

Full Length Research Paper

Allelopathic impact of aqueous extracts of *Eclipta alba* L. on germination and seedling growth of *Melilotus alba* Medik.

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Received 9 June, 2011; Accepted 12 June, 2014

Allelopathy refers to the beneficial or retardatory effect of one plant on another plant through the release of chemicals from plant parts by leaching, root exudation, volatilization, residue decomposition and other processes in both natural and agricultural system. Allelochemicals concentration in the producer plants may vary from each part. Allelopathic effect of different parts extract of *Eclipta alba* L. on seed germination and seedling growth of *Melilotus alba* Medik. was conducted under laboratory condition. The trial was replicated three times in completely randomized design with four concentrations (0.5, 1, 2 and 4%). Aqueous extracts of leaf, stem and root were prepared by soaking the powder of different parts in distilled water for a period of 24 h. The germination of seeds was recorded for 15 days and radical and plumule length were recorded. The result suggested that aqueous extract from leaves significantly inhibited not only the germination but also the radical and plumule length of seedlings. Stem and root extracts also suppress the germination and seedling growth as compared to control. However, treatment with higher concentration had negative effect on rate of germination, plumule length and radical length. Hence, it is suggested that *E. alba* L. has strong allelopathic potential and might be candidate for biological control of weeds.

Key words: Aqueous extract, biological control, *Eclipta alba* L., *Melilotus alba* Medik.

INTRODUCTION

Weeds are one of major constraints to plant production worldwide. Weeds affect crop growth and production that may be significantly reduced when weeds compete with them for light, water and minerals (Hussein, 2001). Existing weed control methods are either expensive or hazardous. Heavy use of chemical herbicides in most integrated weed management systems is a major concern since, it causes serious threats to the environment, public health and increase cost of crop production.

Therefore, alternative strategies against weed must be developed. Rice (1983) defined allelopathy as the effect of one plant on other plants through the release of chemical compounds in the environment. Brown et al. (1991) defined allelopathy as the direct or indirect harmful or beneficial effects of one plant on another through the production of chemical compounds that escape into the environment. Many of the phytotoxic substances that inhibit germination and growth have been identified from plant tissues and soils. These substances are termed

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allelochemicals (Whittaker and Feeny, 1977).

Allelochemicals not only govern various ecological processes such as productivity and vegetation patterning but are also important potential source for alternative agrochemicals, pharmaceuticals and biological control agents (Hirai, 2003; Cheema et al., 2004; Macias et al., 2007; Norton et al., 2008). Many plants have been studied for their allelopathy against crops and natural vegetation (Bais et al., 2003; Fujii, 2003; Weston and Duke, 2003; Kato-Noguchi, 2003; Hussain et al., 2004, 2005; Kato-Noguchi and Tanaka, 2006).

Uludag et al. (2006) reported that allelopathy involves both inhibitory and stimulatory effects. Borges et al. (2007) working on the allelopathic activity of *Viola surinamensis* suggested that radical and hypocotyls elongation of test species were more intensely inhibited than seed germination. The allelopathic properties of plants can be exploited successfully as tool for pathogens and weed reduction (Xuan et al., 2005). Carmo et al. (2007) reported that aqueous extracts from various parts of Brazilian sassafras (*Ocotea odorifera*) inhibited seed germination, root and shoot growth and chlorophyll content of sorghum seedlings. Le et al. (2008) observed the growth inhibitory effect of cucumber on various test species. Furthermore, it was also observed that inhibition increased with amplifying concentration of extract. Rua et al. (2008) tested foliar leaf extracts of *Sapium* against seed germination and seedlings growth and found that allelopathy does not contribute to *Sapium*'s invasive success. Sisodia and Siddiqui (2007c) reported the phytotoxic or allelopathic effect of aqueous extract of weed, *Mikania micrantha*. Macias et al. (2007) suggested allelopathy as an alternate strategy for weed control. Siddiqui et al. (2009) observed the leaf extract of *Prosopis juliflora* inhibited the germination, root length and shoot length of wheat Norton et al. (2008) stated that *Centurea* avoids grazing and gains competitive advantage due to allelopathy. It is obvious that allelopathy plays important role in natural and agro ecosystem. It can also be exploited for searching new bio-control agents for weeds and insects (Hirai, 2003; Carmo et al., 2007; Borges et al., 2007; Norton et al., 2008). The present study was conducted to explore the allelopathic potential of *Eclipta alba*.

MATERIALS AND METHODS

Preparation of aqueous extracts of leaf, stem and root of donor plant

Leaf, stem and root of *E. alba* were collected from the adjoining area of the University campus, Aligarh. The aqueous extract was prepared from fresh leaves, stem and roots of the donor plant (Kumari et al., 1985). The leaves stem and roots were shed dried and then stem cut into small pieces with knife and ground in a mixer for getting powder. The ground powder passes through 2 mm mesh sieve to get fine powder.

The leaf, stem and root powder were soaked in distilled water separately and kept for 24 h. Then, extract was filtered through

Whatman No. 1 filter paper. The extract was diluted to obtain the concentrations of 0.5, 1, 2 and 4% while distilled water used as the control and stored in refrigerator in conical flasks until required.

Seed germination test (SGT)

Germination test was performed for the aqueous extracts of leaf, stem and root of donor plant. Healthy and uniform size of 10 seeds were selected and presoaked in distilled water for 24 h and then evenly placed on two layers of filter paper in sterilized Petri dish (9 cm diameter). 10 to 15 ml of aqueous extract of different concentration of aqueous extracts or distilled water for control treatment was added. The Petri dishes were placed in growth chamber (25°C). Treatments were arranged in a completely randomized design with three replications. Seeds were considered germinated upon radicle emergence. Germination was determined by counting the number of germinated seeds at 24 h intervals. Germination was recorded everyday for 15 days. Then, the root length and shoot length were recorded.

RESULTS AND DISCUSSION

In nature, many ecological ways are involved for releasing and transporting phytotoxins from allelopathic plants. Soaking in rain water, irrigation or even moist soil releases water soluble substances from living and/or dead plant parts that might have allelochemicals. The present study demonstrated the presence of allelochemicals in different parts of *E. alba* that strongly inhibited the germination and seedling growth (Figures 1 to 3). Maximum germination was reached in control (98%) and minimum (68%) was observed in 4% leaf extract. It was seen that different concentration of different parts of the donor plant significantly inhibited the germination of the test plant, especially by extracts obtained from leaves. This suggested that inhibitory effects on germination enhanced with increasing the concentration. The root and shoot growths of the test species were significantly reduced in all the treatments, especially in extract from leaf and those for higher concentration (Figures 2 and 3).

The minimum growth of root and shoot was 1.58 ± 0.03 and 4.36 ± 0.06 , respectively. The results agree with those of Pereira et al. (2008) who observed that aqueous extracts of alfalfa leaves inhibited germination, radical and hypocotyls growth. El-Rokiek and Eid (2009) who found that the inhibitory effect of foliar extract of Eucalyptus on germination of some weeds was proportional to the concentration of the extract. The similar result also observed by various authors in different plant species include (*Eucalyptus camaldulensis* (Dadkhah and Asaadi, 2010), *M. micrantha* (Sisodia and Siddiqui, 2007c), *Ageratum conyzoides* (Batish et al., 2002b; Singh et al., 2003b) and *Cyperus rotundus* (Quayyum et al., 2000). It was also observed that the toxicity of extract progressively increased with increasing the concentration. The germination, root and shoot growth of the test species were significantly decreased in all the treatments. The degree of different parts of *E. alba*

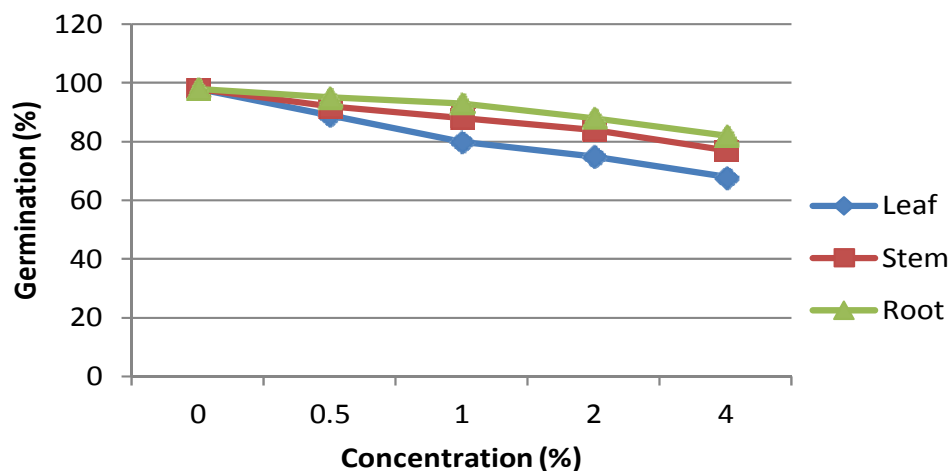


Figure 1. Allelopathic effect of *Eclipta alba* on germination of *Melilotus alba*.

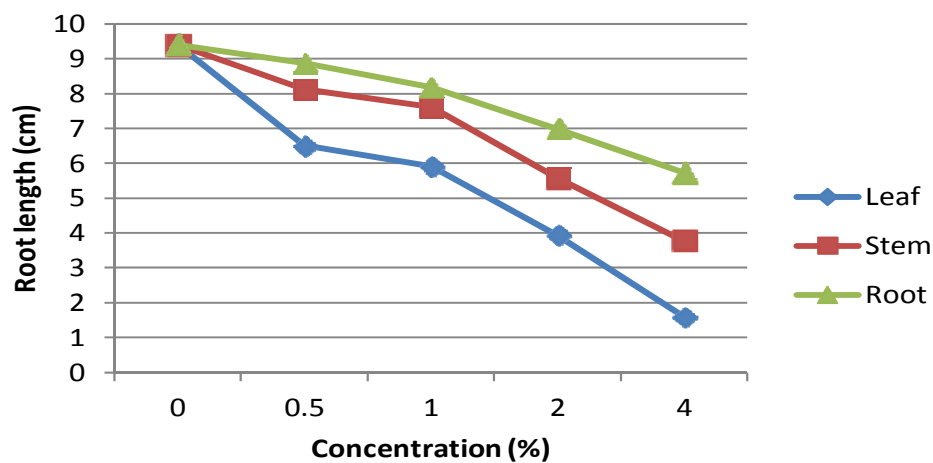


Figure 2. Allelopathic effect of *Eclipta alba* on Root length of *Melilotus alba*.

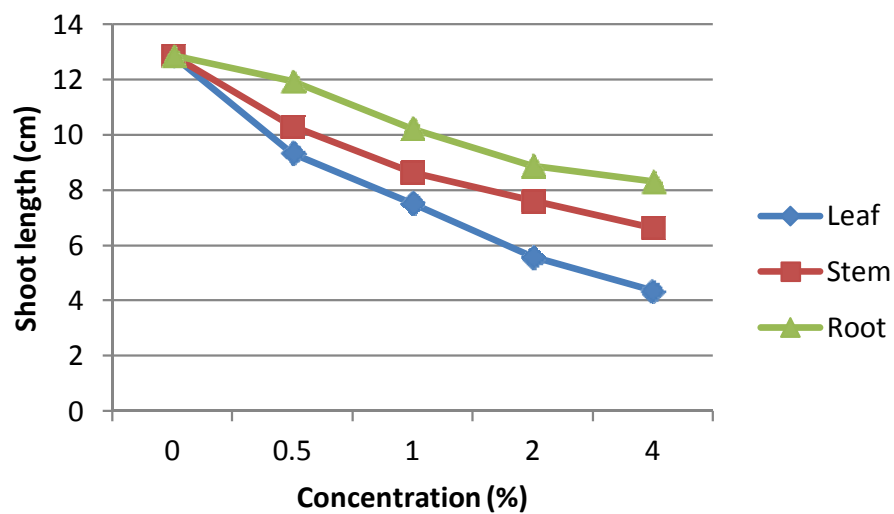


Figure 3. Allelopathic effect of *Eclipta alba* on Shoot length of *Melilotus alba*.

can be ranked in the following order of inhibition: leaves > stem > root.

Conflict of Interests

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENT

The authors are thankful to the Chairman, Department of Botany, Aligarh Muslim University, Aligarh for providing necessary facilities to complete the work.

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