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Effect of Calotropis procera Leaf Extract on Seed Germination of Some Plants

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Abstract

Calotropis procera (Asclepidaceae) is an evergreen plant and widely distributed in Hormozgan province. This plant has the allelopathic properties including germination inhibition, plumule and radicle growth reduction. In this study the effect of different concentrations (0, 5, 10, 20, 40 and 60%) of dry leaf water extraction of this plant on the germination of cucumber (*Cucumis sativus*), tomato (*Lycopersicon esculenthum*), and eggplant (*Solanum melongena*) were investigated. The results showed that water extract significantly decreased the germination percentage especially at high concentrations. The radicle and plumule length also were affected by the extract concentrations.

Keywords: Allelopathic, *Calotropis procera*, Germination, Plumule, Radicle.

INTRODUCTION

Milkweed (*Calotropis procera*) a member of Asclepiadaceae family is a evergreen plant that grows in tropical regions(Grace, 2006). This plant is native of Asia (India, Pakistan, Afghanistan, Iran, Arabia and Jordan) and Africa (Somalia, Egypt, Libya, South Algeria, Morocco, Mauritania and Senegal) (Mascolo *et al.*, 1988; Rahman and Wilcock, 1991). Its height is 2 to 4 meters but it may sometimes reach up 6 meter (Grace, 2006). It has reported that all the parts of this plant are poisonous(Staples and Herbst, 2005). *C. procera* can be a useful plant for control of soil pollution(Altaf, 2006). Milkweed is adapted to hot and dry climates and it can tolerate drought but preferes locations that have 150-1000 mm autumn rainfall(CAB International, 2005). *C. procera* is able to grow in a wide range of soils such as alkaline and saline soils, but it prefers sandy soils. Parts of this plant, especially the root bark, are applied for treatment of variety range of illness including, fever, malaria, and snake bite (Parrotta, 2001). It has reported leave extracts of this plant have great promising effects as nematocides, in vitro and in vivo (Anver and Alam, 1992). It has demonstrated that this plant has allelopathic properties and it can inhibit seed germination and growth of other plants (Johnston, 1961; Bokhari, 1978). Therefore the goal of this study was evaluate of effect of leaf extract of giant milkweed on germination and growth of cucumber, tomato and eggplant seeds.

MATERIALS AND METHODS

Giant milkweed leaves were collected from Bandar Abbas city in Hormozgan province, Iran. All leaves were initially washed with distillated water to remove dust and other residues, then they located at 65°C for 48 h in the Oven to dry. Dried samples were crushed to powder using a mortar. After that, leaf powder soaked in distilled water (1:10 w/v) for 24 hours at room temperature. Extracts filtered by Whatman filter paper No.1 (Al-Zahrani and Al-Robai, 2007). Finally extract diluted by distilled water to obtained concentrations of 5, 10, 20, 40, 60%. The distilled water was as the control treatment. Seeds of cucumber, tomato and eggplant selected for this research. The experiment was carried out in factorial experiment with complete randomize block design in four replications. Each replication was 15 seeds in one petridish. For each treatment 15 ml of the leaves extracts (water distilled for control) was added to petridishes. Duration of experiment was 14 days. Statistical analysis of data was carried out by using SPSS and Excel software. Comparison of means was carried out by with the Duncan's multiple range tests using SPSS.

RESULTS AND DISCUSSION

Percentage of Germination

Mean comparison showed that there was not significant difference among control with other treatments (5, 10 and 20%) in cucumber, but 40 and 60 % showed significant difference with control ($P \leq 0.05$). Also it was found significant difference between 40 and 60 % ($P \leq 0.05$). In seeds of tomato was not found significant difference in percentage of seed germination among control and other treatments (5, 10, 20 and 40%). It only was found significant difference among treatment of 60% with others ($P \leq 0.05$). In eggplant, concentration of 60% showed significant difference with control but the difference among other treatments was not significant ($P \leq 0.05$). The results showed that leaf extract of milkweed reduced germination percentage in studied plants. In treatment of 60%, germination percentages of seeds of cucumber, tomato and eggplant were 17.77, 84.44 and 93.33, respectively, while seed germination of these plants in control treatment (distilled water), were 100, 97.77 and 100 %, respectively. Therefore, the greatest and the least inhibitory effects of leaf extract on percentage of seed germination were belonged to cucumber and eggplant, respectively. Effect of different levels of leaf extraction on seed germination of cucumber, tomato and eggplant were shown in fig. 1.

Growth of Radicle and Plumule

The results showed that the differences among treatments were significant in each plant (table 1), and the highest length of radicle and plumule observed in control seeds.

1. Growth of Radicle.

With increasing of extract concentration, inhibitory effects of extracts on radicle growth increased, therefore highest reduction in radicle length observed in treatment of 60%. In cucumber the differences in radicle growth between 0 and 5 % was not significant, but there was significant differences among treatments 10, 20, 40 and 60% with control ($P \leq 0.05$). There was not significant difference among treatments 10 and 20%. Also it was found significant difference between treatments 40 and 60 %. In tomato, significant difference observed between control and other treatments ($P \leq 0.05$). The highest reduction in radicle length was observed in 60%. It was not found significant difference among treatments of 5, 10 and 20 % ($P \leq 0.05$). Treatments 40 and 60% had significant differences with other concentrations (0, 5, 10 and 20%). Also it was found significant difference between treatments 40 and 60 % ($P \leq 0.05$). In eggplant, there was not any significant differences among control treatment with 5 and 10 % , but treatments 20, 40 and 60% showed significant differences with control($P \leq 0.05$). The difference obtained among treatments of 20, 40 and 60 were significant ($P \leq 0.05$). The highest reduction of root length was showed in highest concentration (60%).

2. Growth of Plumule

Application of leaf extract of milkweed reduced plumule length in cucumber, tomato and eggplant (table 1). In all plants, the highest reduction in plumule length observed in treatment of 60%. In cucumber were not found significant differences among treatments 0, 5, and 10 % , but the differences among 20, 40 and 60% were significant with other treatments (0, 5 and 10 %) at $P \leq 0.05$. The differences among treatments 20, 40 and 60% also were significant at $P \leq 0.05$. In tomato and eggplant, treatment of 5% increased plumule growth in comparison with control. Other treatments reduced plumule growth. It was not found significant differences among treatments 0, 5, 10 and 20%, while the difference among 0, 40 and 60% was significant. The difference between 40 and 60% was significant ($P \leq 0.05$).

The results showed that water extract of dried leaves had inhibitory effects on seed germination and growth of seedlings of cucumber, tomato and eggplant. The results also showed that radicle was more sensitive than plumule. Our results were similar to report of Al-Zahrani and Al-Robai (2007). More sensitivity in radicle can attributed to earlier suction of allelopathic material compared with plumule (Turk and Tawaha, 2002). Results of this study also showed plumule growth in tomato and eggplant increased at treatment of 5%. In all studied plants, the greatest inhibitory was found in the highest concentration (60%). Similar evaluations have been reported from allelopathic effect of extract in other plants. Extracts of different parts of this plant affect germination and seedling vigor of many crops (Oudhia and Tripathi, 1999). Al-Zahrani and Al-Robai (2007) also showed extract of *C. procera* had inhibitory effects on seed germination of *Senna occidentalis*. Kayode and Ayeni(2009) showed aqueous extracts of sorghum stem and rice husks had allelopathic effects on the germination and growth of maize and the degree of inhibition depends on extract concentration. Lydon *et al*., (1997) reported that extract of *Artemisia annua* inhibited germination of corn and grass seeds. But, extracts of *Calatropis* can not control weeds such as *Chenopodium album*, *Melilotus alba*, *Melilotus indica*, *Sphaeranthus indicus*, and *Phalaris minor* (Oudhia and Tripathi, 1997). It has reported that presence of some elements in *C. procera* can result in inhibition of germination and growth of seeds (Abbasi *et al*., 1992). Cheema (1988) stated that mature sorghum contain allelopathic compounds such as benzoic acid, p-hydroxybenzoic acid, vanillic acid, m-comadic acid, p-coumaric acid, gallic acid, caffeic acid, ferulic acid, and chlorogenic acid, but Chou and Lin (1976) reported that rice husks contain phenolic compounds such as p-hydroxybenzoic, vanillic, ferrulic, p-coumaric, and o-hydrophenylacetic acid.

In general, it was concluded that milkweed, with allelopathic properties, has negative effects on germination and growth of seeds of cucumber, tomato and eggplant. Therefore leaf extract of milkweed has inhibitory and allelopathic effects on growth and germination of cucumber, tomato and eggplant.

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Tables

Table 1. Effect of different concentrations of nano silver particles and thymol on measured characteristies

eggplant		tomato		cucumber		Treatments (%)
Radicle length (mm)	Plumule length (mm)	Radicle length(mm)	Plumule length(mm)	Radicle length(mm)	Plumule length(mm)	
6.81±0.6 a	6.89±0.05 a	9.13±0.469 a	7.39±0.11 a	11.27±0.45 a	12.20±0.132 a	0
6.28±0.217 ab	7.37±0.158 a	7.64±0.235 b	7.70±0.12 a	10.41±0.87 a	12.17±0.617 a	5
6.16±0.043 ab	6.35±0.227 a	6.83±0.16 b	7.07±0.033 a	9.04±0.41 b	11.58±0.22 a	10
5.74±0.201 b	6.22±0.34 a	6.71±0.478 b	6.82±0.206 a	8.46±0.38 b	9.70±0.61 b	20
4.71±0.089 c	5.14±0.55 b	5.38±0.566 c	5.45±0.349 b	5.36±1.2 c	7.80±2.72 c	40
2.60±0.284 d	2.74±0.31 c	3.57±0.19 d	3.82±0.233 c	2.28±0.6 d	4.60±1.55 d	60

*Mean in each column with the same letters are not significantly different at 5% level of probability using DMRT.

Figures

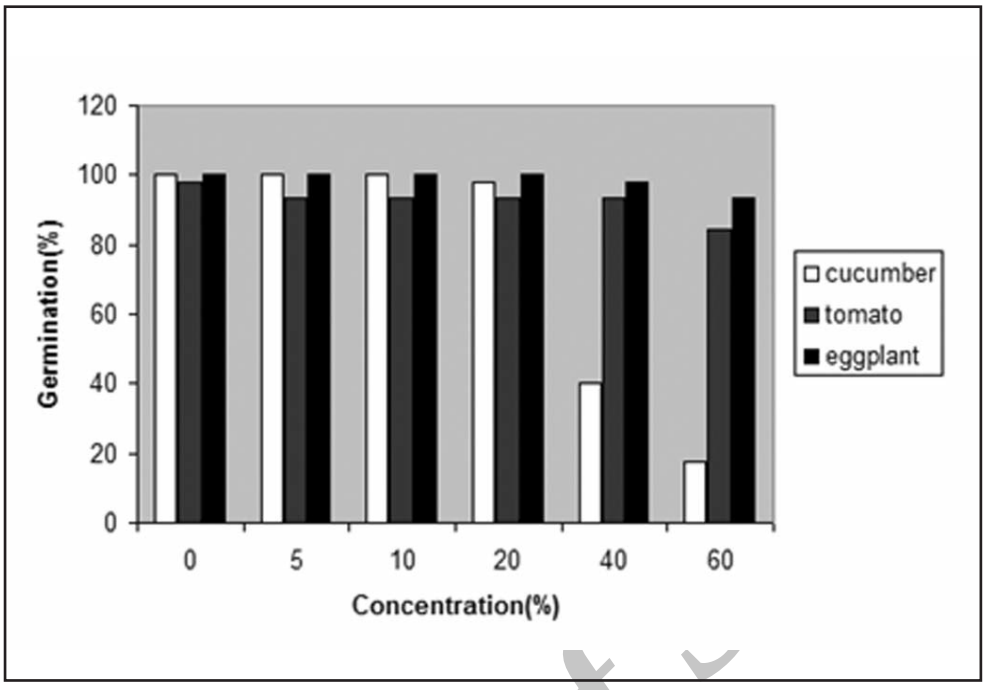

Fig. 1. Effect of different levels of leaf extract on germination percentage of seeds of cucumber, tomato and eggplant.