ALLELOPATHIC EFFECTS OF AZADIRACHTA INDICA AND EUCALYPTUSGLOBULUS ON GERMINATION OF VIGNA SP

Gaikwad S.V.
Dada Patil Mahavidyalaya, Karjat, Dist.Ahmednagar 414402. (MS) India.
suvarna406@gmail.com

Dr.Nikam V.K.
Sadguru Gadage Maharaj College, Karad, Dist.Satara 415110. (MS)India.

Dr.Pawar K.B.
Department of Botany, Shivaji University, Kolhapur 416004. (MS) India.

Abstract

The present study was carried out to investigate the allelopathic effectof Azadirachtaindica A.Juss.andEucalyptus globulusLabill.onseed germination and growth parameters of Vigna radiata and Vigna aconitifoliain nearby Pandharpur area, Maharashtra, India.Leaf leachate of different concentration (1%,5% and 10%)of A.indica and E.globuluswere used for the study.The results revealed that both A.indicaand E.globulushave allelopathic potential and have inhibitory effect on germination of Vigna sp.As compare to A.indica,E.globulus had more inhibitory effects on germination and growth parameters of Vigna species.From present investigation,it is concluded that this will useful to avoid negative impact of chemical herbicides which are used by farmers for increasing agriculture production.

Keywords:*Allelopathy, Azadirachta, Eucalyptus, Leaf leachate, Inhibitory effect.*

Introduction:

Allelopathy is a novel approach offering multiple solutions for weed management.It can replace hazardous chemical and mechanical approaches being used in crop production (Farooq *et al*, 2013).Agroforestry is a system in which there is integration of trees and shrubs into farming landscapes to increase sustainability of farming (Fikreyesus*etal.*, 2011).Many higher plants in agroforestry system have some effect on associated plant.This effect may be either positive or negative. A mechanism in which live or dead plant materials release certain chemical substances, which inhibit or stimulate growth of assosiatedplant, is called as Allelopathy(Macias *et al*. 2003; Cheng and Cheng 2016).These chemical substances are called as allelochemicals,e.g. Phenolics, alkaloids, flavonoids,etcwhich are present in plant parts like root, stem, leaves &fruits.These allelochemicals can be released into environment by processes like weathering, volatization, root exudation, leaching and decomposition of plant residues(Rice,1984).According to Inderjit and Mukerji,2006 there is great demand for compounds with selective toxicity that can be readily degraded by either plants or soil microorganisms which provide new strategies for maintaining and increasing agricultural production in future.

A.indica(Family Meliaceae) is an evergreen tree native to Southeast Asia.All parts of tree have been used medicinally such as toothpastes,soaps,lotion and insecticides(Ashrafi,*et al*.2009).*Eucalyptus globulus* belongs to Myrtaceae family and are Indigenous to Australia(May and Ash,1990).Test plants are green gram and moth bean.Green gram (*Vigna radiata* L), is an annual herbaceous plant and belongs to family Fabaceae. Moth bean (*Vigna*

aconitifolia L.),is a draught resistant legume and also belongs to family Fabaceae. Seeds of *Vigna* species may be used in variety of dishes like soups, snacks, bread, etc.They are sometimes specifically grown for green manure.

A.indica and *E.globulus* are the dominant species in Pandharpur area. According to EI-Darier,2002 large area of ground surface beneath of *Eucalyptus* remains bare and is limited understory vegetation growth.Taking into consideration, studies on allelopathic effects of leaf leachates of *A.indica*and *E.globulus*on growth and germination of *Vigna* crops was undertaken.

Materials and Methods

1.Preparation of leachate

Fresh and clean leaves of *A.indica* and *Eucalyptus* plants were collected from Pandharpur region,Maharashtra,India.The leaves were washed with distilled water, blotted to dry and dried in hot air oven at 60^{o}c.The leachates of different concentration like(1%,5%,and 10%)were prepared with distilled water and the extracts were filtered through the muslin cloth. This filtrate was used as leachate for further study.

2. Germination study

Petri plate technique was followed for germination studies. Sterilized Whatsman 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 10 seeds were kept for germination in each petri plate and control sets were maintained with distilled water.Germination percentage, root length, shoot length,Fresh weight and dry weight were determined after 72 hrs by drying the seedling in oven at 60^{o}c.

Results and Discussion

Effect on Seed germination

Allelopathic effects of leachate of *A.indica*on germination and growth parameters on***Vigna sp.*** are summarized in table 1 & 2.From table 1 and 2,it is observed that leaf leachate of *Azadirachta*showed inhibitory effect on germination of *V.radiata* and *V.aconitifolia*.The inhibitory effect get increased with increasing leachate concentration. Highest inhibitory effect on germination percentage was observed at 10% leachate concentration and at 72 hrs treatment. Inhibition of germination percentage was proportional to leachate concentration and treatment dutration,it means there is concentration dependant inhibition. These results are silmilar to the study done by (Randhawa,*et al*,2002) who worked on allelopathic effect of *Sorghum* water extract on the germination and seedling growth of *Trianthemaportulacastrum*.

Effect on seed germination on both *Vigna*sp.due to *E.indica*leaf leachate was shown in table 3 and 4.It is observed that,leaf leachate of *Eucalyptus* also showed inhibitory effect on *Vigna*sp.It is also concencentration dependant inhibition,where maximum inhibition was seen

at 10% leachate concentration. Similar results were obtained in tomato by (Fikreyesus*et.al*,2000),in wheat by (Khan *et al*.,2008)and in cucumber by (Allolli and Narayanareddy,2000)due to leaf extract of *Eucalyptus*sp.According to Chapius-Lardy et *al*.2002,there are certain phenolic compounds such as caffeic, coumaric, gallic, gentisic, hydroxybenzoic,synergic and vanillic acids in *Eucalyptus* which act as allelochemicals(Rice,1984),which can inhibit gibberelic acid.Gibberellic acid regulate enzymatic activity during seed germination(Das *et al*.,2012).So,there is possibility that seed germination get inhibited due to *Eucalyptus*.

Effect on Root and Shoot Length

Effects of leaf leachate of *A.indica* on root and shoot length of *Vigna*sp.areshown in table 1&2.Root and shoot length get reduced at all concentrations in both *Vigna* sp.This reduction increases with increase in concentration of leaf leachate.These findings are supported by the work of Zhang and Shenglei(2010).He reported that the length of radicles and plumules of radish,cucumber and chinese cabbage treated with litter extracts of three *Eucalyptus* species were shorter than control and higher concentration induced greater phytotoxicity.

From table 3 & 4,it is revealed that root and shoot length of both *Vigna*sp.get inhibited due to *Eucalyptus* leaf leachate.Among the different concentrtion,prominent inhibition seen at highest leachate concentration i.e.at 10% concentration.Pawar and Chawan (1999) reported that some forest trees including *Eucalyptus globulus* reduced nutrient uptake in *Sorghum*.This could be the reason for reducing growth.

Table 1-Allelopathic effect of leachate of *Azadirachta*on germination and growth parameters of *Vigna radiata*

Treatments	Germination Percentage(%)	Root length (cm)	Shoot Length (cm)	Fresh weight of seedling(gm)	Dry weight of seedling(gm)
Control	100	4.09	8.27	2.50	0.28
1%	90	2.00	3.77	1.47	0.26
5%	80	1.02	2.7	1.36	0.22
10%	50	0.67	1.44	0.90	0.13

Table 2-Allelopathic effect of leachate of *Azadirachta*on germination and growth parameters of *Vigna aconitifolia*

Treatments	Germination Percentage(%)	Root length (cm)	Shoot Length (cm)	Fresh weight of seedling(gm)	Dry weight of seedling(gm)
Control	100	3.85	7.05	1.45	0.21
1%	90	3.0	5.71	1.41	0.14
5%	70	1.82	3.46	0.80	0.14
10%	50	0.84	2.53	0.67	0.6

Table 3-Allelopathic effect of leachate of *Eucalyptus* on germination and growth parameters of *Vigna radiata*

Treatments	Germination Percentage(%)	Root length (cm)	Shoot Length (cm)	Fresh weightof seedling(gm)	Dry weight seedling(gm)
Control	100	4.74	7.00	1.76	0.77
1%	90	3.77	6.38	2.42	0.33
5%	60	0.85	1.38	0.61	0.12
10%	50	0.65	1.14	0.44	0.08

Table 4-Allelopathic effect of leachate of *Eucalyptus* on germination and growth parameters of *Vigna aconitifolia*

Treatments	Germination Percentage(%)	Root length (cm)	ShootLength (cm)	Fresh weight of seedling(gm)	Dry weight of seedling(gm)
Control	100	4.21	6.67	1.67	0.24
1%	90	3.32	6.63	1.43	0.19
5%	60	0.37	1.32	0.42	0.07
10%	50	0.18	1.09	0.31	0.06

Effect on Freshand dry weight

From table 1 and 2 it is observed that,fresh and dry weight of both *Vigna*sp.get reduced as the concentration of leachate of *A.indica*increases.Moreover,maximum inhibition in fresh and dry weight seen at 10% leachate concentration and at 72 hrs.According to Namkeleja*et al*.,2014,allelochemicals reduce plant water potential and inhibits minerals and ion uptake by plants and reduces fresh weight.Bajalan et al.,2013 also found similar results while working on allelopathic effects of aqueous extract from *Salvia officinalis* L.on seed germination of Barley and purslane.

Effect of *Eucalyptus* leachate on fresh and dry weight both *Vigna* sp.depicted in table 3 and 4.It also show significant inhibition on fresh and dry weight of *Vigna* sp.According to (Hassannejad et al.,2013),a number of previous studies have suggested that the degree of inhibition increases with increase in extract concentrations.

Conclusion

From present study it can be concluded that, all concentrations of leaf leachate of *A.indica* and *E.globulus* had allelopathic effects on germination and growth parameters of *V. radiata* and *V.aconitifolia*. The leaf leachate of *Azadirachta* and *Eucalyptus* showed continuous Inhibitory effect on the growth and germination of*Vigna* sp. It is useful in the industries for the production of different types of agrochemicals particularly organic herbicides which is helpful to avoid negative effect of chemical herbicides. Moreover, further research has to be done to identify the type of allelochemicals present in *Azadirachta and Eucalyptus*.

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