

Allelopathic effect of *Azadirachta indica* L. on the germination of *Abelmoschus esculentus* L.

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ABSTRACT

The chemical compounds have been reported to be exuded by plants and their inhibitory effects of other plants. The research work was carried out to study the allelopathic effect of root, bark and leaf extracts of *Azadirachta indica* L. on the seed germination of *Abelmoschus esculentus* L. Germination studies were conducted in laboratory, the bhendi seeds treated with the root, bark and leaf extracts of Neem. On the seventh day the morphological parameters, photosynthetic pigment and biochemical contents were analysed. The result showed that the rate of germination of bhendi decreased in all *Azadirachta indica* L. extracts. The reduction in biochemical contents of bhendi was also noted. The highest rate of germination was observed in control (distilled water) treatment and the highest rate of inhibition was observed in root extract followed by bark and leaf extracts.

Keywords: Allelopathy; *Azadirachta indica* L.; *Abelmoschus esculentus* L.; Germination and Biochemical

1. INTRODUCTION

Allelopathy is a biological phenomenon by which an organism produces one or more biochemicals that influence the growth, survival and reproduction of other organisms. These biochemicals are known as allelochemicals and can be beneficial (positive allelopathy) or detrimental (negative allelopathy) effects on the target organisms.

Allelopathy can also be defined as an interference mechanism, in which live or dead plant materials release chemical substances, which inhibit or stimulate the associated plant growth (Harper, 1977; May and Ash, 1990). Allelopathy, may also play an eminent role in the intraspecific and interspecific competition and may determine the type of interspecific association.

The allelochemicals are present in virtually all plant parts viz., roots, stem, leaves and fruits (Rice, 1984). Allelochemicals are produced by plants as end products, byproducts and metabolites. Most of the allelochemicals are secondary metabolites and produced as byproducts of primary metabolic pathway. The allelochemicals can be released into the environment by process like weathering, volatilization, root exudation, leaching and decomposition of plant residues (Putnam and Weston, 1986). Under specific conditions, these chemicals are released into the environment in ample quantities and long persistence to affect a neighboring or succession plant (Chou, 1990).

Interference may occur when one plant species fails to germinate, grows more slowly, shows symptoms of damage, or does not survive in the presence of another plant species. Such interference can result from competition and allelopathy (Nelson, 1996). Allelopathy is an important mechanism of plant interference mediated by the addition of plant - produced phytotoxins to the plant environment and competitive strategy of plants (Oussama, 2003). A large number of weeds are responsible for producing allelopathic compounds which when come in contact with the crop plants inhibit their growth. Additionally, some weeds interfere with crop plants through allelochemicals which inhibit crop growth and development (Qasem and Foy, 2011; Bhowmik and Indrajit, 2003; Romero *et al.*, 2005; Batish *et al.*, 2007).

Thus the present investigation was carried out to study the allelopathic effect of *Azadirachta indica* L. plant extracts on the germination, growth and Biochemical properties of *Abelmoschus esculentus* (L) Moench.



Photo 1. *Azadirachta indica* L.



Photo 2. *Abelmoschus esculentus* L.

2. MATERIALS AND METHODS

2. 1. Materials

100 gm of *Azadirachta indica* L. leaf, bark and root samples were collected in the morning at Botanical garden of the A.V.C College (Autonomous), Mannampandal and it placed in 250 ml of distilled water for 24 hours. The extract was filtered through the fine double layered muslin cloth and the filterates were used for germination studies to find their alleopathic effect. The seeds of *Abelmoschus esculentus* were obtained from Pulses seed Research Station, Vamban, Pudukkotai district. Healthy and uniform seeds were selected for the study.

2. 2. Method

The alleopathic effect was studied by following the method of Deena singh *et al.*, (1999). 15 seeds were kept in sterile petridish containing sterilized soil. 10ml of *Azadirachta indica* L. extract (root, bark, & leaf) was added In each petridish. Seeds treated with distilled water were served as control. Five replicates were taken for each treatment seeds were grown upto seven days.

2. 2. 1. Treatment details

- | | | |
|----------------|---|--|
| T ₁ | - | Control (distilled water) |
| T ₂ | - | Leaf extract of <i>Azadirachta indica</i> L. |
| T ₃ | - | Bark extract of <i>Azadirachta indica</i> L. |
| T ₄ | - | Root extract of <i>Azadirachta indica</i> L. |

2. 2. 2. Germination percentage

The number of germinated seeds was counted on the tenth day and germination percentage was calculated by using the following formula.

$$\text{Germination percentage} = \frac{\text{Number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

2. 2. 3. Root length and Shoot length

Ten seedlings were randomly selected for recording the root length and shoot length of *Abelmoschous esculentus* L. plant. They were measured by using centimeter scale and recorded.

2. 2. 4. Fresh weight and dry weight of seedlings

Ten seedlings samples were randomly selected from each treatments. They were thoroughly washed with tap water and then by distilled water. Their fresh weight were recorded by using electrical single pan balance. They were separated into seedling crop and they were kept in hot air oven at 80 °C for 24 hrs. After keeping them in a dessicator for some time. Their dry weight was taken by using an electrical single pan balance.

2. 2. 5. Biochemical Analysis

Ten days old *Abelmoschus esculentus* L. seedlings were separated into root and shoot. They were used for biochemical analyses such as Chlorophyll (Arnon, 1949), Carotenoids (Kirk and Allen, 1965), Starch content (Mc Cready *et al.*, 1950), Estimation of protein (Lowry *et al.*, 1951), Estimation of amino acids (Moore and Stein, 1948) and Estimation of sugars (Nelson, 1944).

The experiments were carried out in the PG laboratory of Botany Department, A.V.C College (Autonomous). All the experiments were carried out in replicates & the results were expressed as the parenthesis of the five.

3. RESULTS AND DISCUSSION

Germination, the critical phase in the life cycle of a crop plant, is subjected to numerous environmental factors. It is a consequent enhancement in the metabolic activity of plants (Copper, 1979). The germination in *Abelmoschus esculentus* L. seeds was inhibited in all treatments when compared to control. The highest inhibition of germination was recorded in the treatment with root extracts in *Abelmoschus esculentus* L. Similar inhibition were noticed herbaceous plant seeds (Deka *et al.*, 2011), wheat and corn (Roth *et al* 2000; Khanh *et al.*, 2007).

The root length and shoot length in *Abelmoschus esculentus* L. were inhibited in all treatments when compared with control. The highest inhibition of root length and shoot length was recorded in the treatment with root extracts of *Abelmoschus esculentus* L. Similar inhibition were also noticed in maize (Ahmed, 1982) and paddy (Mary Christi, 2011) with the weed extracts. Reddy and Singh (1984) observed that the allelochemicals were move sensitive to root growth and shoot growth.

The fresh weight and dry weight of *Abelmoschus esculentus* L. were inhibited in all treatments when compared with control. The highest inhibition of fresh weight and dry weight in the treatment with *Azadirachta indica* L. root extracts in *Abelmoschus esculentus* L. Similar observation were also noticed in the paddy (Mary Christi *et al.*, 2011), Herbaceous plants (Deka *et al.*, 2011) and wheat (Bhasker *et al.*, 2006) with the weed extracts and *Cleome gynandra* L. extracts.

Photosynthetic pigment (chlorophyll a, chlorophyll b and total chlorophyll) in *Abelmoschus esculentus* L. were inhibited in all treatments when compared to control. The highest inhibitory effect were recorded in the treatment with root extracts of *Azadirachta indica* L. The inhibitory effect in photosynthetic pigments coincided with corresponding degrees in carotenoides. Similar observation were also recorded in paddy (Mary Christi *et al.*, 2011) with weed extracts.

The proteins content of *Abelmoschus esculentus* L. was inhibited in all treatments when compared to control. The highest inhibitory effect of protein was seen in the treatment with root extracts in *Abelmoschus esculentus* L. The inhibition in protein was also coincided with corresponding degrees in the content of starch, Amino acid and sugars. Similar observation was noticed in the crop plants (Lowry *et al.*, 1951; Nelson, 1944 and Snell and Snell, 1954).

The chemical compounds have been reported to be exuded by plants and their inhibitory effects have also been observed in many cases. There are evidences showing liberation of chemicals by volatilization from aerial parts, exudation from roots, leaching from plants and their residues by rain or by decomposition of residues. The quantity of such allelochemicals released into the environment by a species is directly responsible for the survival as well as dominance of that species and reduction or even elimination of the plant species growing in vicinity.

Table 1. Allelopathic effect of *Azadirachta indica* L. plant extracts on the germination and growth parameters of *Abelmoschus esculentus* L.

Treatments	Germination percentage (%)	Inhibition percentage (%)	Shoot length (cm/plant)	Root length (cm/plant)	Fresh weight of seedlings (mg/plant)	Dry Weight of seedlings (mg/plant)
Control (Distilled water (T ₁))	100	0	17.3	10.7	0.590	0.210
Leaf extract (T ₂)	86	14	15.9 (8.09)	10.4 (2.8)	0.510 (13.5)	0.190 (9.52)
Bark extract (T ₃)	73	27	9.8 (43)	9.3 (13.08)	0.390 (33.8)	0.110 (47.6)
Root extract (T ₄)	60	40	8.7 (49.7)	7.3 (31.7)	0.320 (45.7)	0.080 (61.9)

(±) Percentage over control is expressed in parentheses.

Table 2. Allelopathic effect of *Azadirachta indica* L. plant extracts on the photosynthetic pigments of *Abelmoschus esculentus* L.

Treatments	Chlorophyll "a" (mg/plant)	Chlorophyll "b" (mg/plant)	Total Chlorophyll (mg/plant)	Carotenoid (mg/plant)
Control (Distilled water (T ₁))	0.232	0.186	0.418	0.428
Leaf extract (T ₂)	0.163 (29.7)	0.159 (14.5)	0.322 (22.9)	0.376 (12.14)
Bark extract (T ₃)	0.136 (41.3)	0.128 (31.1)	0.264 (36.84)	0.316 (26.16)
Root extract (T ₄)	0.122 (47.4)	0.112 (39.78)	0.234 (44.01)	0.272 (36.44)

(±) Percentage over control is expressed in parentheses

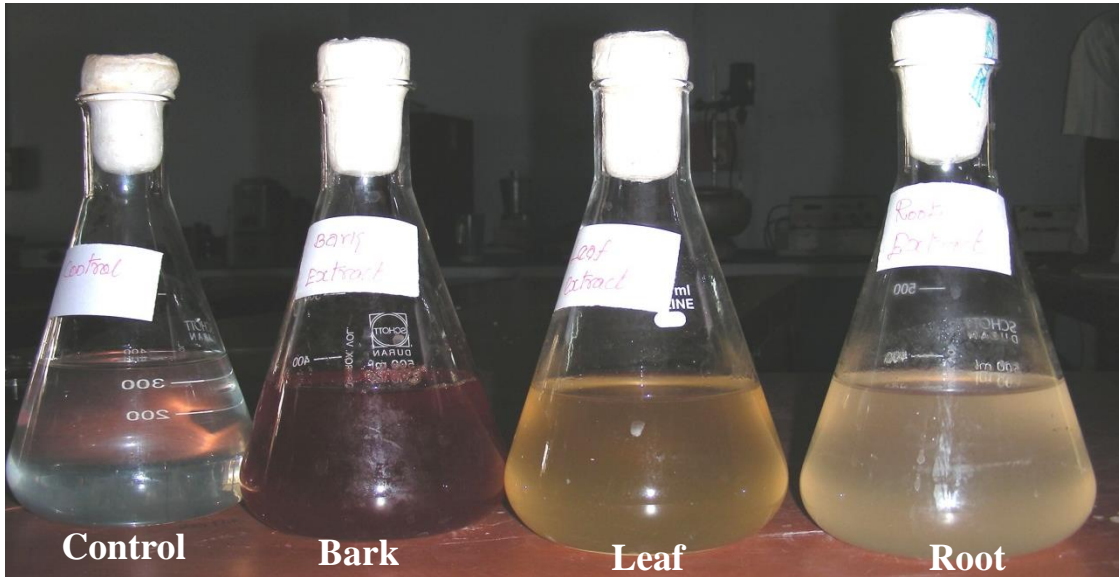
Table 3. Allelopathic effect of *Azadirachta indica* L. plant extracts on the biochemical contents of *Abelmoschus esculentus* L.

Treatments	Protein (mg/plant)	Starch (mg/plant)	Amino acids (mg/plant)	Sugars (mg/plant)
Control (Distilled water (T ₁))	0.724	0.942	0.372	0.214
Leaf extract (T ₂)	0.616 (14.91)	0.832 (11.67)	0.294 (20.96)	0.208 (2.80)
Bark extract (T ₃)	0.542 (25.13)	0.814 (13.58)	0.263 (29.30)	0.126 (14.12)
Root extract (T ₄)	0.472 (34.80)	0.628 (33.34)	0.124 (66.67)	0.114 (46.72)

(±) Percentage over control is expressed in parentheses.

Plate - 1

***Azadirachta indica* L. Plant extracts**



Distilled

Allelopathic effect of *Azadirachta indica* L. plant extracts on germination of *Abelmoschus esculentus* L. (3 Days)





T₁ - Distilled water
T₃ - Bark extract

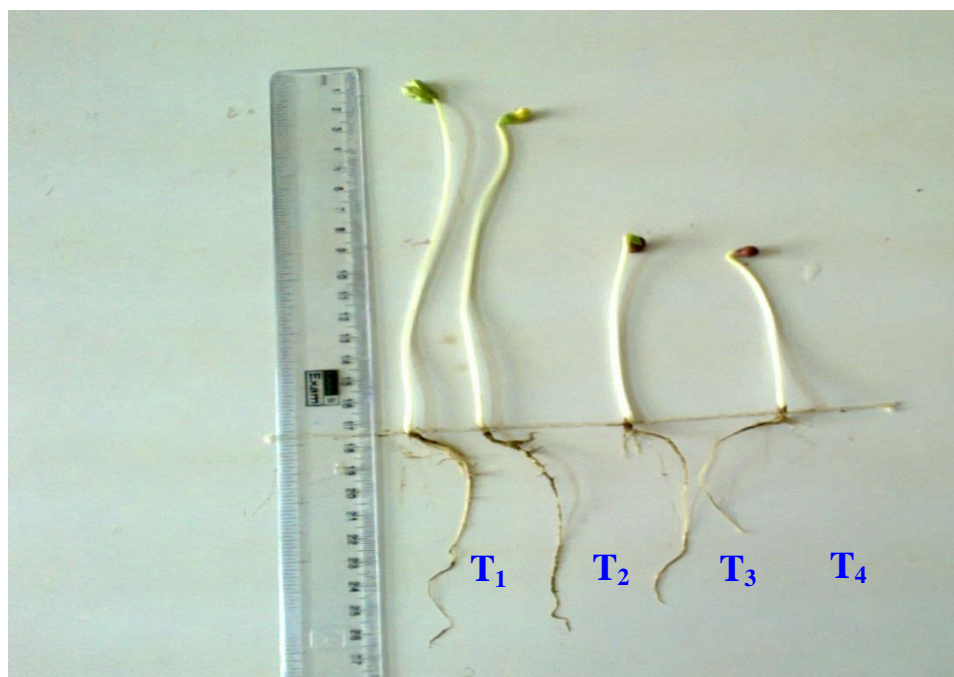
T₂ - Leaf extract
T₄ - Root extract

Plate - 2

Allelopathic effect of *Azadirachta indica* L. plant extracts on germination of *Abelmoschus esculentus* L. (7 Days)



Allelopathic effect of *Azadirachta indica* L. plant extracts on seedling growth of *Abelmoschus esculentus* L. (7 Days)



T₁ - Distilled water

T₃ - Bark extract

T₂ - Leaf extract

T₄ - Root extract

4. CONCLUSION

The present study revealed that the allelopathic effect of *Azadirachta indica* L. plant extracts on the germination of *Abelmoschus esculentus* L. seeds. There was inhibition in germination and growth of seedlings grown in neem plant extracts. The root extract caused maximum decrease in germination, shoot length, root length, fresh and dry weights and also biochemical contents. The highest rate of inhibition was observed in root extract followed by bark & leaf extracts.

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