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Allelopathic effects of *Anthocephalus cadamba* on germination and growth behavior of some pulses

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ABSTRACT

The present study was undertaken to explore the allelopathic capability of *Anthocephalus cadamba* leaf litters on four common pulses *viz. Pisum sativum*, *Phaseolus mungo*, *Cicer arietinum* and *Lens esculenta* uncovered critical hindrance of seed germination and seedling development. The leaf powder obtained after shade drying (1, 2, 5 and 10 g) was doused independently in 100 ml distilled water for a day and a half (36hrs). Application of this leaf extracts reduced seed germination rate and suppressed early seedling growth. With increase in extract concentration from 1 to 10%, a slow abatement in seed germination and seedling length happened. The inhibitory impacts were relative to the groupings of leaf separates and the higher fixation (5-10%) had more inhibitory impacts. Among the test crops, *Cicer arietinum* and *Pisum sativum* seeds were least touchy to the utilization of different groupings of leaf extracts while *Lens esculenta* and *Phaseolus mungo* seeds were more helpless to the allelopathic impacts of *Anthocephalus cadamba*. The results suggest that leaf extracts of *Anthocephalus cadamba* had strong allelopathic activity although the activity differed depending on concentration. The current investigation could be significant in arranging the field under various harvests considering the common agro-biological system for better return. It is also suggested that these pulses should not be planted close to *Anthocephalus cadamba* due to unfriendly impacts on their development and advancement. These results suggested that the *A. cadamba* had allelopathic potential which decreases germination and plant development.

Figures : 03 References : 30 Tables : 03
KEY WORDS : *Anthocephalus cadamba*, Common pulses, Leaf extracts, Seed germination

Introduction

Anthocephalus cadamba commonly known as Kadamb in India is a huge tree with straight round and hollow bole has a place with family Rubiaceae. It is quickly developing in nature and can fill in various places of India. Considering the high market interest of wood in India, *A. cadamba* is one of the promising and possible trees, being developed on the ranch land as agroforestry. Allelopathy is the ability of a plant to release chemicals, known as allelo chemicals, which can influence growth and development in a nearby species[27]. It impacts one plant upon another plant filling in its encompassing region by the arrival of certain metabolic poisonous items. Allelopathy can be viewed as a segment of organic control in which plants are utilized to diminish the power and advancement of different plants[3,11,24]. It impacts one plant upon another plant filling in its encompassing region by the arrival of certain metabolic poisonous items. These chemicals adversely affect the environment, bringing about the decrease and postponing in germination, mortality of seedlings and decrease in development and the yield. It has been shown that where *Eucalyptus* stand is displaced by the agrarian gather, that yield will not foster well, fundamentally for several years [4]. Inhibited or slow seed germination rate, reduced radicle and plumule growth, necrosis of root tips, the root axis curling and discoloration of tissues are indicators of Allelopathy[19].

A few investigations uncovered that huge spaces of the ground surface underneath the *Eucalyptus* remains totally exposed and ground vegetation is extremely restricted in degree. The allelopathic impacts of *Eucalyptus* species have incredibly been explored on various plant species[14,28,29,]. Various plant parts, including blooms, leaves, leaf mulch and leaf litter, bark, roots, stems, soil and soil leachates and their construed compounds, can have allelopathy activity that movements over a developing season[16,25]. Allelopathic artificial materials can similarly proceed in soil, affecting both connecting plants similarly as those leaf litter and foliar leachates of *Eucalyptus* species, for example, are more harmful than bark leachates to some food crops[23]. These parts have allelochemicals like phenolic compounds, alkaloids, flavonoids, amino acids and terpenoids affect

TABLE-1: Allelopathic effects of *Anthocephalus cadamba* on seed germination (%) of different pulses. Results are the mean of 6 replicates±SE

	Rate of seed germination (%) on 12 hrs treatment					Rate of seed germination (%) on 24 hrs treatment				
Crops	**Control**	**1%**	**2%**	**5%**	**10%**	**Control**	**1%**	**2%**	**5%**	**10%**
Pisum sativum	96±0.9	77±1.54	65±0.91	58±1.15	38±1.38	94±0.98	69±0.86	51±1.07	46±1.06	31±0.66
Phaseolus mungo	97±0.85	73±1.92	59±1.59	46±1.69	31±1.47	96±0.48	61±0.76	49±0.99	40±0.9	33±0.83
Cicer arietinum	95±0.54	81±1.41	62±1.74	49±1.48	41±2.01	94±0.46	72±0.79	56±1.9	42±0.68	33±0.81
Lens esculenta	96±1.2	79±1.75	57±1.49	39±1.34	30±1.64	93±0.98	68±1.19	43±1.4	33±0.86	27±0.39

TABLE-2: Allelopathic effects of *Anthocephalus cadamba* on shoot length (cm) of different pulses. Results are the mean of 6 replicates ±SE

	Shoot length(cm) on 12 hrs leaf extract treatment seeds					Shoot length(cm) on 24 hrs leaf extract treatment seeds				
Crops	Control	1%	2%	5%	10%	Control	1%	2%	5%	10%
Pisum sativum	4.8±0.3	4.3±0.1	4.0±0.6	3.3±0.6	3.1±0.3	4.6±0.2	3.6±0.4	3.1±0.3	2.9±0.4	2.8±0.2
Phaseolus mungo	4.9±0.2	4.3±0.4	3.9±0.2	3.2±0.6	3.0±0.2	4.7±0.5	3.9±0.2	3.1±0.1	2.6±0.3	2.4±0.5
Cicer arietinum	5.6±0.5	5.4±0.3	4.8±0.1	3.7±0.7	3.6±0.3	5.4±0.1	5.0±0.2	4.2±0.6	3.0±0.3	2.5±0.3
Lens esculenta	4.4±0.4	4.0±0.6	3.9±0.2	3.0±0.2	2.4±0.3	4.2±0.2	3.6±0.2	3.1±0.6	2.2±0.3	2.0±0.1

the seed germination of the harvest plant[5,17,18]. The leaf remove has much allelochemicals property concentrated[13]. It has been reported that leachates from leaf possess metabolites that have toxic effects and these metabolic toxins are species or genus specific[1]. Similar allelopathic effect was also reported for *Anthocephalus cadamba*[12], where it seems to affect the production in rice field of Assam[22]. Henceforth, the current examination is intended to close allelopathic impacts of *Anthocephalus cadamba* which is a sort of normal tree and how it consequences for seed germination and development on few commonly used pulses.

Materials and Methods

Preparation of *Anthocephalus cadamba* leaf extracts:

Hundred (100) grams of fresh leaf of *Anthocephalus cadamba* were harvested at vegetative stage. Leaves were thoroughly washed with tap water to remove the dust particles and then shade dried for 10 -15 days at room temperature till constant weight and later these were oven dried at 70°C for 72 hours. Dried leaves were powdered with the assistance of a grinder and put away in polyethylene sacks. The dried leaf powder (1, 2, 5, and 10 g) was doused independently in 100 ml distilled water for a day and a half (36hrs) at room temperature. Gathered concentrates were sifted through a fine fabric to eliminate trash lastly separated utilizing Whatman No. 1. The filtrate was a stock preparation and afterward pre-arranged 1, 2, 5 and 10% fixation with distilled water. The four concentrate levels other than the control (distilled water) was picked to go through the examination.

Petri dishes were used for the seed germination and the bottom of each Petri dish contained one piece of filter paper. This paper was wet with the particular solution concentration. The vigorous identical seeds of *Pisum sativum*, *Phaseolus mungo*, *Cicerarietinum* and *Lens esculenta* were surface cleaned with 1% sodium hypo-chloride solution for 10 minutes, then, at that point flushed with distilled water a few times to dispose of the abundance of the substance. Then, at that point surface cleaned seeds were drenched for treatment in various convergences of plant extracts for 12 and 24 hours, whereas for control, distilled water were utilized. Twenty seeds were placed on top of the paper then another piece of filter paper was placed over the seeds. The top filter paper was wet again with the solution concentration to get an even moist environment. The top of the Petri dish was put on it and afterward it was set in a sprouting Biological Oxygen Demand (B.O.D.) type chamber, controlled at 25ÚC consistent temperature and 12 hours photoperiod for multiple days (5days). For every treatment, four imitates were utilized and each recreates contained 20 seeds. The level of seed germination was determined following five days and the normal development of shoot and root was estimated and contrasted. The experiments were compared with controls and informations were statistically analysed. The information was recorded on seed germination rate and shoot and root length over the span of trial.

Results

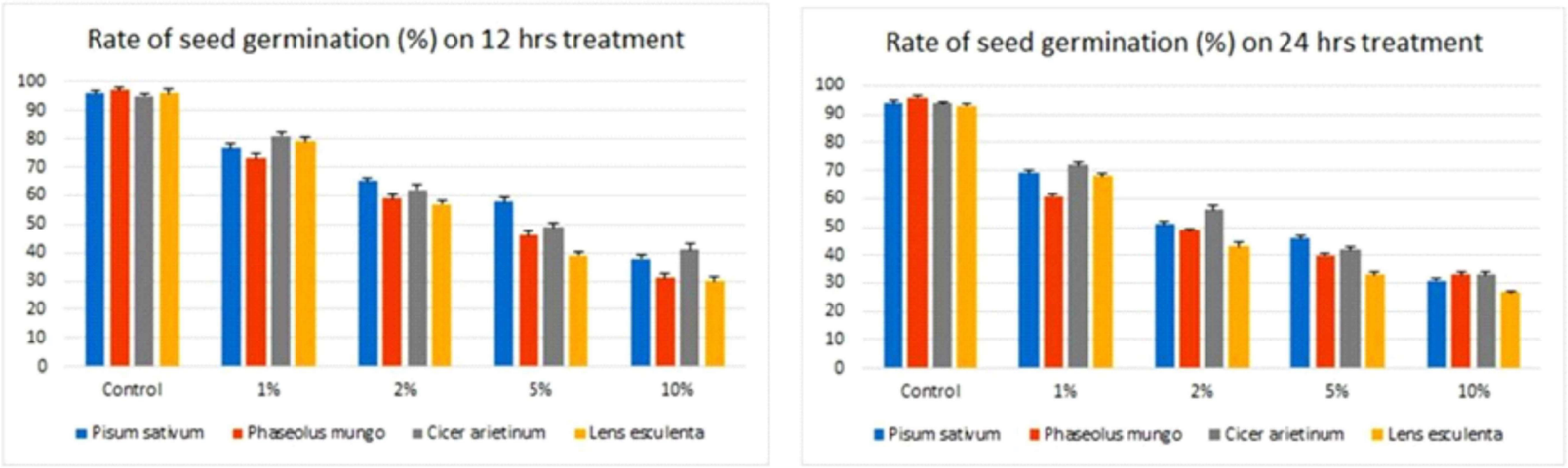
Effects on seed germination:

In *P. sativum* seed germination took place about 96±0.9%, 77±1.54%, 65±0.91%, 58±1.15% and 38±1.38% of in control, 1%, 2%, 5% and 10% leaf extract solution respectively when the seeds were wet on 12 hours. On the other hand, about 94±0.98%, 69±0.86%, 51±1.07%, 46±1.06% and 31±0.66% of seed germination took place in control, 1%, 2%, 5%, and 10% extract solution respectively when the seeds were wet on 24 hours in the same species. The other pulses, *P. mungo* there are about 97±0.85%, 73±1.92%, 59±1.59%, 46±1.69% and 31±1.47% of seed germination took place when the seeds were soaked on 12 hours and about 96±0.48%, 61±0.76%, 49±0.99%, 40±0.9% and 33±0.83% on 24 hours treatment in control, 1%, 2%, 5%, and 10% extract solution respectively. In *Cicer arietinum* there were about 95±0.54%,81±1.41%, 62±1.74%, 49±1.48% and 41±2.01% of seed germination took place in control, 1%, 2%, 5%, and 10% extract solution respectively when the seeds were soaked on 12 hours. Alternatively, about 94±0.46%, 72±0.79%, 56±1.9%, 42±0.68% and 33±0.81% of seed germination took place in control, 1%, 2%, 5%, and 10% extract solution respectively when the seeds were soaked on 24 hours in the same species. In *Lens esculenta* there were about 96±1.2%, 79±1.75%, 57±1.49%, 39±1.34% and 30±1.64% of seed germination took place when the seeds were soaked on 12 hours and about 93±0.98%, 68±1.19%, 43±1.4%, 33±0.86% and 27±0.39% on 24 hours treatment in control, 1%, 2%, 5%, and 10% extract solution respectively.

The use of different concentrations of leaf extracts of *Anthocephaluscadamba* were significantly inhibited the germination and seedling growth of *Pisum sativum*, *Phaseolus mungo*, *Cicer arietinum* and *Lens esculenta* as compared to the control. It is clear from the results that application of aqueous extracts reduced germination rate of all used pulses. Seed germination rate as shown in Table-1, among various concentrations of leaf extracts and time period on seed treatment, maximum germination rate was observed in control while the minimum was found in 10% leaf extract on both 12 and 24 hours treatment. The examination uncovered that the inhibitory impact of leaf extricates expanded with expanding extract concentration and time (Table-1). Seed germination of *P. sativum* was strictly inhibited and only 38 and 31 percent

TABLE-3: Allelopathic effects of *Anthocephalus cadamba* on root length (cm) of different pulses. Results are the mean of 6 replicates ±SE

	Root length(cm) on 12 hrs leaf extract treatment seeds					Root length(cm) on 24 hrs leaf extract treatment seeds				
Crops	Control	1%	2%	5%	10%	Control	1%	2%	5%	10%
Pisum sativum	3.3±0.5	3.2±0.4	2.6±0.1	2.3±0.2	2.0±0.3	3.3±0.1	3.0±0.1	2.3±0.3	2.2±0.2	2.0±0.2
Phaseolus mungo	3.3±0.6	3.2±0.4	2.8±0.6	2.5±0.1	2.0±0.2	3.3±0.4	3.2±0.2	2.2±0.6	2.1±0.6	2.0±0.2
Cicer arietinum	3.6±0.8	3.1±0.7	3.0±0.1	2.4±0.4	2.2±0.2	3.6±0.1	2.8±0.4	2.3±0.2	2.2±0.7	2.1±0.8
Lens esculenta	3.6±0.5	3.6±0.2	2.8±0.7	2.8±0.3	2.6±0.6	3.6±0.2	3.5±0.1	2.9±0.4	2.5±0.5	2.1±0.3



Graph-1: Allelopathic effects of *Anthocephalus cadamba* on seed germination (%) of different pulses

seed germination observed in 10% extract when the seeds soaked on 12and 24 hours treatment respectively. On the other hand, only 31%, 41% and 30% seed germination were observed on *P. mungo*, *C. arietinum* and *L. esculenta* when soaked in 10%extract on 12 hours treatment respectively (Table-1 & Fig. 1).

Shoot Length

It is shown that the shoot length of treated germinated seeds was significantly reduced with the application of leaf extract. Shoot length decreased extensively with increasing leaf extract of *A. cadamba* in all the treatments (Table-2 & Fig. 2). Number of leaves reduced significantly with increasing concentration of the leaf extract. The maximum inhibitory effect on shoot length was found in 10% concentration of leaf extract while the lowest was found in 1%. The shoot length of *P. sativum* was severely inhibited and only 3.1±0.3 cm and 2.8±0.2cm length observed in 10% extract when the seeds soaked on 12 and 24 hours treatment respectively. On the other hand, only 3.0±0.2 cm, 3.6±0.3 and 2.4±0.3 cm shoot length was observed in *P. mungo*, *C. arietinum* and *L. esculenta* when soaked in 10% extract on 12 hours treatment and 2.4±0.5 cm, 2.5±0.3 cm and 2.0±0.1 cm respectively when soaked in 10% extract on 24 hours treatment (Table-2 & Fig. 2).

Root length

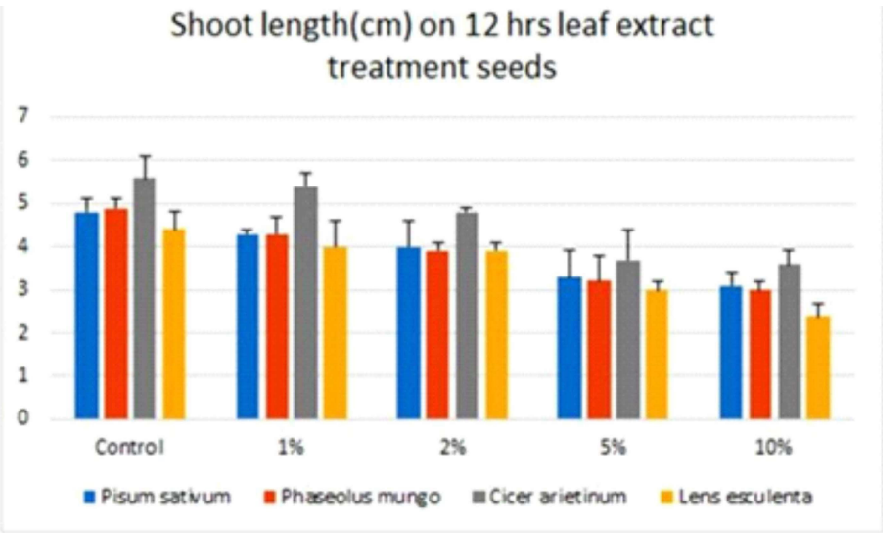
The mean root length for the control group was 3.3±0.5cm, with the 1% leaf extract mixture measuring 3.2±0.4 cm and the 10% *A. cadamba* mixture measuring 2.0±0.3 cm (Table-3). Root length decreased significantly with increasing leaf extract of *A. cadamba* in all the treatments. The highest inhibitory effect on root length was found in 10% concentration of leaf extract. The highest root length was observed in control where the length of roots is 3.3±0.5 cm, 3.3±0.6 cm, 3.6±0.8 cm and 3.6±0.5 cm in *P. sativum*, *P. mungo*, *C. arietinum* and *L. esculenta* respectively. Root length of *P. sativum* was strictly inhibited and only 2.0±0.3 cm and 2.0±0.2 cm length observed in 10% extract when the seeds soaked on 12 and 24 hours treatment respectively. On the other hand, only 2.0±0.2 cm, 2.1±0.8 cm and 2.1±0.3 cm root length was observed in *P. mungo*, *C. arietinum* and *L. esculenta* when soaked in 10% extract on 24 hours treatment respectively (Table-3 & Fig. 3).

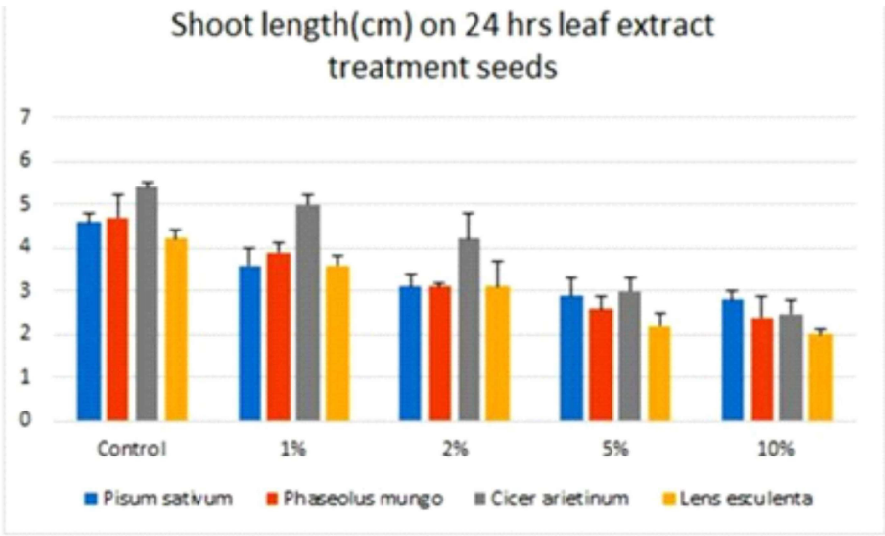
Discussion

Present investigation shows that treatment of leaf extracts of *Anthocephalus cadamba* on *Pisum sativum*, *Phaseolus mungo*, *Cicer arietinum* and *Lens esculenta* seeds sharply reduced seed germination and also influenced the seedling development and hindrance intensified with expanding concentration. The reduction in seed germination rate and seedling growth might be credited to the diminished pace of cell division and cell extension because of the presence of the allelochemicals[8]. The allelopathic extracts from teak leaves significantly inhibited germination and growth of *Lycopersicum esculentum*, *Solanum melongena* and *Capsicum annum*[10,15]. The allelopathic influence of *Eucalyptus* sp. has been significantly inhibited the germination speed, radical and plumule length of crops with increased concentrations of leaf extracts[20,30]. Several workers have covered the allelopathic capability of normal weeds on germination, seedling development and yield of a few harvest crop types[7,9,17]. Examination of various allelopathic studies revealed that inhibition of seed germination is generally attributed to the change in pH, presence of phenolic content in plant extracts and due to alterations in the enzymatic activity of seeds[2,6,26]. Therefore, this study has examined the inhibitory nature of interference of leaf extract of *A. cadamba*. Comparison of treatments revealed that shoot and root length of *P. sativum*, *P. mungo*, *C. arietinum* and *L. esculenta* was reduced with the application of extract. The length of shoots and roots were greatly reduced in all leaf extracts of *A. cadamba* and inhibition increased with increasing concentration. Workers[21] have reported teak as a potential harmful allelopathic plant to maize. But the length of shoot, root and leaf area decreased while increasing the concentration of *Tectona* dry leaf extract treatment on seedling growth. Other workers[30] announced that the length of radicles and plumules of cucumber, radish and chinese cabbage treated with litter concentrates of three *Eucalyptus* species were more limited than control and higher focus instigated more prominent phytotoxicity. Moreover, leaf concentrates of *E. camaldulensis* diminished root and shoots lengths of tomato[4]. From the present study, it can be concluded that various concentrations of leaf extracts of *A. cadamba* had allelopathic consequences for germination and seedling development of common pulses.

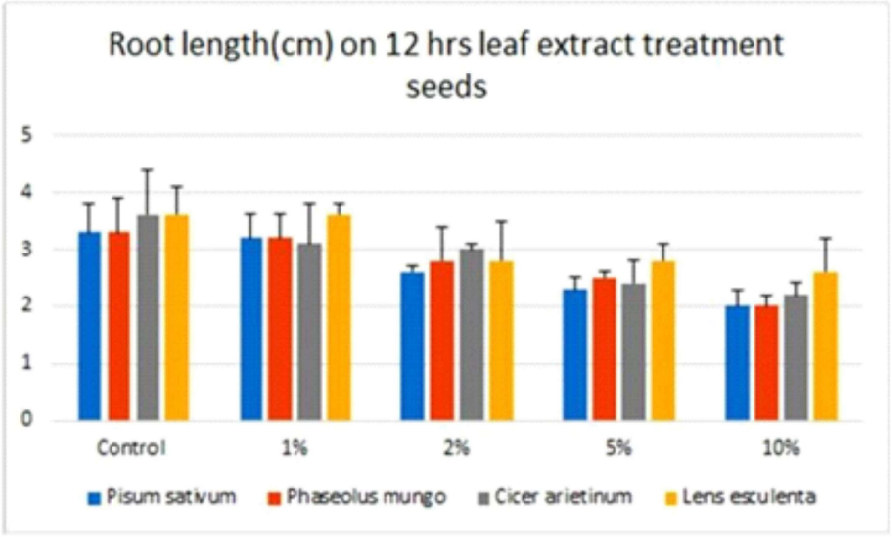
Conclusion

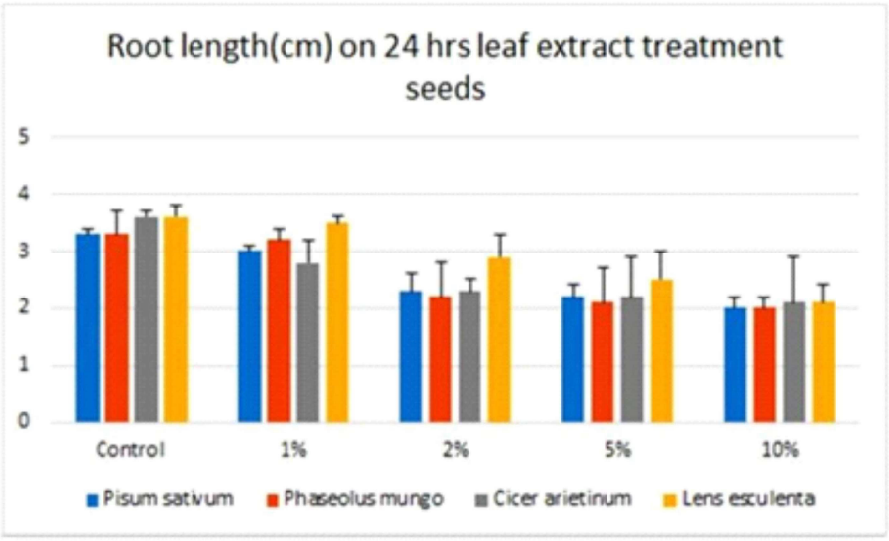
From the present investigation it may be concluded that the allelopathic effects of *A. cadamba* has succeeded in suppressing the common pulses, namely *P. sativum, P. mungo, C. arietinum* and *L. esculenta*. Allelopathy is a concentration dependent phenomenon whereby its effect increases as the concentration of the extracts increases. Compared with the control, higher concentrations reduced the seed germination rate, shoot and root lengths.





Graph-2: Allelopathic effects of *Anthocephalus cadamba* on shoot length (cm) of different pulses





Graph-3: Allelopathic effects of *Anthocephalus cadamba* on root length (cm) of different pulses

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