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ALLELOPATHIC EFFECTS ON HERBACEOUS WEED PLANT SEEDS GERMINATION

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ABSTRACT

This paper deals with the allelopathic effects of weed plants on the germination of herbaceous plant seeds. It was observed that the rate of germination of *Amaranthus spinosus*, *Amaranthus viridis*, *Amaranthus hybridus* and *Amaranthus tricolor* are affected by the allelopathic compounds secreted by the weed plant extracts and leachates of *Mikania micrantha*, *Chromolaena odorata* and *Xanhium strumarium*. The rate of germination by leaf extract of *Xanthium strumarium* was more than that of the *Mikania micrantha* and *Chromolaena odorata*. In case of leachate *Xanthium strumarium* was also more affective then that of *Mikania micrantha* and *Chromolaena odorata* in the germination of seeds of herbaceous plants.

Key words: Allelopathy, Herbaceous plants, Weed plants, Germination, Inhibition.

INTRODUCTION

Interference may occur when one plant species fails to germinate, grows more slowly, shows symptoms of damage or does not survive in the presence of another plant species. Such interference can result from competition and allelopathy (Nelson, 1996). Allelopathy is an important mechanism of plant interference mediated by the addition of phytotoxins to the plant environment and competitive strategy of plants (Oussama, 2003). A large number of weeds are responsible for producing allelopathic compounds which come in contact with plants, inhibit their growth. Additionally, some weeds interfere with crop plants through allelochemicals which inhibit crop growth and development (Qasem & Foy, 2001; Bhowmik & Indrajit, 2003; Romero-Romero *et al.*, 2005; Batish *et al.*, 2007). Anders using some extracts from the dried materials (root and aerial part) of the weed proved that alcoholic extracts of its aerial part produced more significant effects on growth parameters such as seedlings elongation and fresh weight of the Cowper small plants than its root extracts (Ahanchede *et al.*, 2003).

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Allelochemicals effect on germination and growth of plants. It effect specific plant processes such as cell division and elongation, action of inherent growth regulators, mineral uptake, photosynthesis, respiration, stomatal opening, protein synthesis, membrane permeability and specific action (Rice, 1974). Roth *et al.*, (2000) showed that water extracts from sorghum residues inhibited germination and decreased root and shoot growth of corn (*Zea mays* L.) and wheat. Khanh *et al.*, (2007) found that inhibitory substances involved in allelopathy are mainly terpenoids and phenolic substances. A wide array of biologically active constituents is produced by plants in the genus *Artemisia* (Regina *et al.*, 2007). Bertholdesson (2005) showed that volatile oil of *Artemisia afra* have several biological activites, notably antibacterial, antifungal and anti-oxidative properties. Monoterpene vapors may cause anatomical and physiological changes in plant seedlings and exposure to volatile terpens can lead to accumulation of lipid globules in the cytoplasm, reduction in organelles including mitochondria and disruption of membranes surrounding mitochondria and nuclei (Monari *et al.*, 2005). The root tip cells subjected to the alkaloids gramine and hordenine caused damages to the cell walls, disorganization of organelles, increase cell vacuoles and the appearance of lipid and globules, showing food

reserves (Rasmussen *et al.*, 2004). Large amounts of monoterpene hydrocarbons and sesquiterpenes are found to lower the antimicrobial activity of essential oils (Alexa *et al*., 2004).

MATERIALS AND METHODS

The allelopathic effects on germination of herbaceous plants seeds of *Amaranthus spinosus* L., *Amaranthus viridis* L., *Amaranthus hybridus* L. and *Amaranthus tricolor* L. were treated in the aqueous extracts and leachates of *Chromolaena odorata* L., *Mikania micrantha* H. Bk. and *Xanthium strumarium* L. separately. Leaves from the above mentioned weeds were collected, 50 gm of fresh sample were taken separately.

The water extracts of leaves above mentioned plants, prepared filtered solutions of four concentrations 1:01, 1:02, 1:05 and 1:10 by adding distilled water. The above mentioned plants fresh leaves were soaked in water and keep it for 24 hours called leachate and filtered, prepare same concentration. The weed seeds were soaked in water and placed in sterilized petridishes and the final germination percentage out of five replicates were recorded. The statistical analysis was carried out as per the standard procedure (APHA, 2005).

Figure 1. Effect of Leaf extract on Gerination of herbaceous plant seeds

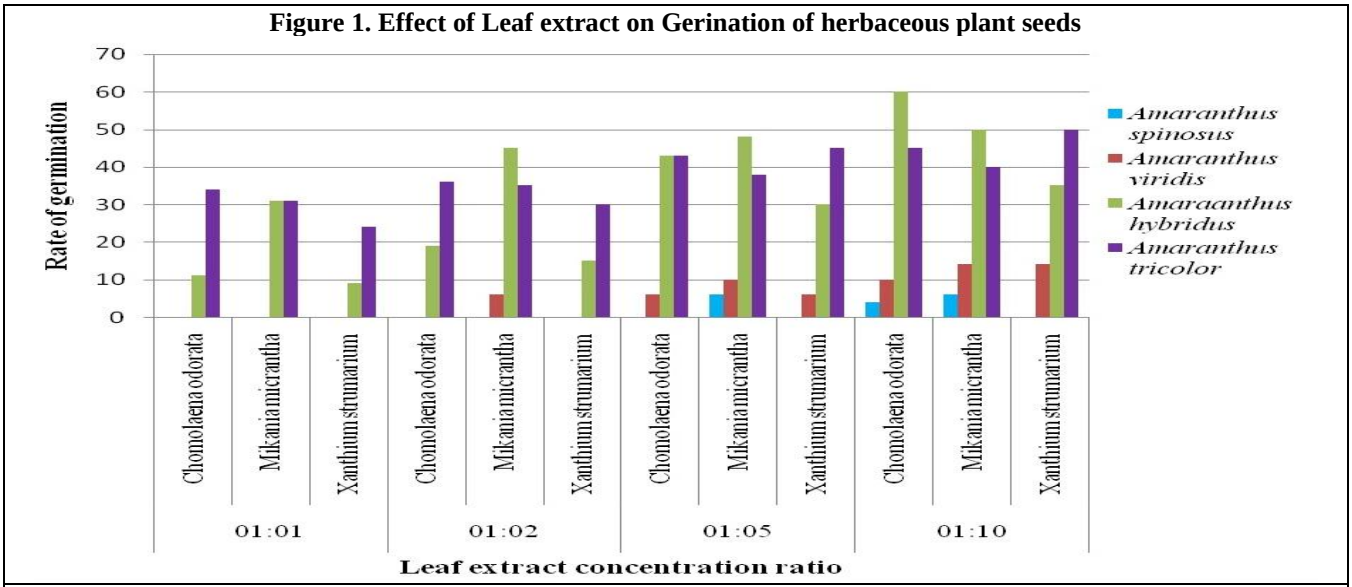

Figure 2. Effect of leaf leachate on germination of herbaceous plant seed

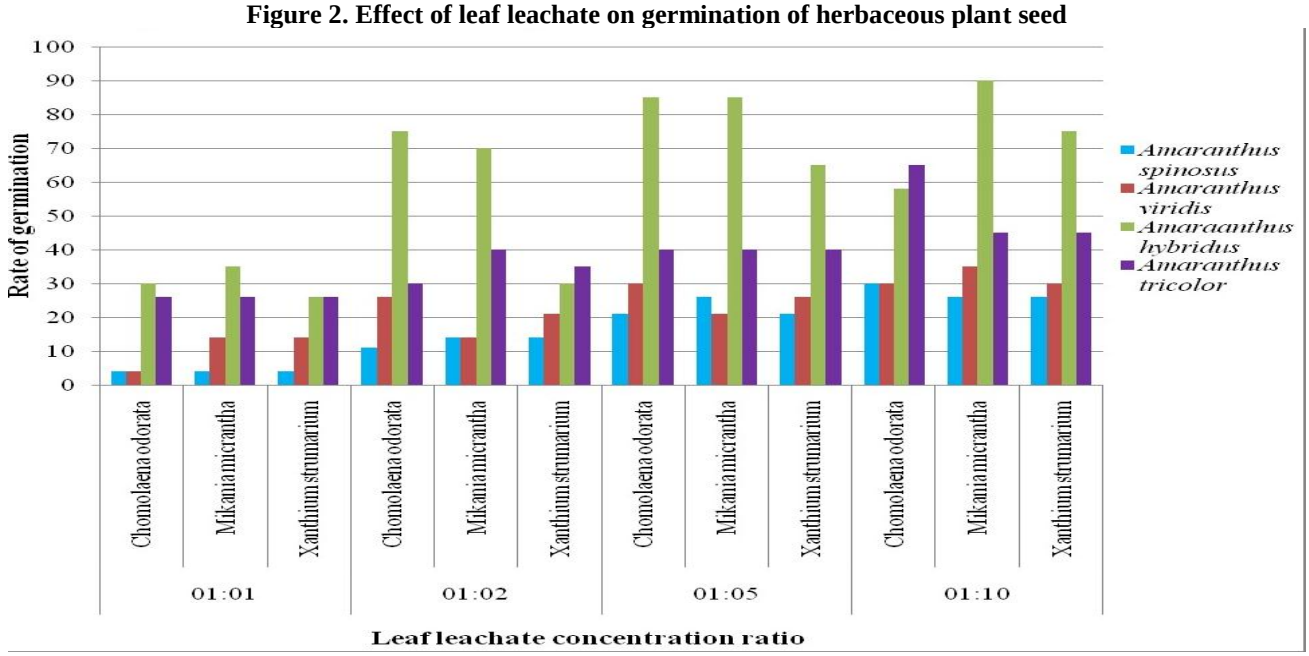

Table I. Allelopathic effects on germination of herbaceous weed plants seeds.

Leaf extract treatment						Leaf leachate treatment					
Concentration	Plant Names	*Amaranthus spinosus*	*Amaranthus viridis*	*Amaraanthus hybridus*	*Amaranthus tricolor*	Concentration	Plant Names	*Amaranthus spinosus*	*Amaranthus viridis*	*Amaraanthus hybridus*	*Amarant hus tricolor*
1:01	*Chomolaena odorata*	0	0	11±2.75	34±2.74	1:01	*Chomolaena odorata*	4±2.75	4±2.24	30±2.74	26±2.74
	Mikania micrantha	0	0	31±2.24	31±2.74		*Mikania micrantha*	4±2.75	14±2.74	35±2.74	26±2.74
	Xanthium strumarium	0	0	9±2.50	24±2.74		*Xanthium strumarium*	4±2.75	14±2.74	26±2.74	26±2.74
1:02	*Chomolaena odorata*	0	0	19±2.24	36±2.24	1:02	*Chomolaena odorata*	11±2.24	26±2.74	75±2.24	30±2.74
	Mikania micrantha	0	6±2.50	45±2.24	35±2.74		*Mikania micrantha*	14±2.24	14±2.74	70±2.24	40±2.74
	Xanthium strumarium	0	0	15±2.74	30±2.24		*Xanthium strumarium*	14±2.24	21±2.74	30±2.24	35±2.74
1:05	*Chomolaena odorata*	0	6±2.75	43±2.24	43±2.24	1:05	*Chomolaena odorata*	21±2.75	30±2.24	85±2.74	40±2.74
	Mikania micrantha	6±2.50	10±2.74	48±2.75	38±2.24		*Mikania micrantha*	26±2.75	21±2.24	85±2.74	40±2.74
	Xanthium strumarium	0	6±2.74	30±2.24	45±2.24		*Xanthium strumarium*	21±2.24	26±2.74	65±2.74	40±2.74
1:10	*Chomolaena odorata*	4±2.75	10±2.74	60±2.24	45±2.74	1:10	*Chomolaena odorata*	30±2.24	30±2.24	58±2.74	65±2.74
	Mikania micrantha	6±2.50	14±2.74	50±2.24	40±2.74		*Mikania micrantha*	26±2.74	35±2.74	90±2.74	45±2.74
	Xanthium strumarium	0	14±2.74	35±2.74	50±2.24		*Xanthium strumarium*	26±2.74	30±2.74	75±2.74	45±2.74

RESULTS AND DISCUSSION

The leaf water extract of *Chromolaena odorata*, *Mikania micrantha*. and *Xanthium strumerium* inhibit germination of *Amaranthus spinosus*, *Amaranthus viridis*, *Amaranthus hybridus* and *Amaranthus tricolor* (Table I). *A. spinosus* is more inhibited in germination. From these three plant species extracts *X. strumerium* extract is more effective in *A. spinosus* seed germination. In *A. viridis* 1:01 and 1:02 leaf extract concentration show no germination but 1:05 and 1:10 concentration showed lower rate of germination. *A. hybridus* and *A. tricolor* showed little germination (Table I) (Fig. 1). In leachate of three selected plant species also showed inhibition of germination in four selected plants. These four plants species *A. spinosus*, *A. viridis*, *A. hybridus* and *A. tricolor* showed poor germination in 1:1 concentration and in 1:10 concentration showed maximum germination (Table I) (Fig. 2). Toxic compounds present in the water extract of dried leaves and water leachate of certain weed reduced the rate of germination of crop seeds to a great extent (Lodhi, 1978). Reduced growth of under story vegetation under cherry bankoaks was observed by Hook and Stubbs (1967) and confirmed by De Bell (1971). Leaching of substance from oak crown by rain presumably causes inhibition of vegetation beneath cherry bark oak. Similarly, herbaceous plants fail of grow under sycamore (Al-Naib *et al*., 1971). Self inhibition of germination also noticed in a number of plants. Tomato seeds fail to germinate while inside the fruit, if the seeds are removed from fruit, dried and planted, they germinate rapidly. The failure to germinate in the fruit because of chemical germination inhibitors (Mayer 1974; Mayer & Poljakiff-Mayber 1975). They also found that even 10 to 20 times dilution of tomato juice caused inhibition on germination of many seeds. Some are cyanide-releasing complexes, especially in rosaceous seeds, while others are ammonia releasing substances. Other important organic compounds include organic acids, unsaturated leactones especially coumarin, parasorbic acid and protoanemonin

aldehydes, essential oils, alkaloids and phenolic compounds. These substances occur not only in seeds but in leaves, roots and other parts of the plants and leached out or released during decay and may cause inhibition in germination of seeds or root development in the vicinity of the parent plant. Some organic substances produced by other plants act as germination promoters.

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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