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Allelopathic Effects of Some Fruit Plant Species with Weeds

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aqueous extracts of seven fruit plant species viz., banana (*Musa paradisiaca*), Indian gooseberry (*Phyllanthus emblica*), jack fruit (*Artocarpus heterophyllus*), guava (*Psidium guajava*), mango (*Mangifera indica*), litchi (*Litchi chinensis*), wood apple ((*Aegle marmelos*) were tested for germination, radical and plumule growth of barnyard grass and green amaranth. The lowest germination percentage (9.5 and 14.4%), plumule (3.94 and 0.92 cm) and radicle length (0.825 and 0.495 cm) of barnyard grass and green amaranth seedlings were obtained in seed treated with wood apple aqueous extract due to presence of some toxic compounds or other inhibitory materials in the species. One of these plant extract which performed the best i.e. wood apple leaves extract has the potential for use as an alternative crop as a herbicide (protectants) against barnyard grass and green amaranth weed species.

Keywords: Aqueous extract; germination; radical; plumule.

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1. INTRODUCTION

Biochemical interactions (deleterious or beneficial) between the plants is called allelopathy and allelopathic interactions play a vital role in agro-ecosystems, where farming replaces the nature flora than in stable pasturelands [1,2]. Various studies have shown the inhibitory effects of phytotoxins from weeds on crops [3,4,5,6,7]. Thus, incorporating allelopathy in agricultural weed management programs may reduce the usage of herbicides [8]. This information is necessary to develop sustainable cropping systems for this region.

There are different types of essential constituents of the human requirements of plants those comes under groups of cereals, pulses, oilseeds herbal or medicinal plants, woody plants, narcotic crops, herbaceous plant, shrubs, weeds and fruit plants etc. in the plant kingdom. Different types of naturally occurring organic and bio organic 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 provide raw material for clothing and medicine [6,8,9]. However, the allelopathic effects of major weeds on vegetable crops [10]. Allelopathy arises from the release of chemicals by one plant species, which adversely affects the other plant species in its vicinity. Certain plant leaves have the herbicidal and insecticidal activities which are available in nature, which checks the environmental pollution and soil pollution. The synthetic or chemical compounds may be toxic and health hazards needs careful handling where as botanical or organic herbicides and pesticides are safe and have no high toxicity [6]. 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 two weed seeds, and their primary growth rate.

2. MATERIALS AND METHODS

This study was conducted on the Premises of Krishi Vigyan Kendra, Mon (Aboi), Nagaland, India (26.59ºN latitude, 94.9670ºE longitude and 582.53 m altitude) during October to November, 2020. The mean annual average rainfall was 2467 mm and mean temperature ranged from 13.5 to 16.0ºC. There are seven fruit tree species viz., banana (*Musa paradisiaca*), Indian gooseberry (*Phyllanthus emblica*), jack fruit (*Artocarpus heterophyllus*), guava (*Psidium guajava*), mango (*Mangifera indica*), litchi (*Litchi chinensis*), wood apple ((*Aegle marmelos*) lessing in this district. The influences of seven major fruit tree species were determined on two selected weeds viz., barnyard grass and green amaranth in petriplate bioassays under laboratory conditions.

Table 1. Effects of fruit leaves extract on barnyard grass and green amaranth grass seeds (±SD)

Treatment	Barnyard grass			Green amaranth		
	Germination (%)	Shoot length (cm)	Root length (cm)	Germination (%)	Shoot length (cm)	Root length (cm)
Banana (T_1)	67.4±6.2	5.45±0.9	1.32±	36.8±4.5	1.52±0.6	0.965±0.5
Indian gooseberry (T_2)	68.6±6.0	6.65±1.0	1.76±	60.4±8.5	1.68±0.7	1.065±0.5
Jack fruit (T_3)	58.4±5.3	6.70±1.5	2.02±	34.0±6.3	1.58±0.7	0.948±0.4
Guava (T_4)	60.0±5.5	5.65±1.5	1.45±	43.5±6.0	1.44±1.0	1.022±0.4
Litchi (T_5)	44.0±4.1	4.10±1.1	1.05±	56.6±8.0	1.30±1.0	0.855±0.3
Mango (T_6)	60.8±7.8	5.20±0.7	1.85±	51.2±7.5	1.60±0.9	1.044±0.5
Wood apple (T_7)	9.5±3.5	3.94±0.7	0.825±	14.4±3.0	0.920±0.3	0.495±0.2
Control water (TC)	55.6±7.5	5.62±0.8	3.25±	61.6±7.0	1.58±0.8	0.942±0.4
CD at 5%	2.71	0.31	0.25	2.80	0.25	0.20

The mature leaves of banana, Indian gooseberry, jack fruit, guava, mango, litchi, and wood apple were collected in the last week of September 2020. The leaves were dried and ground separately in a mechanical grinder. The powdered sample, 2 gm of each species was weighed and added to 100 ml distilled water and kept for 72 hours at room temperature (18±2^{0}C) to make 2% aqueous extracts of each species, respectively. The resulting brownish and dark extractions were filtered through three layers of Whatman No. 1 filter paper and stored in dark in conical flasks, until required. Twenty five seed of each test crop (in four replicates) were placed in sterilized petri dishes (13.0 cm dia.), lined of Whatman No. 1 filter paper. Ten ml extract of each plant was added per petri plate on first day. Distilled water served as control. Moisture in the petri dishes was maintained by adding 2 ml of extract or distilled water as required. The seed germination, radical and plumule growth was recorded at seven days after sowing. The data was statistically analyzed using critical difference at 5% level of significance.

3. RESULTS AND DISCUSSION

The aqueous extracts of leaves of fruit plants in 2% concentration severely suppressed the root, shoot and root length of green amaranth as compared to barnyard grass. Wood apple leaf extract had significant effect to reduce the growth and germinating of barnyard grass seeds (Table 1). The lowest germination percentage was 9.5% for barnyard grass seeds treated with aqueous extract of wood apple while 54.0%, 58.4%, 60.0%, 60.8%, 67.4% and 68.4% was recorded treated with the extracts of litchi, jackfruit, guava, mango, banana and goose berry. So the reduction of seed germination percentage was found in seeds treated with wood apple probably 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 of shoot and root length of barnyard grass seeds. The lowest shoot and root growth was recorded in wood apple leaves extract (3.94 and 0.825 cm) followed by litchi leaves extract (4.10 and 1.05 cm). The highest shoot length of barnyard grass seedlings was noticed to jackfruit leaves extract (6.70 cm). Similarly, barnyard grass seedlings growth was significantly reduced by the aqueous extracts of litchi leaves as compared with control (5.62 and 3.25 cm).

The lowest germination percentage, shoot and root length of barnyard grass seedlings was obtained in seeds treated with wood apple aqueous extract due to presence of some toxic compounds or other inhibitory materials in the species.

The least germination percentage 14.4% was recorded in green amaranth in seeds treated with wood apple as compared the control and other treatments (Table 1). The second lowest germination percentage was found 34.0% in seeds treated with jackfruit followed by 36.8% and 43.5% in seeds treated with banana and guava, respectively. The germination percentages of green amaranth 61.6%, 60.4%, 56.6%, 51.2% were found in seeds treated with water, goose berry, litchi, and mango, respectively, which were similar among themselves. 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, respective species. Table 1 shows that the lowest shoot and root length of green amaranth seedlings (0.92 cm and 0.495 cm) was recorded in seeds treated with wood apple. The second lowest shoot and root length of green amaranth seedlings in seeds treated with litchi leaves extract (1.30 cm and 0.855 cm) as compared with control and other treatments. Very less information is available on the allelopathic effects of trees of this region on the weeds. The growth inhibitory effect of ten fruit leaves on selected weeds viz. barnyard grass, spiny and green amaranth [6]. Likewise, allelopathic effects of *Ageratum conyzoides* and *Eupatorium odoratum* on germination and seedling growth of rice and Allelopathic effects of weeds on germination and growth of legumes and cereal crops have been reported [4,7]. Phyto-allelopathic effect of different trees leaves aqueous extracts on seed germination and seedling growth of *Echinochloa crus-galli* [10]. Our findings are in agreement with the observations of these workers.

4. CONCLUSION

The lowest germination percentage and growth of barnyard grass and green amaranth seedlings was obtained in seeds treated with wood apple leaves aqueous extract. The study indicated that the aqueous extracts of wood apple tree 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 and green amaranth seeds.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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