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Plant growth inhibitory potential of chloroform and acetone fractions of various parts of *Albizia-lebbek* L. (Benth.)

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Abstract

Chemical communication between two nearby plants causing unpropitious effect on germination and development of one plant species or microorganisms is described as allelopathy. Such interactions and mechanism of phytochemicals resulting plant growth inhibition have not completely known yet. Chloroform and acetone fraction of crude extract of different parts viz. stem, root and seeds of *Albizia lebbek* were examined for their growth inhibitory potential against germination of radish seeds. The recent frontier is the usage of allelochemicals as substitute of precarious weedicides as they do not impart hazardous impact on environment. So the comparative approach of growth inhibitory potential of chloroform and acetone fractions of stem, root and seeds of *Albizia lebbek* on germination of radish seeds is being reported in this research paper.

Keywords: unpropitious, phytochemicals, albizia lebbek, fractions

1. Introduction

Every plant found on the earth has its own special expertise to synthesize phytochemicals using inorganic and organic resources according to their needs and deeds. Such chemical compounds having diverse molecular structures, physical and chemical properties show peculiar chemical communications with living creatures of aforesaid vicinity i.e. plants or microbes in an undefined way. These chemical interactions may cause inhibition or stimulation effect on germination of plant or microbes in their rhizospheres. This plant growth inhibitory tendency of a plant is called allelopathy. The word 'Allelopathy' was originated from the Greek word, allelon, meaning 'among each other', and pathos, meaning 'suffering'. The first time usage of word 'Allelopathy' was reported by an Austrian plant physiologist Hans Molisch in 1937 in his last book, *Der Einfluss einer Pflanze auf die andere – Allelopathie*, in Germany (Willis, 1985) [7].

Allelopathy is not only provoked by intrusion of two contiguous plants but also it has intimacy of soil mediated intercession. Aforesaid soil mediated allelopathy may be afflicted by physical, chemical and biotic factors arose in vicinity (Inderjit and Weiner, 2001) [3]. In worldwide agricultural practices, interference of undesired plants i.e. weeds to the crop is an age old problem and mazor concern is to revamp quality and yield of crop but it is sceptically influenced by weeds (Kasasian, 1971; Khanh *et al.*, 2011) [4, 5]. Crop yield loss due to affliction of weeds was found to be more than overall loss caused by diseases and pests (Asaduzzaman *et al.*, 2010) [1]. Inhibitory effect of weeds over crop is not only by virtue of competition for resources and needs but also due to allelopathic interactions (Sanjerehei *et al.*, 2011) [6]. The intention of research is the usage of plant growth inhibitory potential in agropractices. This paper implies the comparative approach of growth inhibitory potential of chloroform and acetone fraction of crude extract of stem, root and seeds of *Albizia lebbek* against radish seed germination. Hence, an attempt has been made to determine the allelopathic influence of various fractions of *Albizia lebbek*.

2. Materials and Methods

2.1 Extraction and Preparation of fractions/extract from stem and test solutions for screening of allelopathic activity

The shadow dried chopped pieces of stem of *Albizia-lebbek* (3.0 kg) were taken into round bottom flask (5 lit.) and extracted with hot methanol for six hours. The solvent was removed to get extractives. The procedure was repeated thrice. The extractives were concentrated over

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water bath under reduced pressure to obtain the viscous mass. This viscous crude extract of stem of *Albizia-lebbek* was mixed with silica gel (60 – 120 mesh) and fractionated successively (the solvent was mixed with extract and kept for six hours) with different solvent viz. hexane and ethyl acetate. The procedure was repeated four times. The fractionated solvent concentrated on water bath under reduced pressure to obtain the viscous mass. The viscous mass thus obtained was the fraction of respective solvent. Crude extract and all obtained fractions were evaluated for their allelopathic activity.

2.2 Extraction and Preparation of fractions/extract from root and test solutions for screening of allelopathic activity

The shadow dried chopped pieces of root of *Albizia-lebbek* (3.0 kg) were taken into round bottom flask (5 lit.) and extracted with hot methanol for six hours. The solvent was removed to get extractives. The procedure was repeated thrice. The extractives were concentrated over water bath under reduced pressure to obtain the viscous mass. This viscous crude extract of root of *Albizia-lebbek* was mixed with silica gel (60 – 120 mesh) and fractionated successively (the solvent was mixed with extract and kept for six hours) with different solvent viz. hexane and ethyl acetate. The procedure was repeated four times. The fractionated solvent concentrated on water bath under reduced pressure to obtain the viscous mass. The viscous mass thus obtained was the fraction of respective solvent. Crude extract and all obtained fractions were evaluated for their allelopathic activity.

2.3 Extraction and Preparation of fractions/extract from seeds and test solutions for screening of allelopathic activity

The shadow dried chopped pieces of seeds of *Albizia-lebbek* (3.0 kg) were taken into round bottom flask (5 lit.) and extracted with hot methanol for six hours. The solvent was removed to get extractives. The procedure was repeated thrice. The extractives were concentrated over water bath under reduced pressure to obtain the viscous mass. This viscous crude extract of seeds of *Albizia-lebbek* was mixed with silica gel (60 – 120 mesh) and fractionated successively

(the solvent was mixed with extract and kept for six hours) with different solvent viz. hexane and ethyl acetate. The procedure was repeated four times. The fractionated solvent concentrated on water bath under reduced pressure to obtain the viscous mass. The viscous mass thus obtained was the fraction of respective solvent. Crude extract and all obtained fractions were evaluated for their allelopathic activity.

A stock solution of 2000ppm of each fraction / extract were prepared in minimum amount of acetone and made up with distilled water. Further dilutions of 1500ppm, 1000ppm, 500ppm and 100ppm were made up from that stock solution for analyzing their allelopathic activity.

3. Experimental Section

Allelopathy Test

The seeds were surface sterilize in 95% ethanol for 15 seconds and sown in Petri plates of 90 mm diameter. In each Petri plate, ten seeds were taken. The Petri plates were layered with two ordinary filter papers each on with 7 ml of test solutions of different compounds of varying concentrations (100ppm, 500ppm, 1000ppm, 1500ppm and 2000ppm) were poured. A mixture of distilled water: ethanol (30: 1, 7 ml) was taken as control. Three replicates of each concentration were taken.

The radish (*Raphanus sativus* L.) seeds selected for activity analysis were collected from Kisan Seva Kender CCSHAU, Hisar. The variety of the seeds used was spheda. The investigations were carried out in the Department of Chemistry. The radish seeds were allowed to germinate at 25 °C in incubator with 12 hours of photoperiod. After 120 hours, the number of seeds germinated in each Petri plate were counted and percent seed germination inhibition values were calculated (Feo, 2003) ^[2].

Allelopathic activity of chloroform fraction

Chloroform fraction of stem, root and seeds of *Albizia-lebbek* were tested for their allelopathic activity against the germination of seeds of radish at 100, 500, 1000, 1500 and 2000ppm concentration. The data of activity presented in figure 1.1.

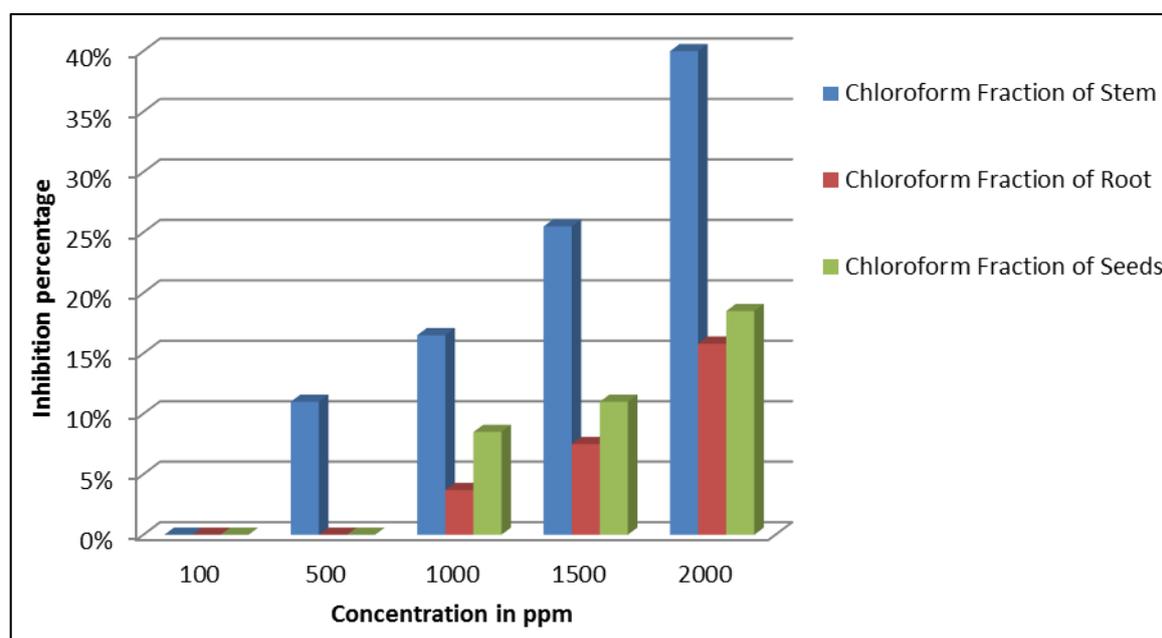


Fig 1.1: Allelopathy activities of chloroform fractions of stem, root and seeds of *Albizia lebbek* L. Benth

Allelopathic activity of acetone fraction

Acetone fraction of stem, root and seeds of *Albizia-lebbek* were tested for their allelopathic activity against the

germination of seeds of radish at 100, 500, 1000, 1500 and 2000ppm concentration. The data of activity presented in figure 1.2.

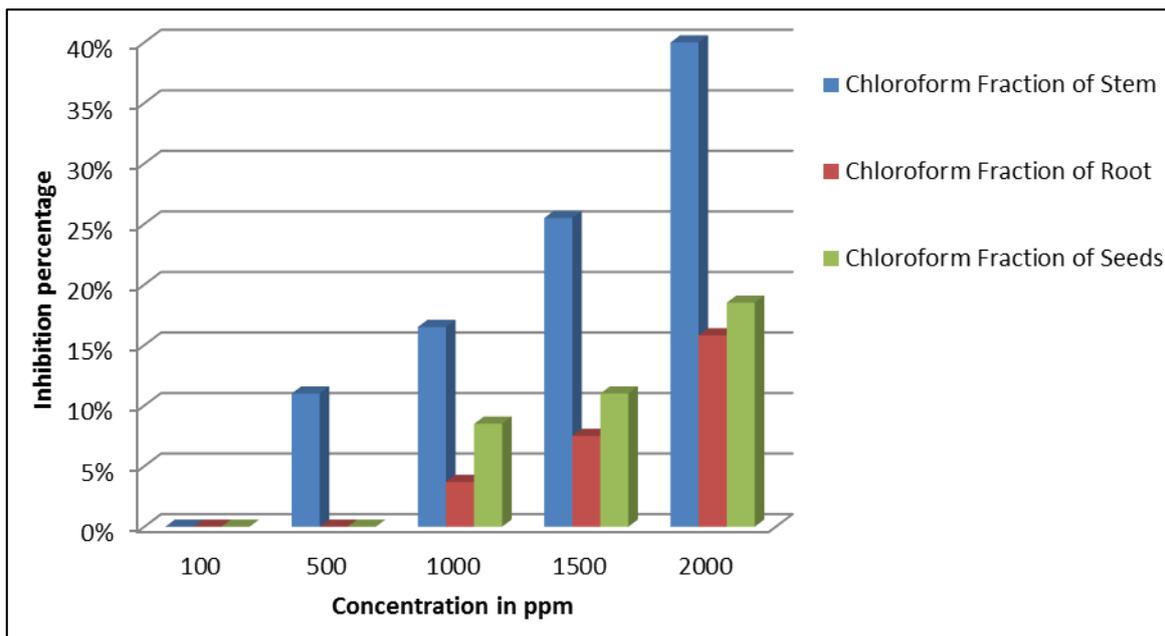


Fig 1.2: Allelopathy activities of acetone fractions of stem, root and seeds of *Albizia lebbek* L. Benth

Allelopathic activity of crude methanol extract

Crude methanol extract of stem, root and seeds of *Albizia-lebbek* were tested for their allelopathic activity against the

germination of seeds of radish at 100, 500, 1000, 1500 and 2000ppm concentration. The data of activity presented in figure 1.3.

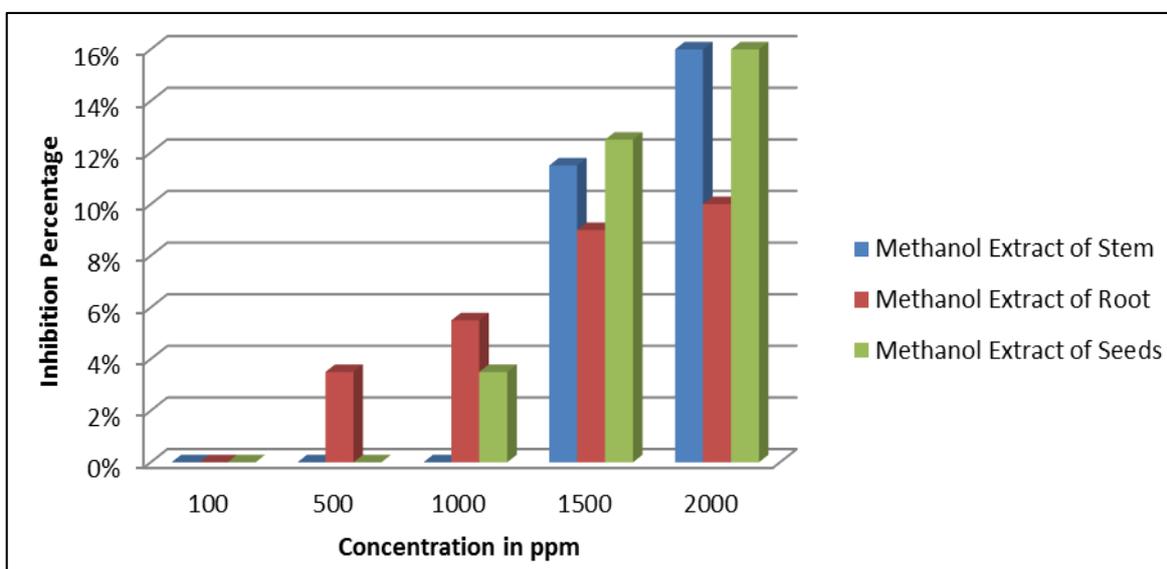


Fig 1.3: Allelopathy activity of crude methanol extract of stem, root and seeds of *Albizia lebbek* L. Benth

4. Result and Discussion

Allelopathy Activity

The data of activity presented in figure 1.1 showed that maximum plant growth inhibitory effect i.e. 40.0% was shown by chloroform fraction of stem at 2000ppm followed by same fraction of seeds at 2000ppm i.e. 18.5%. Chloroform fraction of seeds at 2000ppm concentration revealed 18.5% inhibition followed by same fraction of stem i.e. 16.5% at 1000ppm concentration successively followed by chloroform fraction of root i.e. 15.8%. Among these fractions, chloroform fraction of stem was found maximum allelopathic against germination of radish seeds while chloroform fraction of root

of *Albizia lebbek* was observed as least inhibitory fraction. The data of activity presented in table 1.2 revealed that maximum allelopathic effect was shown by acetone fraction of stem at 2000ppm i.e. 27.7% followed by same fraction of stem at 1500ppm i.e. 16.5%. Acetone fraction of seeds revealed 14.0% inhibition at 2000ppm concentration followed by similar fraction of root i.e. 9.0% at 2000ppm concentration. Acetone fraction of seeds followed by similar fractions of root at low concentration i.e.100ppm and 500ppm were found least active against germination of seeds of radish (*Raphanus sativus* L.).

The data of activity presented in table 1.3 showed that

maximum plant growth inhibitory potential i.e. 16% by crude methanol extract of both i.e. stem and seeds at 2000ppm followed by similar extract of seeds i.e. 12.5% at 1500ppm. Crude extract of stem revealed 11.5% inhibition at 1500ppm concentration followed by methanol extract of root at 2000ppm concentration i.e. 10.0%. Crude methanol extract of stem and seeds at low concentration i.e. 100ppm and 500ppm were found least active against germination of radish seeds. The comparison has been made between chloroform and acetone fractions of different plant parts viz. stem, root and seeds of *Albizia-lebbek*. Chloroform fraction of stem of *Albizia-lebbek* was found most effective allelopathic at 2000ppm and has a greater potential of allelopathic research. This fraction was followed by acetone fraction of stem and chloroform fraction of seeds. The above mentioned activity result showed a comparative study of different extract/fractions i.e. methanolic crude extract and chloroform/acetone fractions at different concentration and found that acetone fraction of root has least allelopathic potential while chloroform fraction of stem of *Albizia lebbek* has maximum allelopathic potential against the germination of seeds of radish and much attention should be paid by researcher for fantastic plant growth inhibitory potential of chloroform fraction of stem of *Albizia lebbek* (L.) Benth.

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