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Growth inhibitory effect of ten fruit leaves on selected weeds

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Abstract: Growth inhibitory effects of aqueous extracts of ten fruit leaves were investigated during July 2007 to December 2007 at the laboratory of the Department of Agricultural Chemistry in Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh. Aqueous extracts of ten common fruit plant leaves viz., mango, black berry, jack fruit, litchi, wood apple, indian dillenia, guava, banana, indian goose berry, olive were tested for germination and shoot and root growth of barnyard grass, spiny amaranth and green amaranth. The aqueous extracts of wood apple (*Aegle marmelos*) significantly decreased germination of barnyard grass, while spiny amaranth and green amaranth seeds/g control respectively. The lowest germination percentage of were 6.4 %, 8.80% and 8.80%, respectively. The aqueous extract of wood apple leaves showed inhibitory effect on germination and root and shoots growth of barnyard grass, spiny amaranth and green amaranth seedlings. Based on their growth inhibitory properties, mango, black berry, jack fruit, litchi, wood apple, indian dillenia, guava, banana, indian goose berry , olive. One of these plant extracts which performed the best, i.e. wood apple have potential for use as alternative crop as herbicide (protectants) against a number of weed species.
Key words: Aqueous extracts, root, shoot, germination.

Introduction

Plant secondary compounds have been the subject of thorough investigation for the past 30 years in an effort to discover new sources of botanical herbicides, insecticides, rodenticides and antifeedants. Because of increasing problems (resistance, impacts on non-target organisms) associated with the use of acutely toxic synthetic insecticides, there is a pressing need for the development of safer, alternative crop protectants such as botanical insecticides and antifeedants (Akhtar and Islam, 2004). There are different types of plants those are cereals, grains, pulse, oil seeds, herbal plants or medicinal plants, woody plants, narcotic crops, herbaceous plants, shrubs, weeds, fruit plants etc. in the plant kingdom. Different types of naturally occurring organic and bioorganic compounds have been isolated from them. Most of them have effective medicinal, insecticidal, pesticidal or toxic and growth regulatory values. The plant kingdom supply us with food, fuel, fodder, shelter, wind breaker, beauty and provides raw material for clothing and medicine (BBS, 2004). Farmers of Bangladesh are cultivating different kinds of crops in a year but during cultivation of crops they are facing so many problems to control different kinds of weeds grown in the crop field and also which have allelopathic effect (Dongre *et. al*., 2004). Some of these viz., aryl (*Leersia hexandra*), Tita begun (*Solanum nigrum*), China box, Parrot tree, Cap Jasmine (Roy et al., 2006; Roy *et al.* 2008) has documented growth inhibitory effects. Some families are Lamiaceae, Annonaceae, Apiaceae and Asteraceae. Oreganum vulgare (Lamiaceae) usually known as oregano, has documented antifungal (Thomson, 1989), antiviral, and antibacterial (Sivropoulou *et al.* 1996) properties. Challa and Ravindra (1998) examined the allelopathic effects of major weeds on vegetable crops. Plant releasing chemical into the environment may how deleterious and beneficial effects on other plants growing in their vicinity. The allelopathic effects of winter crop residues on the growth of succeeding summer crop were revealed by Sandhu (1997). Certain plant leaves have the herbicidal and insecticidal activities which are available in nature, which checks the environmental pollution and soil pollution**.** Natural Products as sources of herbicides: current status and future trends **(**Duke *et al.* 1999). The synthetic or chemical compounds may be toxic and needs careful handling where as botanical or organic herbicides and pesticides are safe and have no high toxicity (Duke, 1986). Herbicides, especially synthetic herbicides are harmful for our environment as well as expensive to farmers. Therefore, the present study was undertaken to examine the influence of aqueous extract of some fruit plants on germination of three weed seeds, and their primary growth rate.

Materials and Methods

The experiment was conducted at the laboratory of the Department of Agricultural Chemistry in Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh from July 2007 to December 2007. The aqueous extracts leaves of mango (*Mangifera indica)*; T_1, jackfruit (*Artocarpus heterophyllus*); T_2, black berry (*Syzygium cumini*); T_3, guava (*Psidium guajava*); T_4, litchi (*Litchi chinensis*); T_5, indian dillenia (*Dillenia indica*); T_6, banana (*Musa sp*); T_7, wood apple (*Aegle marmelos*); T_8, olive (*Elaeocarpus floribundus*); T_9, indian gooseberry (*Phyllanthus emblica*);T_{10} and Water as control; Tc were used for test materials. The freshly prepared aqueous extracts from the test species were applied on the seeds of selected weeds, viz, barnyard grass (*Echinochloa crussgali*), spiny amaranth (*Amaranthus spinosus*) and green amaranth (*Amaranthus viridis*) to observe their germination and growth performances.

Preparation of Aqueous Leaf Extracts: 100 g of each fresh leaf was taken and chopped followed by wet paste by blender machine with required amount of water. Then it was transferred to a 500 ml reagent bottle in which 400 ml of water was added and was kept for 72 hours at room temperature (25±2°C) with regular interval of stirring for aqueous slury. After 72 hours, the aqueous slurry was filtered through Whatman filter paper No.1 and was stored in reagent bottle.

Germination and Growth Performance of Weed Seeds: Petridish experiment was performed using aqueous extracts of ten fruit leaves for investigating the germination percentage, shoot growth and root growth of barnyard grass, spiny amaranth and green amaranth seeds. For this, two sheets of filter paper were placed on clean petridish. Twenty five seeds of each weed were placed on two sheets of filter papers moistened with 15 ml aqueous

extract of fruit plants in 9 cm Petri-dishes which were incubated at 27±2 ^{0}C temperature and 90+2% relative humidity. The filter papers were kept constantly moist with water. The experiment was laid out by completely randomized design with five replications. The germination (%), shoot and root length of the seedling were measured regularly for 7 days after seed placing. The collected data were analyzed statistically and the differences among means were compared by using Duncan's New Multiple Range Test (DMRT).

Results and Discussion

Effects of fruit leaves extract on barnyard grass seed: Wood apple leaf extract had significant effect to reduce the growth and germinating of barnyard grass seeds (Table 1). The lowest germination percentage was 6.4% for barnyard grass seeds treated with aqueous extract of wood apple while 54.4%, 56%, 57.6, 58.4%, 63.2% and 64% was recorded treated with the extracts of litchi, jack fruit, guava, mango, black berry and banana. So, the reduction of seed germination percentage was found in seeds treated with wood apple possibly due to the toxic compounds present in the aqueous extracts. Table 1 shows that the aqueous extract of wood apple had significant effect to reduce the growth and shoot length of barnyard grass seeds. The lowest shoot growth was due to wood apple leaves extract followed by Indian olive, which were statistically identical. The highest shoot length of barnyard grass seedlings was due to effect of the aqueous extract of indian dillenia leaves possibly due to growth inhibitory substances present in it. The wood apple leaves extract had significant effect to reduce the growth and root length of barnyard grass seeds. Similarly, barnyard grass seedlings growth was significantly reduced by the aqueous extracts of olive leaves compared with control. The lowest root length of barnyard grass seedlings (0.72 cm) was recorded in seeds treated with olive, which was statistically different from others. The second lowest root length 0.762 cm was obtained in seeds treated with wood apple which was statistically identical to banana 1.23 cm. The third lowest root length 1.48 cm was found in seeds treated with guava (T_4) which was statistically different from others. The root length 3.29 cm was found in seeds treated with control, which was statistically different from others. The lowest root length of barnyard grass seedlings (0.762 cm) was obtained in seed treated with wood apple aqueous extract due to the presence of some toxic compounds or other inhibitory materials.

Table 1. Effects of fruit leaves extract on barnyard grass seeds

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)
Water control (T_c)	54.4a	5.52abc	3.28a
Mango(T_1)	58.4a	5.23abc	1.88b
Jack fruit(T_2)	56.0a	6.74ab	2.04ab
Black berry(T_3)	63.2a	6.16abc	1.83b
Guava(T_4)	57.6a	5.70abc	1.48b
Litchi(T_5)	54.4a	4.09c	1.73b
Indian dillenia(T_6)	64.8a	7.64a	2.06ab
Banana(T_7)	64.8a	4.60bc	1.22b
Wood apple(T_8)	6.40b	3.83c	0.762b
Indian olive(T_9)	67.2a	4.00c	0.720b
Indian gooseberry(T_{10})	66.4a	6.75ab	1.75b
Sd	4.23	0.764	0.440

Effects of fruit leaves extract on spiny amaranth seed: The lowest germination percentage was found in seeds treated with wood apple over the control and statistically different from others where as the highest germination rate was found in seeds treated with indian goose berry (Table 2). The second lowest germination rate recorded in seeds treated with indian guava and jack fruit (39.2%), which were statistically identical. The germination percentages were found in seeds treated with litchi, mango, indian olive and banana, which were statistically identical. The germination rate was found in seeds treated with indian dillenia extract while indian goose berry. Overall the lowest seed germination percentage was obtained from the seeds treated with wood apple probably due to the some toxic compounds present in the respective species (Table 2). The lowest shoot length 0.570 cm was observed from the aqueous extract of wood apple compared with control (1.41 cm) (Table 2). The maximum shoot length 1.69 cm of spiny amaranth seedlings was recorded in seeds treated with olive, which was statistically different from others. The second lowest shoot lengths was 1.43 cm recorded in banana while black berry, guava, indian dillenia and control had 1.43 cm, 1.48 cm, 1.50 cm, 1.53 cm and 1.568 cm, respectively, which were statistically similar. The shoot lengths of spiny amaranth seedlings was 1.41 cm treated with water and 1.61 cm in litchi which were statistically analogous. The decreasing tendency of shoot length in aqueous extract of wood apple treated seedlings might be due to the presence of some toxic compounds or other growth inhibitory materials. Table 2, shows that the lowest root length of spiny amaranth seedlings was 0.270 cm treated with wood apple extract but the control had 1.05 cm. The second lowest root lengths of spiny amaranth seedlings 0.548 cm was found in seeds treated with guava followed by indian dillenia (0.696 cm), litchi (0.740 cm), jackfruit (0.756 cm) mango (0.848 cm), black berry (0.884 cm) were statistically similar. Similarly, the highest root length of spiny amaranth seedlings was 0.908 cm treated with banana, which was statistically siniicant from others. The reduction of root length of spiny amaranth seedlings in seeds treated with wood apple perhaps due to toxic chemicals present in the species.

Table 2. Effects of fruit leaves extract on spiny amaranth seeds

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)
Water control (T_c)	60.80bc	1.412a	1.052a
Mango(T_1)	44.0de	1.568a	0.848ab
Jack fruit(T_2)	39.20e	1.680a	0.756abc
Black berry(T_3)	27.20f	1.480a	0.884ab
Guava(T_4)	20.80f	1.50a	0.548abc
Litchi(T_5)	43.20de	1.610a	0.740abc
Indian dillenia(T_6)	64.0b	1.538a	0.696abc
Banana(T_7)	52.0cd	1.430a	0.908ab
Wood apple(T_8)	8.80g	0.5700b	0.270c
Indian olive(T_9)	48.80de	1.692a	0.640abc
Indian gooseberry(T_{10})	76.0a	1.532a	0.3560bc

Effects of fruit leaves extract on green amaranth: During the effect of aqueous extracts of fruit plants on green amaranth seeds germination. The least germination percentage 8.80% was recorded in seeds treated with wood apple statistically identical over the control and other treatments (Table 3). The second lowest germination percentage was found 32.0% in seeds treated with jack fruit followed by 34.40% and 37.60% in seeds treated with Olive and Guava, respectively and were statistically identical. The germination percentages on green amaranth 56.80%, 50.40%, 46.40%, 44.80%, 37.60%, 34.40% and 32.00% were found in seeds treated with water, black berry, mango, guava, olive, banana and jackfruit respectively, which were statistically similar among themselves. The reduction of germination percentage of green amaranth possibly also due to presence of some toxic compounds present in the aqueous extracts respective species. During the effect of aqueous extracts of fruit plants on green amaranth seeds germination. The least germination percentage 8.80% was recorded in seeds treated with wood apple statistically identical over the control and other treatments (Table 3). The second lowest germination percentage was found 32.0% in seeds treated with jack fruit followed by 34.40% and 37.60% in seeds treated with olive and guava, respectively and were statistically identical. The germination percentages on green amaranth 56.8%, 50.4%, 46.4%, 44.8%, 37.6%, 34.4% and 32.0% were found in seeds treated with water, black berry, mango, guava, olive, banana and jack fruit respectively, which were statistically similar among themselves. The reduction of germination percentage of green amaranth possibly also due to presence of some toxic compounds present in the aqueous extracts respective species. Table 3 shows that the lowest root length of green amaranth seedlings 0.29 cm was found in seeds treated with wood apple. The second lowest root lengths of green amaranth seedlings in seeds treated with indian dillenia (0.634 cm) and 0.876 cm was recorded in seeds treated with Litchi statistically identical compared with the control and other treatments. The lower root lengths 1.0 cm, 1.002 cm, 1.012 cm, 1.036 cm and 0.9480 cm were recorded in seeds treated with guava, black berry, indian goose berry and mango, respectively, which were statistically identical. The smaller root growth in green amaranth seedlings was found treated with aqueous extracts of wood apple perhaps due to presence of some toxic compounds or other organic compounds on the respective fruit leave species.

Table 3. Effects of fruit leaves extract on green amaranth

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)
Water control	56.8ab	1.488a	0.926ab
Mango	46.4bcd	1.642a	1.036a
Jack fruit	32.0e	1.656a	0.978a
Black berry	50.4abc	1.494a	1.002a
Guava	44.8bcde	1.424a	1.000a
Litchi	54.4ab	1.234ab	0.876ab
Indian dillenia	60.0a	1.390a	0.6340b
Banana	34.4de	1.628a	1.022a
Wood apple	8.8f	0.840b	0.290c
Indian olive	7.6cde	1.652a	0.946ab
Indian gooseberry	56.8ab	1.670a	1.012a
Sd	4.223	0.1794	0.1058

The aqueous extract of wood apple leaves reduced the germination rate, shoot and root length after germination of barnyard grass, spiny amaranth and green amaranth. Wood apple was selected for chemical investigation for which type of compounds is responsible for the above decreasing activities (Gomez 1984**).**

This study indicated that the aqueous extracts of wood apple fruit leaves are perhaps the most promising and received germination and growth of attention at least

partly owing to the presence of growth inhibitory compound. It might have the growth retarding and herbicidal effect on barnyard grass, spiny amaranth and green amaranth seeds.

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