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Full Length Research Paper

Evaluation for allelopathic impact of *Terminalia arjuna* (Roxb.) wight and arn bark against *Cassia sophera*

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Allelopathic performance of the aqueous extract of bark of *Terminalia arjuna* on *Cassia sophera* was evaluated under laboratory conditions. Aqueous extract of bark were prepared at different concentrations of 2, 4, 6, 8 and 10%. Ten seeds of test plant were kept for germination in sterilized Petri dishes of 9 cm diameter lined double with double layer of blotting paper moistened with different concentrations of aqueous extract (2 to 10%) and distilled water. Each treatment had three replicates. The experiment was recorded for 15 days. It was observed that aqueous extract reduced the germination, plumule and radicle length. Phytotoxicity of extract depends upon concentration. However, extract at higher concentration (10%) had strong inhibitory effect on germination and seedling growth of test species. From this we can suggest that *T. arjuna may* be a source of natural weedicide and can be used for controlling invasive plants.

Key words: Allelopathy, aqueous extract, *Terminalia arjuna*, *Cassia sophera*.

INTRODUCTION

Weeds have been a persistent problem for farmers ever since the beginning of agriculture because it causes economic losses by reducing the crop yield, increase cost of crop production and reduced crop quality (Bhuler et al., 1998). They often cause total crop failure (Islam and Molla, 2001). However, various parts of weeds show different behaviour in exerting their allelopathic effects on crops (Veenapani, 2004). Weeds also exert allelopathic effects on crop seed germination and growth by releasing water soluble compounds into the soil (Singh et al., 2005; Batish et al., 2007). Separately, concerns about negative effects of herbicides use such as environmental contamination, development of herbicide resistant weeds and human health problems make it to find necessary to diversify or other weed management options (Holethi et al., 1998).

Allelopathy is fascinating and perplexing subject that concern with the interaction of plants as influenced by the chemical substances that they release into the environment (Willis, 2004; Machado, 2007). Allelopathy can enhance the competitive success of the invader plants, since the release of phytotoxins in the environment may affect the growth and life processes of other community species (Callaway and Vivanco, 2002). The world is still in search of and in the process of developing farming techniques, which are sustainable for environment, crop production and protection as well as socio-economic points of view. Integrated weed management is one of such approaches where allelopathy can play its eco-friendly role in weed management (Hussain et al., 2007). The allelopathic properties of plants can be exploited successfully as tool for pathogens

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Table 1. Mean shoot length, root length and germination percentage of *C. sophera* in treatments.

Extract concentration (%)	Germination percentage	Root length (cm)	Shoot length (cm)
10	98	±2.05	±4.44
8	96	±2.59	±5.22
6	92	±3.15	±6.51
4	88	±3.42	±7.05
2	72	±4.45	±7.15
0	100	±5.22	±9.42

Each value is a mean of three replicates.

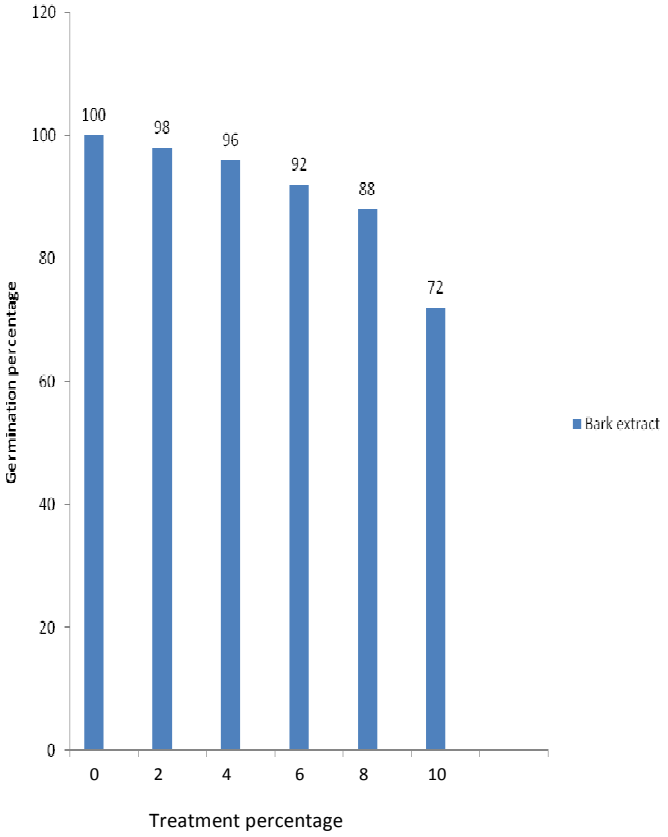

Figure 1. Effect of different concentrations of aqueous bark extract on germination percentage.

and weed reduction (Xaun et al., 2005).

Cassia sophera is growing as weed in common waste lands, on roadsides and in the forests. *C. sophera* is a glaborous shrub, about 8 to 12 paired leaflets, bear rachis with single gland at the base and yellow flowers in carymbose racemes.

MATERIALS AND METRHODS

With the help of a sharp knife, the bark of *Terminalia arjuna* was peeled off from the main trunk and branches of a tree growing in Aligarh Muslim University, Campus. The collected bark was chopped into small pieces with sharp knife and dried at 70°C overnight in a drying oven. The bark was ground into powder with the help of electric grinder and seived through 2 mm sieve mesh to obtain fine powder. 10 g of fine dried powder was dissolved in 100 ml distilled water and left for 24 h in dark at room temperature. The aqueous extract was filtered through one layer Whatman No. 1 filter paper. The extract obtained was considered as stock solution and a series of solution with different strength (2, 4, 6, 8 and 10%) were prepared by dilution. Uniform and surface sterilized seed of *C. sophera* were evenly placed in disposable Petri dishes with two layers of filter paper and moistened with each extract. For control, distilled water was used. The treatments were arranged in completely randomized design (CRD) with three replicates under laboratory conditions (Room temperature 25°C at mid-day and diffused light during day) for 15 days. Germination of seeds was evaluated after every 2 days. On the 15th day, the physiological observation of radicle and hypocotyls and length of both organs were measured. All results were statistically analyzed through LSD. The data were subjected to analysis of variance (ANOVA) followed by Duncan's Multiple Range Test (DMRT) as per Duncan (1955) and 2 sample t-test, wherever applicable.

RESULTS AND DISCUSSION

Germination and seedling growth

A**s** compared to control, there was a reduction in germination of test species in all the concentrations of aqueous extract of bark. At 8 and 10% concentration, germination of *C. sophera* was found to be reduced more (by 96 and 98%) as compared to other concentration series and control (Table 1 and Figure 1). The negative effect increases with increase in concentration of extract. This is similar to the findings reported by Kayode and Ayeni (2009) and Ashrafi et al. (2008) when they examined the allelopathic effect of aqueous extract from sorghum stem and rice husks on the germination and growth of *Zea mays* and *Helianthus annuus*. The pattern of inhibition effect (effect on growth > germination, radical > hypocotyl) is the same reported by several studies concerning other plant species around the world (Dorning and Cipollini, 2006). Tefera (2002) also reported that aqueous extract of *Parthenium hysterophorus* resulted in complete inhibition of seed germination in *Eragostis tef*. A similar trend in reduction of radicle and plumule length

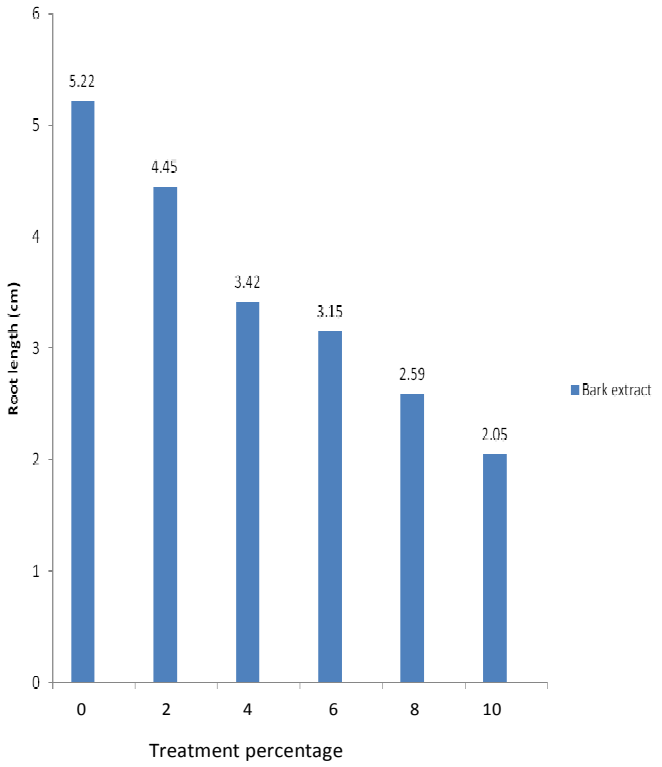

Figure 2. Effect of different concentrations of aqueous bark extract on root length (cm).

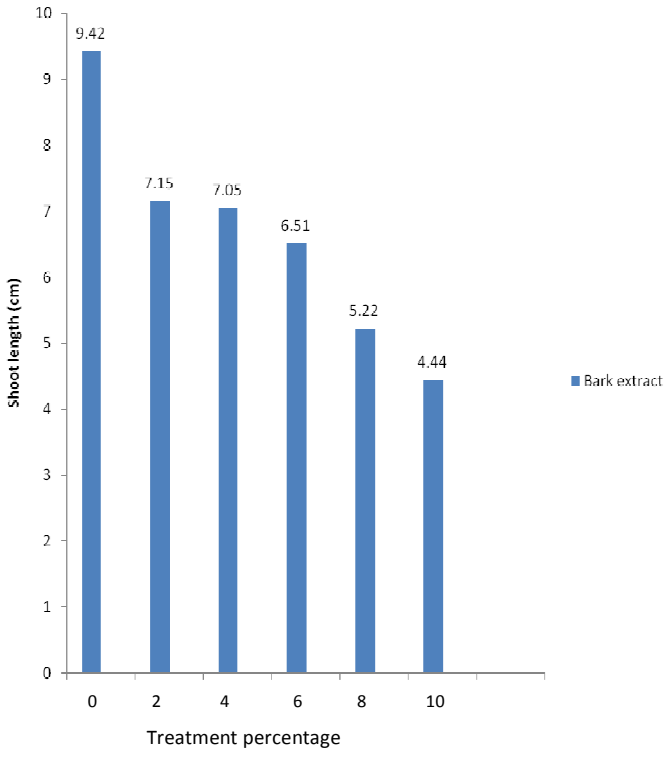

Figure 3. Effect of different concentrations of aqueous bark extract on shoot length (cm).

was also observed in test plant. Higher concentration of aqueous extract of bark had a strong inhibitory effect on radicle and plumule length. Plumule length reduction was highest (±4.44 cm) in 10% concentration, followed by 8% concentration (±5.22 cm) (Table 1 and Figure 3). With respect to radicle length, the highest inhibitory effect was also observed in 8 and 10% bark aqueous concentration (±2.59 and ±2.05 cm) (Table 1 and Figure 2). Parvez et al. (2004) reported that *Tamarindus indica* (L.) bark exhibit allelopathy. *Jatropa curcas* (Igbinosa et al., 2009) which supports our finding indicated that root elongation was affected more that of the shoot. Ashrafi et al. (2008) further reported that radicle length appeared more sensitive to allelochemicals than hypocotyle length.

The effects of allelopathy on germination and growth of plants may occur through a variety of mechanisms including reduced mitotic activity in roots and hypocotyls, suppressed harmone activity, reduced rate of ion uptake, inhibited photosynthesis and respiration, and inhibited protein formation, decreased permeability of cell membranes and/or inhibition of enzyme activity (Rice, 1986). The nature of the inhibitory effect of allelochemical on seed germination could be attributed to inhibit water absorption which is a precursor to physiological processes that should occur in seed before germination is triggered (Ovun, 2006).

The inhibitory effect of *T. arjuna* on seed germination and seedling growth of weed may be due to the presence of allelochemical in the bark. The tree contains the constituents like tannins, cardenolide, triterpenoid, saponins (arjunic acid, arjunolic acid, arjungenin, arjunglycosides), flavonoids (arjunone, arjunolone, luteolin), gallic acid, ellagic acid, oligomeric proanthocyanidins (OPCs), phytosterols, calcium, magnesium and zinc (Kapoor, 1990). Furthermore, the toxicity might be due to synergistic effect rather than single one.

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