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Effect of aqueous extract of neem (*Azadirachta indica* A. Juss) leaves on germination and growth of some agricultural crops

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Abstract

Effect of aqueous extract of *Azadirachta indica* A. Juss leaves observed on agricultural crops like Mung, Cow pea, Jowar and Wheat. It is found that these crops are sensitive to different concentrations of Neem leaf extract on germination stage, root, and shoot length and biomass production.

Keywords: *Azadirachta indica*, Allelopathy, crops, seed germination

1. Introduction

Allelopathy refers to any process involving secondary metabolites which produced by plants, microorganisms, viruses and fungi that influence the growth and development of agriculture and biological systems^[1]. The term 'Allelopathy' was coined by^[2]. Allelopathy involves plant chemical interactions in both natural and agro-ecosystems. The allelochemical compounds can interfere with the metabolism of other plants^[3]. Allelochemicals are the bio-communicators, suggesting the possibility of active mixtures because of the increasing the number of findings in which single compound is not active or it may not be active as mixture^[4]. The allelochemicals are present in all parts of plant such as root, stem, leaves and fruits^[5]. These can be released into the environment by process like weathering, volatilization, root exudation, leaching and decomposition of plant residues^[6]. Allelopathy shows the effects like inhibition of seed germination, seedling growth and alteration in physiology of seed germination^[7].

Azadirachta indica (Family- Meliaceae) is an evergreen tree native to Southeast Asia. It is a valuable multipurpose tree with religious, medicinal and social uses, since last 4000 years. It is widely used in toothpastes, soaps and lotion. It is recognized as biological insecticide due to chemicals present in its leaves, seeds, bark. It consist alkaloids such as nimbin, nimbidin, nimbidol, gedunin, sodium nimbinat, quercetin, salannin and azadirachtin^[8]. These chemicals showed the properties like repellent and anti-feedant. In nature this tree shows variation in flowering, fruiting and chemical point of view, the germplasm collection has been made. Some trees are having properties of non-bitter principals^[9].

Present investigation was carried out to study the allelopathic effects of different concentrations of *Azadirachta indica* A. Juss. Leaf extract on seed germination, shoot length and root length of some agricultural crops like Mung [*Vigna radiata* (L.) Wilczek.], Cow pea [*Vigna unguiculata* (L.) Walp. Subsp. *cylindrica* (L.) van. E. Seltine.], Jowar [*Sorghum bicolor* (L.)] and Wheat [*Triticum aestivum* (L.)].

2. Materials and Methods

Fresh and clean leaves of Neem plant was collected from the Kolhapur region. The leaves were washed with distilled water, blotted to dry and dried in shade. The aqueous extracts of different concentration like 0.5%(T₁), 1%(T₂), 2%(T₃), 5%(T₄) were prepared with the help of distilled water and the extract was filter through the muslin cloth. Petri plate technique was followed for germination studies. Sterilized Whatman No.1 filter paper was kept in the sterilized petri-plates. Seeds were sterilized with 0.1% HgCl₂, washed with distilled water for several times and then 20 seeds were kept for germination in each petri-plate and control sets were maintained with sterilize distilled water. Germination percentage was calculated after 48 hrs. Root and shoot length were taken up to three week intervals. Moisture content and dry weight was determined after three weeks by drying the seedling in oven at 60 °C.

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3. Results and Discussion

The aqueous leaf extract of Neem was found to inhibit the germination in all the crop plants. Inhibition is prominent in Mung, Cow pea and Jowar. In case of Wheat, germination percentage was increased at lower concentration. As compared to control the highest inhibitory effect was recorded in Mung at (T₁) and (T₂) treatment. The lowest inhibitory effect was recorded in Wheat at (T₁), (T₂) and (T₃) treatment. The maximum germination percentage were recorded at 5% concentration in Mung- *vigna radiata* (L.)Wilczek ^[10, 11] and in Wheat ^[12].

Root length and shoot length is arrested in Mung, Cow pea and Wheat of the crops. It is very interesting to note that, the inhibition is variable, not correlated with concentration. The

highest root length was recorded in Mung at (T₀) treatment and lowest root length was recorded in Cow pea (T₄) treatment. The highest shoot elongation was recorded in Jowar at (T₂) treatment and lowest shoot elongation was recorded in Cow pea at (T₄) treatment. The acetone extract of Neem plant shows inhibition in the germination and growth of roots and shoots of crops ^[13].

In the present experiment, it is observed that, there is an increase in the biomass production in case of Mung and Cow pea and lowest biomass production in case of Jowar and Wheat. According to ^{[14], [15]} allelochemicals influence the basic plant processes, hormonal balance, protein synthesis, respiration, chlorophyll production and even plant water relations as well as permeability.

Table 1: Allelopathic effect of Neem plant extract on the germination and growth parameters of Mung.

Treatments	Germination percentage (%)	Inhibition percentage (%)	Root length (cm.)	Shoot length (cm.)	Fresh weight of seedlings (gm)	Dry weight of seedlings (gm)
Control (Distilled water)	80	20	6.2	3.4	4.45	2.10
Leaf extract(T ₁)	60	40	4.0	2.4	4.25	1.90
Leaf extract(T ₂)	70	30	4.4	2.0	3.85	1.70
Leaf extract(T ₃)	90	10	3.0	1.9	3.40	1.60
Leaf extract(T ₄)	100	-	2.5	2.1	3.20	1.45

Table 2: Allelopathic effect of Neem plant extract on the germination and growth parameters of Cow pea.

Treatments	Germination percentage (%)	Inhibition percentage (%)	Root length (cm.)	Shoot length (cm.)	Fresh weight of seedlings (gm)	Dry weight of seedlings (gm)
Control (Distilled water)	90	10	4.7	3.2	3.45	2.20
Leaf extract(T ₁)	70	30	9.9	2.9	3.15	1.60
Leaf extract(T ₂)	70	30	3.1	3.0	2.82	1.40
Leaf extract(T ₃)	90	10	2.6	2.5	2.14	1.30
Leaf extract(T ₄)	90	10	1.6	1.0	1.10	0.70

Table 3: Allelopathic effect of Neem plant extract on the germination and growth parameters of Jowar.

Treatments	Germination percentage (%)	Inhibition percentage (%)	Root length (cm.)	Shoot length (cm.)	Fresh weight of seedlings (gm)	Dry weight of seedlings (gm)
Control (Distilled water)	90	-	4.6	3.3	0.80	0.20
Leaf extract(T ₁)	90	10	4.0	3.4	0.70	0.30
Leaf extract(T ₂)	90	10	5.6	4.5	0.60	0.40
Leaf extract(T ₃)	80	20	4.0	3.1	0.80	0.30
Leaf extract(T ₄)	80	20	3.3	2.8	0.70	0.20

Table 4: Allelopathic effect of Neem plant extract on the germination and growth parameters of Wheat.

Treatments	Germination percentage (%)	Inhibition percentage (%)	Root length (cm.)	Shoot length (cm.)	Fresh weight of seedlings (gm)	Dry weight of seedlings (gm)
Control (Distilled water)	100	-	4.6	3.9	0.60	0.20
Leaf extract(T ₁)	100	-	4.9	4.8	0.70	0.10
Leaf extract(T ₂)	100	-	3.8	2.8	0.80	0.10
Leaf extract(T ₃)	100	-	3.8	2.4	0.90	0.20
Leaf extract(T ₄)	90	10	2.2	1.9	0.60	0.10

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