



## Allelopathic Effect of *Azadirindica indica* Leaf Extract on Seed Germination and Seedling Growth of Some Agricultural Crops

## KEYWORDS

*Azadirachta indica*, Inhibitory effect, seed germination

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**ABSTRACT** Aqueous leaves extract of different concentrations of *Azadirachta indica*, or Neem was used to investigate their allelopathic effects on seed germination, root and shoot length of some agricultural crops such as *Pisum sativum*, *Pennisetum americanum*, *Raphanus sativus*, *Cicer arietinum*. Fresh leaves of neem were crushed and soaked for 24h; the filtrates were diluted to make different concentrations and used to investigate their effect on the test crops. The aqueous leaf extract of *A. indica* was found to have inhibitory effect on germination and root and shoot elongation of receptor plants. The results indicated that the inhibitory effect was much more pronounced at higher concentrations.

## INTRODUCTION

Any direct or indirect and harmful or beneficial effect by one plant (including micro-organisms) on another through production of chemical compounds that escape into the environment is called allelopathy (Rice, 1984). Allelopathy term was coined by Molisch (1937), which generally refers to the detrimental effect of one plant species on seed germination, growth and reproduction of another plant species. Allelopathy is an important factor in determining vegetation pattern, species diversity and vegetation dynamics. Allelopathic strategies aim at reducing environmental pollution and maintaining ecological balance especially soil fauna and flora through reduced use of chemical herbicides or substituting them with natural products (plant and microbial products). In agricultural practice, allelopathy is exploited for weed control (Kohli et al., 1998). The chemicals with allelopathic activity are present in many plants and in many organs, including leaves, flowers, fruits and buds (Ashrafi et al, 2007, May & Ash, 1990; Inderjit, 1996).

*Azadirachta indica*, is an evergreen tree native to Southeast Asia. It belongs to the family Meliaceae. It is a valuable multipurpose tree with religious, medical and social uses, since last 4000 years. It is widely used in toothpastes, soaps and lotion today, as well as being a biological insecticide. Many chemicals such as nimbin, nimbidin, nimbidol, gedunin, sodium nimbinate, queceretin (anti-protozoal), salanin (repellent), and azadirachtin (repellent, anti-feedant, anti-hormonal) present in the neem trees (Sankaram, 1987).

In the present investigation an effort was made to study the allelopathic effects of different concentrations of *Azadirachta indica* leaf extract on seed germination, shoot length and root length of some common agricultural crops such as *Pisum sativum*, *Pennisetum americanum*, *Raphanus sativus*, *Cicer arietinum*.

## MATERIAL AND METHOD

The leaves were detached and washed with distilled water to remove the adherent dust particles. Aqueous extract of *Azadirindica indica* leaves was prepared as under 200g of fresh leaves chopped in small pieces and crushed in the mixture grinder after grinding the material of leaf were soaked in 1000 ml of distilled water for 24 hour, the aqueous extract was filtered through the muslin cloth and then some of the extract was diluted to make the concentrations to 10% (T<sub>1</sub>), 25% (T<sub>2</sub>), 50% (T<sub>3</sub>), 75% (T<sub>4</sub>), 100% (T<sub>5</sub>) (on the basis of volume) and distilled water as a control (T<sub>0</sub>) treatment.

*Azadirindica indica* was considered as the donor plant and the receptor agricultural crops selected were *Pisum sativum*

, *Pennisetum americanum*, *Raphanus sativus*, *Cicer arietinum*.

The seeds were surface sterilized with 0.1% HgCl<sub>2</sub> for 10 min and again washed with sterilized distilled water 4-7 times.

The germination test was carried out in sterile Petri dishes of 12 cm in size placing a whatman number 3 filter paper on petridishes. The extract of each concentration was added to each petridish of respective treatment daily in such an amount just enough to wet the seeds. The controls were treated similarly with distilled water. Twenty seeds were spread in containing whatman's filter paper petri dish. The petridish were set in the four replications. The treatments were kept in randomized design with laboratory of the M.G.C.G.V, Chitrakoot at room temperature ranging from 25-30°C. The experiment was extended over a period of 7 days to allow the last seed germination. The germination was recorded on daily basis.

Data were recorded on counting the number of germinated seeds and lengths of root and shoot.

## Result and Discussion

## Germination Percentage

The table-1 shows the germination percentage of receptor plants. The study revealed that the leaf extracts significantly suppressed the germination and the severity of effect was proportional to the extract concentrations. The maximum seed germination percentage was shown in control where no extract used in all the receptor plants. The highest inhibitory effect (no seed germinate) was recorded in *P.americannuma* at T<sub>4</sub> T<sub>5</sub> treatment. The lowest inhibitory effect (-5%) was in *P. sativum*.

**Table. 1. Effect of *A. indica* leaf extract on germination percentage of agricultural crops .**

Treatment	Agricultural crops			
	P.americannum. (%)	R.sativus (%)	c.arietinum (%)	P. sativum (%)
T <sub>0</sub>	100	100	100	100
T <sub>1</sub>	60 (-40)	83 (-17)	85 (-15)	95 (-5)
T <sub>2</sub>	50 (-50)	64 (-36)	80 (-20)	86 (-14)
T <sub>3</sub>	5 (-95)	11 (-89)	55 (-45)	80 (-20)
T <sub>4</sub>	0	6 (-94)	40 (-60)	40 (-60)
T <sub>5</sub>	0	2 (-98)	20 (-80)	30 (-70)

Values in the parenthesis indicate the inhibitory (-) effects

in comparison to control treatment.

**Shoot elongation (cm):**

The shoot elongations of different receptor crops are presented in Table 2. The extracts of fresh leaves of *A. indica* significantly inhibited the shoot elongation of the test plants.

The highest shoot elongation was recorded as 8.16 cm in *c.arietinum* at T<sub>0</sub> treatment and lowest shoot elongation 0.25 cm in *P.amicannum* at T<sub>3</sub> treatment. T<sub>3</sub> treatment caused the maximum inhibition (-93.76%) of shoot elongation in *P.amicannum*. T<sub>1</sub> treatment caused the minimum inhibition (-14.52) of shoot elongation in *P. sativum*.

**Table:2 Effect of *A. indica* leaf extract on Shoot elongation (cm) of receptor agricultural crops .**

Agricultural crops				
Treatment	P.amicannum.	R.sativus	c.arietinum	P. sativum
T <sub>0</sub>	4.01	7.14	8.16	7.16
T <sub>1</sub>	1.20 (-70.07)	3.15 (-55.88)	5.98 (-26.71)	6.12 (-14.52)
T <sub>2</sub>	.40 (-90.02)	2.00 (-71.98)	4.00 (-50.98)	4.45 (-37.84)
T <sub>3</sub>	0.25 (-93.76)	1.12 (-84.31)	2.45 (-69.97)	2.90 (-59.49)
T <sub>4</sub>	0	1.03 (-85.57)	1.25 (-84.68)	1.45 (-79.74)
T <sub>5</sub>	0	0.90 (-87.39)	1.10 (-86.51)	1.15 (-83.93)

Values in the parenthesis indicate the inhibitory (-) effects in comparison to control treatment.

**Root elongation (cm):**

According to the result recorded in table- 3 the different concentration of aqueous leaf extract of *A. indica* had significant inhibited on root length of test crops. Plant root length were decrease over control with the increasing concentration of extract. Maximum root growth was observed 14.74 cm in *R.sativus* at T<sub>0</sub> treatment and lowest root elongation 0.2 cm in *R.sativus* at T<sub>5</sub> treatment. T<sub>5</sub> treatment caused the maximum inhibition (-98.64%) of root elongation in *R.sativus*. T<sub>1</sub> treatment caused the minimum inhibition (-13.33%) of root

elongation in *P. sativum*.

**Table:3 Effect of *A. indica* leaf extract on root elongation (cm) of receptor agricultural crops .**

crops	Agricultural			
	P.amicannum.	R.sativus	c.arietinum	P. sativum
T <sub>0</sub>	3.78	14.74	10.10	8.25
T <sub>1</sub>	1.20 (-68.25)	11.10 (-24.69)	5.45 (-46.03)	7.15 (-13.33)
T <sub>2</sub>	.60 (-84.12)	8.65(-41.31)	4.50 (-55.44)	5.45 (-33.93)
T <sub>3</sub>	.30 (-92.06)	1.00 (-93.21)	1.50 (-85.14)	3.90 (-52.72)
T <sub>4</sub>	Root not available	0.3 (-97.96)	1.00 (-90.09)	2.40 (-70.90)
T <sub>5</sub>	0	0.2 (-98.64)	1.03 (-89.80)	1.90 (-76.96)

Values in the parenthesis indicate the inhibitory (-) effects in comparison to control treatment.

The present study suggests that leaf extract of *A. indica* have strong allelopathic effect on the germination and growth of agricultural crops. The probable reason of inhibition may be the presence of allelochemicals . The n-hexanesoluble, acetone-soluble and water-soluble fractions obtained from the acetone extract of *A. indica* shoots inhibited the germination and the growth of roots and shoots of six test plant species (Ashrafi et al.,2009). Allelochemicals and phytochemicals are eco-friendly and free from the problems associated with present herbicides.

In the present investigation, thus concludes that all the concentrations of leaf aqueous extract of *A. indica* reduced the germination and growth of agricultural crops.

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