

## Allelopathic effects of aqueous Neem (*Azadirachta indica* A. Juss.) leaf extract on seed germination in some crop plants



### Botany

**KEYWORDS :** Aqueous extract *Azadirachta indica*, *Cicer arietinum*, inhibition, *Vigna aconitifolia*, *Vigna mungo*, *Vigna unguiculata*.

**M. B. Jagtap**

Post –Graduate Department of Botany, P.S.G.V.P.Mandal's Art's, Science and Commerce College, Shahada-425409, Dist-Nandurbar-India.

**S. K. Tayade**

Post –Graduate Department of Botany, P.S.G.V.P.Mandal's Art's, Science and Commerce College, Shahada-425409, Dist-Nandurbar-India.

**N. K. Athawale**

Post –Graduate Department of Botany, P.S.G.V.P.Mandal's Art's, Science and Commerce College, Shahada-425409, Dist-Nandurbar-India.

### ABSTRACT

The allelopathic effect of various concentrations of aqueous extracts of Neem (*Azadirachta indica* A. Juss.) leaves on *Vigna unguiculata* L., *Vigna mungo* (L.) Hepper, *Vigna aconitifolia* (Jacq.) Maréchal, and *Cicer arietinum* L. was conducted in sterile petri dishes at standard growth conditions. The results depicted that the aqueous leaf extract of *Azadirachta indica* significantly inhibited the seed germination, shoot length and root length. The inhibition of growth parameters were increased with the increased concentration of extract. The investigations also revealed that at 75% and 100% there was more inhibition in all test plants whereas at 50% concentration growth was enhanced in *Vigna aconitifolia* and *Vigna unguiculata*.

### Introduction:

Allelopathy is adverse effect of one plant upon another. In allelopathy one plant species chemically inhibits seed germination, growth and development of another plant species. Many crops and weeds are found to possess allelopathic activity on growth and development of other plant (Rice 1974). Mehall and Callaway (1991), Indrajit (1996), Ashrafi et al (2007), opined that the allelopathic compounds are present in leaves, stems, fruits and seeds in many plants. Salam and Nogouchi (2010), Mishra (2014), evaluated the allelopathic potential of Neem plant on seed germination and growth in some plants.

The Neem (*Azadirachta indica* A. Juss.) is a member of family Meliaceae, found in tropical and temperate regions. Neem is evergreen tree native to India (Anonymous 1985; Roxburgh 1874). All parts of the Neem tree are used medicinally from ancient time. Neem parts are found to be promising effective against diseases as Malaria, Diabetes, AIDS, Cancer, Heart diseases and several other diseases (Hashmat et al 2012). Azadirachtin, Nimbidin, Mibolides, Gedunin, Salanin, Nimbin, Valassin are the active principles found in various parts of Neem plant (Sharma et al 2011). Neem plant is found possess allelopathic activities due to presence of various allelopathic compounds. However, much emphasis has been given on research of manure and soil conditioner qualities of Neem plant (Ahmed and Grainage 1986). Research on allelopathic aspects of Neem is far from satisfaction (Alam 1990).

*Vigna mungo* L. is commonly called a Black gram. It is a major source of dietary proteins. It is one of the important pulse crops of India and can be cultivated in wide range of climatic conditions (Sharma et al 2011). Cow pea (*Vigna unguiculata*) is commonly grown as highly nutritional and digestible source of food all over the world (Sheahan 2012). Cow pea was commonly used for human consumption in old world and currently it ensures protein rich diet in India and East Asia population (Allen and Allen 1981). Moth bean (*Vigna aconitifolia*) is herb native to India. The dal prepared from this plant is widely used as food in India (Pandey 1978). *Cicer arietinum* (Gram) is a commonly grown crop in India (Pandey 1978).

### Materials and Methods:

The mature leaves of Neem (*Azadirachta indica*) were collected from the campus of P.S.G.V.P. M's Arts, Science and Commerce College, Shahada, Dist. Nandurbar (M.S.). The leaves were washed thoroughly with distilled water to discard impurities

and dust particles. *Azadirachta indica* was considered as treatment plant while the Agricultural crops *Vigna unguiculata*, *Vigna mungo*, *Vigna aconitifolia*, and *Cicer arietinum* were treated as test plants.

100 gm of Neem leaves were soaked in 100 ml distilled water for 24 hours at room temperature. After 24 hours the solution was filtered through double layered Muslin cloth. The filtrate was considered as a stock solution (100% concentration). From the stock solution five different concentrations of treatment solutions as 10%, 25%, 50%, 75% and 100% were prepared. The control treatment was induced with the help of distilled water as suggested by Jafari et al (2007). The seeds of test plants were surface sterilized with 0.1% HgCl<sub>2</sub> for 10 minutes and subsequently washed 6-7 times with distilled water to remove traces of HgCl<sub>2</sub>.

The germination of treated plants (Control treatment and Neem leaf extract treatment) was carried out in sterile petri plates having a petri plate sized blotting paper. 10 seeds of each test plant were kept in petri plate as per treatment level after noting average seed weight. 5 ml solution of respective treatment was added daily until full growth of control seeds. The petri plates of treated seeds were kept in incubator approximately for 24 hours. After every 24 hours the seed growth parameters like percent seed germination [(No. of seeds germinated/ Total no. of seeds sown) × 100], shoot length and root length were recorded. At the end of experiments dry weight of test plant seeds were recorded by oven drying the biomass produced.

### OBSERVATIONS:

\* Table 1: Percentage Germination of Seeds:-

Percent Germination Of Seeds							
Sr.No	Seed name's	Control	10%	25%	50%	75%	100%
1	<i>Vigna mungo</i>	100	90	86	90	76	63
2	<i>Vigna aconitifolia</i>	100	90	96	100	73	66
3	<i>Vigna unguiculata</i>	96	66	40	100	63	50
4	<i>Cicer arietinum</i>	93	73	56	60	46	40

\*Table 2: Root lengths of Seed in cm

Root length of Seeds in cm							
Sr.No	Seed name's	Control	10%	25%	50%	75%	100%
1	<i>Vigna mungo</i>	2.64	2.12	2.05	1.33	1.76	0.79
2	<i>Vigna aconitifolia</i>	2.20	1.69	0.67	2.00	1.32	1.18
3	<i>Vigna unguiculata</i>	4.40	2.00	1.90	5.20	1.80	1.20
4	<i>Cicer arietinum</i>	4.60	2.60	2.30	2.40	1.50	1.30

**\*Table 3: Shoot length of Seed in cm**

Shoot length of Seed in cm							
Sr.No	Seed name's	Control	10%	25%	50%	75%	100%
1	<i>Vigna mungo</i>	2.71	4.80	4.50	6.71	1.20	0.72
2	<i>Vigna aconitifolia</i>	1.22	3.48	1.61	3.29	1.09	0.84
3	<i>Vigna unguiculata</i>	4.30	2.00	1.80	5.80	1.70	3.70
4	<i>Cicer arietinum</i>	3.90	1.90	1.60	2.10	1.60	1.20

**\* Table 4: Average of Seed fresh weight in mg**

Average fresh weight of Seeds in mg							
Sr.No	Seed name's	Control	10%	25%	50%	75%	100%
1	<i>Vigna mungo</i>	444	530	420	460	530	444
2	<i>Vigna aconitifolia</i>	360	360	400	330	380	430
3	<i>Vigna unguiculata</i>	248	246	237	242	240	254
4	<i>Cicer arietinum</i>	194	154	176	159	164	168

**\*Table 5: Average of Seed dry weight in mg**

Average of Seed weight in mg							
Sr.No	Seed name's	Control	10%	25%	50%	75%	100%
1	<i>Vigna mungo</i>	260	340	230	290	400	320
2	<i>Vigna aconitifolia</i>	190	240	250	200	320	280
3	<i>Vigna unguiculata</i>	201	181	187	176	189	208
4	<i>Cicer arietinum</i>	173	134	156	146	147	147

## RESULTS AND DISCUSSION:

The effect of aqueous extract of Neem (*Azadirachta indica*) on seed germination in *Vigna mungo* and *Vigna aconitifolia* are depicted in table 1. From the data obtained it is observed that, at 25% treatment level *Vigna mungo* and *Vigna aconitifolia* showed slight inhibition of seed germination whereas *Vigna unguiculata* and *Cicer arietinum* showed maximum inhibition. It was observed that, at 50% treatment level there was no inhibition of seed germination in *Vigna aconitifolia* and *Vigna unguiculata*.

Table 2 represents effect of aqueous Neem extract on root length and it shows that the root length is less affected at 10 %, 25 %, and 75 % in all test plants while maximum root length was observed at 50% treatment level in *Vigna unguiculata*. At 75% and 100% treatment level root growth was significantly inhibited.

The inhibitory activity of aqueous Neem extract on shoot length is shown in table 3. The shoot length was significantly reduced at 75% and 100 % conc. in all test plants, while it is enhanced at 10 %, 25% and 50% concentration. Maximum shoot length was observed in *Vigna mungo* and *Vigna unguiculata* at 50% treatment level. *Vigna aconitifolia* showed higher inhibition at 100% treatment level.

The effect of aqueous Neem extract on seed fresh weight and seed dry weight are represented in table 4 and 5 respectively. It is very clear that there is significant effect in all the seedlings at all treatment levels. This indicates that the given seedlings affected by *Azadirachta indica* L. aqueous extract can tolerate stress up to some extent, but as conc. increases, significant reduction in fresh and dry weight.

The results are in accordance with other studies that obtained that allelopathy may vary among plants. (Kangana et al 2012). Salam and Noguchi (2010) reported that, the inhibitory activity of aqueous Neem extract was dependent on the higher concentration and the higher concentration showed strong inhibitory activity over test plants. They also reported the higher inhibition of root growth than shoot growth in test plants. So, they concluded that the Neem leaves may contain growth inhibitory substance and may possess allelopathic potential. Ahangar et al (2013) studied allelopathic effects of aqueous extracts of *Azadirachta indica* and *Eucalyptus citroides* on wheat and found that, the both plants significantly inhibit the percentage germination, shoot and root length of wheat plant.

Some kind of inhibitor(s) present in aqueous leaves extract was responsible for the phytotoxic effect of *A. indica* on germination and seedling growth of *Vigna radiata* (Charchafchi et al 2007). The aqueous leaf extract of Neem may contain phenols, Flavonoids, tannins,  $\beta$ -sitosterol, luped, rutin, ellagic acid and quereetin (Pandey et al 2014). Mishra, (2014), found significant inhibitory action of Neem leaf extract on germination, root and shoot elongation of various test plants. The aqueous extracts of Neem leaf cause significant inhibitory effects on germination, root and shoot length and development of lateral root of some cowpea varieties (Lawan et al 2011).

## CONCLUSION

From the present study it can be concluded that the aqueous Neem leaf extract induces significant inhibition of seed germination, shoot and root length and seed fresh and dry weight in all test plants inducing the allelopathic effects. As the concentration of Neem leaf extract increases the inhibition rate also increases with exception of 50% concentration which merely shows enhancing effects in all plants, so 50% concentration may be useful for plant growth. From the data obtained it can be said that the *Vigna unguiculata* and *Cicer arietinum* showed more inhibition as compared to *Vigna mungo* and *Vigna aconitifolia*.

## REFERENCE

- Ahangar Faroz Ahmad, Rao R J., and Mamta K (2013). Allelopathic effect of Aqueous extracts of Neem (*Azadirachta indica*) and *Eucalyptus citroides* on the growth and germination of wheat (*Triticum aestivum* var. desi) Journal of environmental science. 4(2):169-172. Ahmed S A and Grainage M (1986). Potential of neem tree for pest control and rural development. Economic Botany. 40: 201-209. Alam S M (1990). Effect of wild plant extract on germination and seedling growth of wheat. Rachis. 9: 12-13. Allen O N and Allen E K (1981). The Leguminosae: a source book of characteristics, uses, and nodulation. The Univ. of Wisconsin Press, Madison, WI. Anonymous (1985). The wealth of India - Raw materials. Publication and Information Directorate, CSIR, New Delhi, India. Ashrafi Z, Mashhadi H R and Sadeghi S (2007). Allelopathic effects of Barley (*Hordeum Vulgare*) on germination and growth of wild variety (*Hordeum spontaneum*). Pakistan Journal of weed science. Research. 13(1-2): 99-112. Charchafchi Al Fawzia, Nabhani-Al Iman (2007). Effects of Aqueous extract of *Azadirachta indica* (Neem) leaves on germination and seedling growth of *Vigna radiata* (L.) Pakistan Journal of Biological science. 10(21): 3885-3889. Hashmat Imam, Azad Hussain and Ahmed Ajij (2012). Neem (*Azadirachta indica* A. Juss) Nature's Drugstore: An overview. I. Res. J. Biological Sci. 1(6): 76-79. Inderjit I (1996). Plant phenolics in allelopathy. Botanical Review. 62:186-202. Jafari L, Kholdebarin B and Jafari E (2007). Phytotoxic effects of *Chenopodium album* L. water extract on higher plants. American Journal of Plant Physiology, 2(3): 221-226. Kangana A, Muniyammal P and Manonmani R (2012). Suppressive effects of aqueous extracts of Neem (*Melia azadirachta* L.) on some initial growth parameters of Cow pea and Horse gram. Journal of applied pharmacological science. 02(05): 185-187. Lawan, S A, Suleiman M. and Yahaya S U (2011). Inhibition of germination and growth behavior of some cowpea varieties using Neem (*Azadirachta indica*) leaf water extracts. Bayera Journal of pure and applied science. 4(2):169-172. Mahall B E and Callaway R M (1991). Root communication among desert shrubs. Proceedings of the National Academy of Science of the United State of America. 88: 874-876. Mishra A (2014). Allelopathic effects of *Azadirachta indica* leaf extract on seed germination and seedling growth of some agricultural crops. Indian journal of applied research. 4(5): 53-54. Pandey B P (1978). Economic Botany. S. Chand and Company Ltd. 26-27. Pandey G, Verma K K and Singh M (2014). Evaluation of Phytochemical, Antibacterial and free radical scavenging properties of *Azadirachta indica* (Neem) leaves. International Journal of pharmaceutical science. 6(2): 0975-1491. Rice E L (1974). Allelopathy: Physiological Ecology New York, NY: Academic Press. Roxburgh W (1874). Description of Indian plants, today and tomorrow. Printers and Publishers, New Delhi, India. Salam Md Abdus and Noguchi Kato Hisashi (2010). Evaluation of Allelopathic potential of Neem (*Azadirachta indica* A. Juss) against seed germination and seedling growth of different test plant species. International Journal of Sustainable Agriculture. 2(2): 20-25. Sharma O P, Bambawale O M, Gopali J B, Bhagat S, Yelshetty S, Anand R and Singh O P (2011). Field guide Mungbean and Uedbean. Pp. 1-40. Sharma P, Tomar L, Bachwani M, and Bansal V (2011). Review on Neem (*Azadirachta indica*): Thousand Problem One Solution. Int. Res. J. of Pharmacy. 2(12), 97-102. Sheahan, C M (2012). Plant guide for cowpea (*Vigna unguiculata*). USDA-Natural Resources Conservation Service, Cape May Plant Materials Center, Cape May, NJ.