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Allelopathic effects of *Melia azedarach*, *Morus alba and Moringa oleifera* on germination, radicle and plumule growth of *Glycine max*

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Allelopathy is a natural phenomenon where plant-plant interactions play an important role. Allelopathy plays a significant role under both natural and managed ecosystems (Rice, 1984), and adversely affects seed germination and seedling growth. Rice (1984) defined allelopathy as a process by which plants release chemical compounds in their environment to keep themselves with a competitive advantage (Kong *et al*., 2004). There are hundreds of secondary metabolites in the plant kingdom and many are known to be phytotoxic (Einhellig, 2002). Compounds such as phenolics, terpenoids, alkaloids, fatty acids, steroids and polyacetylenes are known to play an important role in allelopathy, which includes positive and negative effects in the plants (Inderjit, 1996).

In traditional agroforestry systems of Garhwal Himalaya, farmers usually grow agricultural crops and various multipurpose trees on terrace risers especially in rainfed areas. In last few decades with increasing recognition of agroforestry as an alternative land use, many scientists have focused their attention on trees to grow with agricultural crops. These trees contribute to sustainability of food production and are essential for the survival of local population (Tripathi *et al*., 2000; Sachan, 2006), and also contribute in stabilizing and improving farmland productivity, although many trees have allelopathic effect which adversely affect the growth of agricultural crops. Before accepting any tree-crop combination it is essential to test the tree-crop combinations which will indicate the least chances of crop failure or low productivity. Therefore, the present study was undertaken to understand the effects of *Melia azedarach*, *Morus alba and Moringa oleifera* on germination, radicle and plumule growth of *Glycine max*.

The present study was conducted in the year of 2008 to find out suitable order of combinations of *Melia azedarach* Linn., *Morus alba* Linn. *and Moringa oleifera* Linn. with *Glycine max*. The study was carried out for bioassay culture in laboratory under control. Mature trees were selected to collect leaves. The sun-dried leaves of each tree were ground separately in a mechanical grinder. A powder sample of 1g, 2 g, 3g, 5g of each component of leaf of each species was weighed and added to 100 ml of double distilled water and kept at room temperature (25-30°C) for 24 h. The solutions were filtered through Whatman No. 1 filter paper and stored in dark. The effect of the aqueous extracts on germination, radicle and plumule length was tested by placing 10 seeds in petri dishes (15 cm in diameter) with four replicates of each test crop. The filter paper was kept saturated with the aqueous extracts. A separate series of control was set up using distilled water. The germinated seeds were counted every day for 7 days. Data and leaf leachates concentration (%) were compared with control using t-test following Snedecor and Cochran (1968).

The germination of *Glycine max* was tested with the trees leaf leachates of *Melia azedarach, Morus alba and Moringa oleifera* and compared with control. Among the trees leachates the highest (57.5%) germination of *Glycine max* was in *M. alba* followed by *M. oleifera* (55%) and *M. azedarach* (50%). The germination in control was 60%. The germination of *Glycine max* irrespective of tree leachates was 54.17% which was reduced (9.72%) over control.

Radicle and plumule length of *G. max* was reduced by leaf leachates and reduction increased with increasing concentration of leaf leachates. In 1% concentration the maximum radicle (4.14±0.58) and plumule (1.30±0.57) length of *G. max* was in *M. alba* and minimum radicle (3.28±1.24) and plumule (1.23±0.62) in *M. oleifera* (Table 1) and with increasing leaf leachates concentrations the radicle and plumule length were reduced as compared to control. The higher concentration (5%) of leaf leachates reduced 66.1% to 84.6% radicle

Table 1: Effect of tree leachates on germination (%), radicle and plumule length (cm)

Trees		Concentration of leaf leachates (%)				Germination
		1%	2%	3%	5%	(%)
Melia azedarach	Radicle length	3.46±1.09 (19.2)	2.32±0.30 (45.8)	1.19±0.43* (72.2)	0.66±0.09* (84.6)	50.0 (16.67)
	Plumule length	1.28±0.25 (31.2)	1.2±0.84 (35.5)	0.57±0.12 * (69.4)	0.39±0.06* (79.0)	
Morus alba	Radicle length	4.14±0.58 (3.3)	3.22±0.51 (24.8)	2.48±0.36* (42.1)	1.45±0.41* (66.1)	57.5 (4.17)
	Plumule length	1.3±0.57 (30.1)	1.27±0.29 (31.7)	1.11±0.19^{ns} (40.3)	0.8±0.13* (57.0)	
Moringa oleifera	Radicle length	3.28±1.24 (23.4)	3.18±0.62 (25.7)	1.95±0.23* (54.4)	1.18±0.34* (72.4)	55.0 (8.33)
	Plumule length	1.23±0.62 (33.9)	1.18±0.22 (36.6)	0.93±0.12* (50.0)	0.59±0.11* (68.3)	
Control						
	Radicle length	4.28±0.61	4.28±0.61	4.28±0.61	4.28±0.61	60
	Plumule length	1.86±0.34	1.86±0.34	1.86±0.34	1.86±0.34	

*Significant at p<0.05, NS=not significant
(Values in parenthesis indicated % reduction over control)

length and 57 % to 79 % plumule growth in *M. alba* and *M. azedarach* species, respectively (Table 1). The radicle and plumule length of *G. max* was reduced significantly (p<0.05) in 3% and 5% leaf leachates of trees. A similar study on germination and radicle length carried out between trees (*Aporos octandra*, *Anthocephallus chinensis* and *Albizia procera*) and crops (*Glycine max*, *Oryza sativa* and *Brassica campestris*) by Kumar *et al*. (2008), found that irrespective of trees and source of extract, *Glycine max* was the most resistant crop.

The present study indicate that the leaf leachates of all tree species suppress the germination, radicle and plumule growth of *Glycine max* which were subsequently reduced with the higher concentration of all trees leachates. The foliage leachates are potent source of toxic metabolites and their toxic effects are species specific (May and Ash, 1990; Todaria *et al*., 2005; Singh *et al*., 2009). The lower germination and allelopathic inhibition may also be the consequence of the inhibition of water uptake (El-Khatib, 1997). The bioassay studies have also proved that different plant parts release toxic metabolites into the soil that adversely affect germination and growth of food crops (Qusem, 2002).

In conclusion, results of the present study showed that all the tree species tested inhibited germination, growth and development of the tested agricultural crop (*Glycine max*). Further, inhibition was significantly (p<0.05) more marked at higher concentration (3% and 5%) of the leachates. Therefore, it is suggested that tree species should be lopped before leaf litter fall to minimize their toxic effects on the growth of *Glycine max*. The lopped refuse could be used for other purposes e.g., branches could be used as fire wood and leaves as bedding material, fodder *etc*.

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