house condition however, neem extracts did not affect germination of both seeds. Loveth (1989) reported that biological activities are characteristically stimulated at low concentration of allelochemicals, and inhibition as concentration increases. The concentration used throughout was constant and maybe low to inhibit germination. Results of the experiment show that *A. indica* exhibited allelopathy against *S. sophera* seed in the laboratory. The effect on *C. ochroleuca* was not definite. This fact confirms the work of Olabode *et al.* (2010), who reported that *Tithonia diversifolia* does not have a definite effect on okro. Xuan *et al.* (2003) stated that amendments of plant materials with strong allelopathic properties bring important agronomic impact including soil improvement, crop yield increment and weed reduction.

**Table 1** Effect of neem extract on germination of *S. sophera* and *C. ochroleuca* grown on filter paper.

Treatment	Germination period			
	4 days after planting	5 days after planting	6 days after planting	7 days after planting
<i>Senna</i> + water	15.5 ± 0.6 a	17.7 ± 0.2 a	17.7 ± 0.2 a	18.0 ± 0.4 a
<i>Senna</i> + leaf litter	7.7 ± 2.7 c	10.7 ± 3.8 b	11.2 ± 3.3 b	11.7 ± 3.9 a
<i>Senna</i> + root extract	12.7 ± 2.4 b	12.2 ± 2.2 ab	14.0 ± 3.3 b	14.5 ± 1.5 a
L.S.D	2.4	2.6	4.4	NS
<i>Crotalaria</i> + water	10.0 ± 0.0 a	1.7 ± 0.2 a	3.0 ± 0.0 a	3.2 ± 0.4 a
<i>Crotalaria</i> + leaf litter	1.0 ± 0.0 a	1.0 ± 0.0 a	1.0 ± 0.0 b	1.7 ± 2.2 a
<i>Crotalaria</i> + root extract	0.7 ± 0.2 b	1.0 ± 0.0 a	1.5 ± 0.5 b	1.7 ± 0.2 a
L.S.D	NS	NS	NS	NS

Means followed by the same letter of the alphabet within a column are not significantly different ( $P \leq 0.05$ )

**Table 2** Effect of neem extract on the germination of *S. sophera* and *C. ochroleuca* grown on soil.

Treatment	Germination period			
	4 days after planting	5 days after planting	6 days after planting	7 days after planting
<i>Senna</i> + water	11.5 ± 2.3 a	8.6 ± 0.9 a	11.6 ± 1.2 a	13.3 ± 1.7 a
<i>Senna</i> + leaf litter	10.3 ± 0.5 a	13.5 ± 0.8 a	13.6 ± 2.3 a	13.7 ± 1.9 a
<i>Senna</i> + root extract	8.7 ± 1.3 a	11.5 ± 0.2 a	11.5 ± 0.2 a	13.2 ± 1.4 a
L.S.D	NS	NS	NS	NS
<i>Crotalaria</i> + water	1.0 ± 0.0 a	1.0 ± 0.5 a	1.9 ± 0.4 a	2.7 ± 0.6 a
<i>Crotalaria</i> + leaf litter	0.5 ± 0.2 a	2.0 ± 0.0 a	1.7 ± 0.4 a	2.0 ± 0.0 a
<i>Crotalaria</i> + root extract	1.0 ± 0.5 a	2.0 ± 0.0 a	1.7 ± 0.2 a	2.7 ± 0.6 a
L.S.D	NS	NS	NS	NS

Means followed by the similar letter of the alphabets within a column are not significantly different ( $P \leq 0.05$ )

**Table 3** Effect of neem extract on the germination of *S. sophera* and *C. ochroleuca* grown on soil.

Treatment	Plant height			
	4 weeks after planting	5 weeks after planting	6 weeks after planting	7 weeks after planting
<i>Senna</i> + water	7.8 ± 0.5 a	8.6 ± 0.9 a	11.6 ± 1.2 a	13.3 ± 1.7 a
<i>Senna</i> + leaf litter	9.1 ± 0.6 a	10.3 ± 0.5 a	12.5 ± 0.6 a	14.8 ± 0.9 a
<i>Senna</i> + root extract	7.1 ± 0.8 a	8.7 ± 1.3 a	11.5 ± 0.2 a	13.2 ± 1.4 a
L.S.D	NS	NS	NS	NS
<i>Crotalaria</i> + water	18.2 ± 0.6 a	32.2 ± 0.6 a	41.7 ± 0.7 a	47.5 ± 0.2 a
<i>Crotalaria</i> + leaf litter	10.6 ± 3.0 a	14.7 ± 4.4 a	23.1 ± 7.0 b	34.0 ± 9.4 a
<i>Crotalaria</i> + root extract	14.2 ± 1.8 a	21.0 ± 2.5 ab	27.5 ± 5.5 ab	39.5 ± 3.3 b
L.S.D	NS	NS	NS	NS

Means followed by the similar letter of the alphabets within a column are not significantly different ( $P \leq 0.05$ )

The application of allelopathic plants does not provide the same level of weed control as synthetic herbicides, but the remaining weeds left after application of plant materials can be controlled successfully by a lower dose of herbicides. This leads to a reduction of applied herbicides. Hence, the soil environment may be kept from detrimental effects caused by synthetic agrochemicals.

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