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Research Article

Allelopathic Effect of *Chenopodium album* L., *Vernonia cinerea* (L). Less. and *Celosia argentea* L. on Germination and Growth of *Cicer arietinum* L.

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Abstract: Allelopathic substances regulate plant growth, and their progression may have an impact on a neighbouring plant's endurance and advancement. The germination of Bengal gram was investigated using leaf leachates from Chenopodium album L., Vernonia cinerea (L.) Less., and Celosia argentea L. The seed was planted in Petri dishes. in a pot, culture weed extracts containing 0.5 percent, 1.0 percent, and 5.0 percent leaf leachates. The seedling growth was measured on the 28th day after sowing, whereas the germination percentage was measured at the end of the 7th day after sowing. Mean was used to evaluate the experimental data statistically (average).The decrease in seed germination and seedling growth was linked to the increase in leachate concentrate. At a concentration of 5.0 percent, all of the leachates severely decreased seed germination, root, and shoot length. In Celosia argentea L., the highest suppression of seed germination and growth was attributed at a concentration of 5.0 percent leachate.

Keywords: Allelopathy, Chickpea, Extract of weeds, Germination, Inhibition, Root-Shoot length

Introduction

Allelopathy comes from two Greek words: allelon, which means "together," and pathos, which means "to suffer," referring to the harmful consequences of one on another. Allelopathy is a term that describes the negative effects of higher plants of one species (the donor) on the germination, growth, and development of plants of other species (the recipients) (Shamsher Narwal, 1994). Allelopathy refers to the direct or indirect, negative or positive impacts of plants on other plants in the environment (E. L. Rice, 1984).Allelopathy is a plant growth inhibition or stimulation mechanism in which live or dead plant components emit chemical compounds that hinder or encourage the growth of the linked plant (Harper, 1977; Dhavan S. R. and Narwal S. S., 1994). Allelochemicals or allelochemicals are compounds that have allelopathic effects on the receiving species (Shamsher and Narwal S.,1994). Allelochemicals generated by weed residues may have the following effects on crop plants: (1) biological nitrogen fixation inhibition. (2) Seed germination, growth, and yield inhibition, and (3) Bioaccumulation inhibition.Weeds are a major problem in all crops because they compete for light, water, and nutrients, as well as harboring diseases and insects (Pathipati et al., 2011). The allelopathic effects of weeds on crops can be used to identify both dangerous and beneficial weeds. Photosynthesis, respiration, transpiration, biochemical metabolism, protein, and nucleic acid synthesis are all regulated by allelopathic chemicals in plants (Chou., 2006). Weeds, with over 30,000 species, are the second largest group after natural vegetation in terms of quantity, size, and range.Weeds, due to their dynamic character, remain to be major biotic restrictions in India's cultivated and non-cropped fields.

Cicer arietinum L is also known as Bengal gram, Garbanzo, Egyptian pea, and Chana (Baynes T. S.; Smith W.R., eds, 1880). It is one of the first legumes to be cultivated. They're generally grown in India and other regions of the Indian subcontinent, but they're also grown in Ethiopia, Mexico, and Iran (www.Feedipedia.org). Chickpea production in 2017: Crops/Regions/World List/Production Quantity (Chickpea production in 2017: Crops/Regions/World List/Production Quantity) India produced 67 percent of the world's total (Chickpea

production in 2017: Crops/Regions/World List/Production Quantity). It is a member of the Fabaceae family. Chickpeas are grown primarily for their seeds and are a staple of the vegetarian diet on the Indian subcontinent.

Sowing can start as early as mid-May and continue until the beginning of July, depending on the variety. They've evolved to thrive in the region's more alkaline soils. In the Northern cropping region, illness and frost damage are the two greatest restrictions to chickpea output (Whish et al., 2007).

Chenopodium album L., Vernonia cinerea (L.)Less., and Celosia argentea L. are some of the most frequent weeds that infest the area. Allelochemicals are released by these weeds, which disrupt plant development and seed germination, affecting productivity.

Materials and Methods

Bioassay

The leaves were washed with water numerous times, sorted, and sliced into little pieces before being dried in the shade. Theaqueous extract wasprepared using the method provided by Dhawan and Narwal in 1994.

In a grinding machine, the dried leaves were ground.The dried powder ingredients were combined individually in 100 ml distilled water and homogenized in a shaker machine for 2hr. and filtered through Whatman No. 1 filter paper, with the filtrate diluted with distilled water to obtain a concentrationof 0.5%, 1.0%, and 5.0%. The powder is kept in sealed jars until it is needed.

The effects of aqueous extracts of Chenopodium album L., Vernonia cinerea (L).Less. and Celosia argentea L.leaves on the crop plant were investigated.The goal of this study was to determine the allelopathic effects ofChenopodium album L., Vernonia cinerea (L).Less. and Celosia argentea L.on Cicer arietinumL.germination and growth. This experiment took place in July 2019.

Objectives of Study

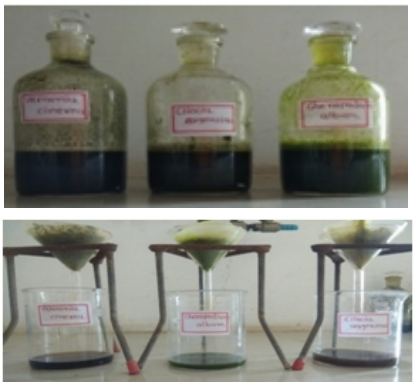
The study was undertaken with the following objectives.

1. To learn more about how allelopathy affects the germination of other plants.
2. To come up with an Allelopathyhypothesis.
3. To gather and show information.
4. To make sense of the data.
5. To make recommendations for additional research.

Extract of Leaves

The experiment consists of:

1. One test crop is included in the trial.
2. Chenopodium albumL., Celosia argentiaL., and *Vernonia cinerea* (L.) Less. leaf extracts
3. Three different concentrationswere used including control viz. 0.5%, 1.0%, 5.0%.



Extract of Leaves

Germination Test

Cicer arietinum L seeds were employed as a test crop. Petri dishes with a diameter of 9.0 cm were used for the experiment. After washing, the Petri dishes were disinfected by soaking them in ethyl alcohol. Surface sterilization was achieved by immersing the plant seeds in 0.05 percent HgCl2solution for 10 minutes and then washing them with tap water. Twenty homogeneous chickpea seeds were planted in each petri dish and 5 ml extract was given to each Petri plate on alternate days as treatment, while distilled water was used as a control. During data collection, the experiment was conducted in complete darkness with minimal exposure to light. Seeds with a radicle of 3.0 mm were considered germinated.germination was tracked daily for up to 7 days. The percentage of seeds that germinated in each petri dish was calculated by counting the number of seeds that germinated in each petri dish.

Pot Culture

Chenopodium album L., *Vernonia cinerea* L.(Less), and *Celosia argentea* L. aqueous leaf extracts (0.5 percent, 1.0 percent, and 5.0 percent) were produced from three weeds: *Chenopodium album* L., *Vernonia cinerea* L.(Less), and *Celosia argentea* L. A 100 g soil mixture was placed in plastic pots with a diameter of 3 cm (clay: sand: peat in the ratio of 3:1:1). Surface sterilization was achieved by immersing the plant seeds in a 0.05 percent HgCl2 solution for 10

minutes and then washing them with tap water. The test crop was seeded in pots with 22 seeds and then irrigated with aqueous leaf extracts of the three weeds. Distilled water was used to irrigate the control pots. A Completely Randomized Design with one replication was used in the investigation. At the end of the experiment, on the 28th day, seedling growth was measured.Cicer arietinum roots/seedlings, total root length, and shoot length were measured from 15 seedlings chosen at random.

Statistical Analysis

Mean was used to evaluate the experimental data statistically (average).

Results and Discussion

Allelochemicals were shown to be generally present in plants, and one of its most essential physio-biochemical roles is a defense against their adversaries, according to recent research (Gavazzi et al.,). Although poisonous metabolites are found throughout the plant (Rice,1974), they are most commonly found in the leaves and bark (Bhatt et al.,1997, Bhatt and Chauhan,2000). Water is the solvent extraction medium in nature (Hill et al.,2006), which is why aqueous extracts are used in this study. Because these chemicals are biodegradable in a short amount of time, they will not cause problems in plants or soil systems like pesticides.

Bioassay

The test crop's seed germination was inhibited by all of the extracts (Table-1). The germination percentage was reduced as the concentration of all three weed extracts was raised. *Celosia argentea* L. leaf leachate suppressed chickpea germination the most, followed by Chenopodium album L. and *Vernonia cinerea* L. (Less).in comparison to the control group Following the application of different concentrations of *Celosia argentia* L., *Chenopodium album* L., and Vernonia cinerea (L).Less In comparison to *Cicer arietinum* L., a concentration of 0.5 percent aqueous extraction of leaves of *Vernonia cinerea*(L) Less exhibited the highest germination (80%), and *Celosia argentea* L., showed the least germination (50%) when compared to control (99 percent). Leaf leachates reduced the chickpea germination percentage by 0.5 percent, 1.0 percent, and 5.0 percent, respectively. *Celosia argentea* L., the most toxic of the three weeds, outperformed the other two extracts.

Observation Table

Table: 1. Effects of various weed leaf extracts on Cicer arietinum L. germination (in Bio-assay)

Sr.No	Scientific Name of the Weed	Concentration percentage of the Extract	Germination percentage
1.	Celosia argentea	Control	99
		0.5	50
		1.0	40
		5.0	20
2.	Chenopodium album	Control	99
		0.5	60
		1.0	45
		5.0	25
3.	Vernonia cinerea	Control	99
		0.5	80
		1.0	65
		5.0	45

Table: 2. The effects of several weeds' aqueous leaf extracts on *Cicer arietinum* L. seed germination and growth (in pot culture)

Sr. No	Scientific Name of the Weed	The concentration percentage of the Extract (%)	Germination percentage	Length of the Root(cm)	Length of the shoot (cm)
1.	Celosia argentea	Control	99	11.5	13.0
		0.5	50	8.5	10.7
		1.0	40	7.0	7.8
		5.0	20	4.7	6.5
2.	Chenopodium album	Control	99	11.5	13.0
		0.5	60	9.7	11.3
		1.0	45	7.3	9.3
		5.0	25	5.3	8.9
3.	Vernonia cinerea	Control	99	11.5	13.0
		0.5	80	9.9	12.1
		1.0	65	5.7	11.2
		5.0	45	6.0	9.0

Pot Culture

When the different concentration of aqueous leaf extracts was applied in the pot culture inhibited the seed germination (Table -2) as observed in the bioassay.After the treatment of various concentrations of Celosia argentea, Chenopodium album, and Vernonia cinerea with Cicer arietinum L. it has been revealed that concentration Of 5% aqueous extraction of the leaves of Celosia argentea L.(6.5 cm) and Chenopodium album (8.9 cm) showed the highest inhibition in shoot length as compared

to control (13.0 cm). The Celosia argentea showed a more lethal effect than the Chenopodium album and Vernonia cinerea. In comparison to control all three weeds suppressed the seedling germination.Seedling germination reduced as weed concentrations increased. Celosia argentea had the most negative impact on Chickpea growth. The other two weeds had a lower detrimental impact than Celosia argentea. When compared to the control, the length of the shoots and roots reduced as the quantity of Celosia argentea extracts increased. It could be caused by the absence of cell division and cell elongation. It is vital to identify local weeds with the least amount of toxins in the soil to effectively manage crops.Phytotoxic responses of leaf extracts from diverse agroforestry tree crops to field crop germination, radicle, and plumule extension have previously been documented (Todariaet al.,2005:Bhatt and Chauhan,2000, and Bhatt et al.,1997). Many agriculture crops have been reported to suffer from harmful allelopathic effects of these weeds on germination and seedling vigor (Narwal, 1994).All three weeds' leaf leachates were recognized as hazardous leachates in this study because they caused reduced germination and seedling vigor. This may be related to the presence of fatal allelochemicals. In Celosia argentea, for example, p-coumaric acid, protocatechuic acid, pyrogallol, and 4-hydroxybenzaldehyde. This research implies that removing these weeds from the field as soon as possible is critical to avoid losses due to poor germination and seedling vigor. The three-leaf leachates were all shown to be hazardous.

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