ALLELOPATHIC EFFECT OF KIKAR (*ACACIA NILOTICA*) ON THE GERMINATION OF FIELD CROPS

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Abstract

An experiment was conducted to study the inhibitory effects of leaf and litter leachates (extracts) of kikar (*Acacia nilotica*) on the germination of wheat (*Triticum aestivum*) maize (*Zea mays*), sorghum (*Sorghum bicolor*), millet (*Pennisetum typhodeum*), sunflower (*Helianthus annus*), brassica (*Brassica compestris*) and taramira (*Eruca sativa*). Seed germination of all sevel crops was significantly and negatively affected due to the application of extracts as compared to tap water treatment. Highest adjusted reduction in germination (89.67%) was recorded in Sorghum followed by Taramira (85.36%), while maize was least affected (60%).

Keywords: Allelochemicals, kiker, *Acacia nilotica*, field crops, germination.

Introduction

Allelopathy is the production of chemical compounds (allelochemicals) that escape in to the environment (Malik, 1991) and leaves are considered to be the potent source of allelochemicals. It has assumed a tremendous importance in recent years for investigating and estimating the decrease in yield of various crops associated with forest trees. However, toxic metabolites are also distributed in other plant parts in various concentrations. The degree of impact of allelopathy depends markedly on available soil moisture and soil microflora. Research on allelopathy showed a considerable influence of allelochemicals in inhibiting the plant gowth. Sharma *et al.* (1987) observed allelopathic effect fo leachates from commonly grown farm tree species on the germination and growth of wheat, raya, field pea and lentil. They reported that *Morus alba* had a most toxic effect on all crops. Generally root and shoot length and vigour index (germination and seeding length) was reduced by leachates. Allelopathic effect of Juglone on germination and growth of herbaceous and woody species was reported by Rietveld (1980). Similarly, Srinivasan *et al.* (1990) observed reduced crop germination and growth of mung, mash, cowpea, pigeonpea and soybean due to allelochemicals. A reduction in wheat yield was also noted by Khattak *et al.* (1981).

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Pakistan, being an agrarian country, unfortunately faces chronic shortage of forest area (5.2%) which is not sufficient to meet the wood demand and forest products of the inhabitants. Populatoin pressure (timber demand and overgrazing), arid climate, water constraints, financial limitation, salinity, water logging and erosion have led to continuous dwindling of forests in Pakistan (Keerio, 1991). The countryis also not self sufficient in basic food commoaities. A huge foreign exchange is consumed to import edible oil and other food commodities every year. Among yield limiting factors, one of the most serious but less noticeable is the release of certain biochemicals which inhibit the growth of many field crops to a great extent. It is therefore, imperative to have a balance integration of the two to overcome the gap. The only solution to this is to promote agroforestry – a collective term for all land use in which woody perennials are deliberately grown on the same land management unit with crops and/or animals in some form of spatial or temporal arrangement. It has been presumed that many trees grown on farmlands decrease the crop yields.

In Pakistan one such trees is Kikar (*Acacia nilotica*). The present study was undertaken to evaluate the allelopathic effect of kikar, which is a fast growing fuel wood tree in most parts of the country.

Materials and Methods

The investigation was carried out in the laboratory, Pakistan Forest Institute, Peshawar. The crops under study were wheat (*Triticum aestivum*), maize (*Zea mays*), sorghum (*Sorghum bicolor*), millet (*Pennisetum typhodeum*), sunflower (*Helianthus annus*), brassica (*Brassica compestris*) and taramira (*Eruca sativa*). The experiment was comprised of two treatments and replicated four times. Total 56 Petri dishes were used, 8 for each species. These Petri dishes were filled with equal amount of sterilized sand and 10 seeds were placed in each Petri dish. Seeds of each crop species wee soaked in the extracts of *A. nilotica* and in tap water for 24 hours. All Petri dishes were placed in the germinator at 76°F for 12 days. Number of seed germinated were counted and converted into percentage. Data were subjected to statistical analysis using standard paired student's t-test procedure. Adjusted germination affected by the kikar extracts was calculated by the formula described by the Fleming and retnakaran, 1985.

Results and Discussions

The t-test of the data shows that *A.nilotica* significantly ($P > 0.01$) reduced germination of wheat, sorghum, sunflower, and brassica over fresh water treatment. Rest of the crop seed i.e. maize, millet and taramira gave significantly less germination when treated with *A.nilotica* extracts than fresh water (P> 0.05) (Table 1).

Table 1. Allelopathic effect of Kikar (*Acacia nilotica*) on the germination of field crops

Treatments	Crops						
	Wheat	Maize	Sorghum	Millet	Sunflower	Brassica	Taramira
Fresh water							
Mean	15.25	30.00	7.75	20.25	20.00	20.00	10.25
Variance	156.91	66.66	20.25	320.25	66.66	66.66	60.25
SD	12.51	8.16	4.50	17,89	8.16	8.16	7.76
Extract of *A.nilotica*							
Mean	80.00	75.00	75.00	55.00	65.00	75.00	70.00
Variance	466.66	166.66	300.00	166.66	166.66	166.66	333.33
SD	21.60	12.91	17.32	12.91	12.91	12.91	18.25
t-value	9.73**	5.19*	6.64**	5.43*	15.58	8.52**	4.69*
Probability	0.002	0.013	0.007	0.012	0.000	0.003	0.018

** = Significant at P > 0.01 * = Significant at P > 0.05

For the freshwater treatment, standard deviation for wheat and millet was relatively higher than rest of the crop seed, highest variance for these two crops may be due less number of replications and/or great variations in the observation. Similarly relatively higher standard deviation in *A.nilotica* treated seeds of wheat and taramira with a higher variance could also be attributed to the same reason.

Higher rate of non-germination in millet (45%) sunflower (35%) and taramira (30%) in freshwater treatment may be due to non-viable seed, which might have depleted the germination. The environmental conditions (temperature and relative humidity) also play an important role in the seed germination in lab conditions.

Highest adjusted reduction in germination (89.67%) was recorded in Sorghum followed by Taramira (85.36%), while maize was least affected (60%) (Table 2). However, it seems that some inhibiting chemicals present in the *A.nilotica* affecting the germination, as rest of the conditions were kept uniform. Millet seed was least affected by the *A.nilotica* extract (55%) compared to that of freshwater (20%).

Table 2. Adjusted percent germination of different crops species as affected by Kikar (*Acacia nilotica*) extract

Crop	Germination		
	Fresh water	Extract	Adjusted
Wheat	80.00	15.25	80.74
Maize	75.00	30.00	60.00
Sorghum	75.00	07.75	89.67
Millet	55.00	20.25	63.18
Sunflower	65.00	20.00	69.23
Brassica	75.00	20.00	73.33
Taramira	70.00	10.25	85.36

It is well depicted from the findings that extract of *A. nilotica* affect the germination of major crops adversely, the findings are well supported with the previous workers like Khattak *et al.* 1981; Sheram *et al.*, 1987; Srinivasan *et al.*, 1990, who found significantly less germination of different crops when treated with *A. nilotica* extracts.

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