PHYTOTOXIC EFFECTS OF SOME MEDICINAL PLANTS ON GERMINATION AND SEEDLING GROWTH OF SOME SELECTIVE PLANTS

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Dedicated to
My Beloved Parents

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ABSTRACT

An experiment was conducted during the period of January-June, 2017 at the Agricultural Chemistry Laboratory and net house (field condition) to investigate the phytotoxic effects of ten medicinal plants (cirota, bohera, anantamul, nagesshor, ashok, arjun, bashok, akandho, darucini and rosundi) aqueous extract on germination and seedling growth efficiency of five selective plants, three dicot (cauliflower, broccoli and tomato) and two monocot (foxtail millet and barnyard grass) under both condition. The aqueous extracts of medicinal plants at six different concentrations (control, 0.001, 0.003, 0.01, 0.03 and 0.1 g/ml) were examined on five plant species in the laboratory condition and concentrations (control, 1, 2, 3, 4 and 5 g/ml) were examined only for bashok extract on five plant species in the net house (field condition). Result indicated that the germination efficiency, plumule length (cm) and radicle length (cm) and dry weight of plants were completely inhibited at the highest concentration of aqueous extracts (0.1g/ml) where at least inhibition was observed at control. There was a clearly observed variation of treatment effect between the monocot and dicot plants where monocot plants (foxtail millet and barnyard grass) showed great treatment effects than dicot plants (cauliflower, broccoli and tomato) and out of three dicot plants, the least variation of treatment effect was found in tomato because of its larger seed size and hard seed coat . Among the (leaf & flower) aqueous extract of ten medicinal plants, the treatment effect of cirota, bashok and rosundi caused the greatest variation in the germination percentages, plumule length, radicle

length and dry weight of five selective plants but mostly in foxtail millet and barnyard grass. Thus, phototoxic effects of cirota, bashok and rosundi may reduce weed competition with crops by significantly affecting the germination and seedling growth of foxtail millet and barnyard grass.

CHAPTER I

INTRODUCTION

Phytotoxicity is described as the beneficial and deleterious biochemical interaction between plants and micro-organisms. It is any direct or indirect effect by one plant, including micro-organisms, on another through the production of chemical compounds that escape into the environment and competition which involves the removal of some factors (nutrient, water and light) from the environment, habitat or through chemicals released from one plant (donor) that affect the other (receiver) sharing the habitat. The phenomenon known as "phytotoxicity" is now considered as important as competition for influencing plant growth both in natural and agricultural ecosystem. Leaf or flower injury can be caused by a chemical foliar spray or soil drench. It can be defined as a delay of seed germination, inhibition of plant growth or any adverse effect on plants caused by specific substances (phytotoxins) or growing conditions (PAS 100). If a phytotoxic effect of a certain material is stated, further investigations should be carried out to identify the specific cause. Phytotoxicity symptoms may show up as leaf speckling, leaf margin necrosis (browning) or chlorosis (yellowing), brown or yellow leaf spots or patches, leaf cupping or twisting, plant stunting or plant death. Again such damage may be caused by a wide variety of compounds, including trace metals, salinity, pesticides, phytotoxins

or allelochemicals. It is the degree of toxic effect of these chemical compounds on plant growth which creates a condition in a given substance in the environment is harmful to plants.

Phytochemicals emancipated as residues, exudates and leaches by many plants from leaves, stem, roots, fruit and seeds reported to interfere with growth of other plants (Asgharipour and Armin, 2010).

These chemicals products mainly affect plants at seed emergence and seedling levels (Alam and Islam, 2002; Hussain *et al.*, 2007; Mohamadi and Rajaie, 2009; Naseem *et al.*, 2009). In general, the chemical interactions that occur among living organisms including plants, insects, microorganisms and organic compounds involved in phytotoxicity are called phytochemicals. The release of phytochemicals from plants occurs by volatilization, leaching from leaves, stems, buds, flowers, fruits, seeds, exudation from roots, and degradation of dead plant parts. All parts have been shown to contain phytochemicals but leaves and roots are the most important sources.

Phytotoxicity plays an important role in agricultural ecosystems and in a large scale, in the plant covers among the crop-crop, crop-weed and tree-crop covers. These interactions are detrimental and occasionally, are useful and gave attention to phytotoxicity in natural and agricultural ecosystems. Today, phytotoxicity is recognized as appropriate potential technology to control weeds using chemicals released from decomposed plant parts of various species (Naseem *et al.*, 2009).

There are different stages in plants growth such that each stage has been different chemical compounds (secondary metabolites) that result in varying effects on other organisms or plants. Sometimes a single chemical produced by one organism or plant is harmful to another but

beneficial to a third organism or plant. In addition, environmental conditions and genetic characteristics are the most effective agents in enhancing synthesis and exudation of phytochemicals.

Severe uncontrolled weed infestations often cause poor crop establishment or complete crop failure (Pannacci *et al.,* 2010). Bioherbicides represent solution to heavy use of synthetic herbicides which it causes serious threats to the environment, consumers and increases costs of crop production (Asghari and Tewari, 2007). Unavailability of grass herbicides registered both for pre- and post-emergence applications (Pannacci *et al.,* 2010). Moreover, continuous use of herbicides for weeds control causes herbicide resistant (Naseem *et al.,* 2009). Many authors reported employ plants extracts for controlling weeds with variable success (Hussain *et al.,* 2007; Naseem *et al.,* 2009). However, phytochemicals might affect both crop and weeds when found together. The crop was distress directly or indirectly by the phytochemicals and lead to either stimulation or inhibition of growth (Asgharipour and Armin, 2010). Several works have demonstrated the harmful influence of application of medicinal plant species to some selective plants including reduced seeds germination, seedlings emergence and biomass gain. Aqueous extracts of leaves have notably inhibited seed germination of sorghum with application of *Parthenium hysterophorus* (Murthy *et al.,* 1995), *Ipomoea cornea* (Jadhav *et al.,*1997), *Commelina bengahalensis* and *Cyperus rotundus* (Channappagoudar *et al.,* 2003) and *Eucalyptus camaldulensis* (Mohamadi and Rajaie, 2009).

OBJECTIVES:

1. To investigate the potential phytotoxic effects of some selected medicinal plants on germination and seedling growth

2. To assess the inhibition of germination and seedling establishment and also inhibits the growth of weeds and crops

3. To find out valuable and environmental friendly alternatives to the synthetic pesticides

CHAPTER II

REVIEW OF LITERATURE

Phytotoxicity is a toxic effect by a compound on plant growth. Such damage may be caused by a wide variety of compounds, including tracemetals, salinity, pesticides, phytotoxins or allelochemicals. High concentrations of mineral salts in solution within the growing medium can have phytotoxic effects. Therefore, relevant information available in the literature pertaining to the phytotoxin effect of some medicinal plants on germination and seedling growth of some selective plants were reviewed in this section. Moreover literatures related to the efficient multivariate techniques were also reviewed in the following headings.

- **Phytotoxicity on germination**
- **Phytotoxicity on seedling growth**

2.1 Phytotoxicity on germination:

Alam and Islam (2002) reported that plants produce chemicals, which interfere with other plants and affect seed germination and seedling growth. These chemicals have harmful effects on crops in the eco-system resulting in the reduction and delayed germination, seedling mortality and reduction in growth and yield (McWhorter, 1984; Herro and Callaway, 2003).

Asgharipour and Armin, (2010) reported that the study of phytotoxicity of plant organs extract at seed germination and seedling growth stages was beneficial for it is difficult to separate the phytochemicals effects from that of competition among crop and allelopathic plants. The allelochemicals sometimes have positive effects on sorghum growth. For example, *Moringa oleifera* leaf extracts enhanced germination of sorghum by 29% (Phiri, 2010).

The same kind of germination pomotary behaviour was also observed in extract of *Cassia angustifolia* (Hussain *et al*., 2007).

Azizi and Fujji (2006) found that *Eucalyptus* sp. essential oils had a strong inhibitory effect on the germination of *A. retroflexus*.

Ghorbani *et al*. (2008) studied that aqueous extracts of sunflower reduced germination and mean daily germination.

Jeffersona and Pennacchio (2003) carried out an investigation and revealed that allelochemicals may reduce weed competition with crops by delaying weed germination. Aqueous extracts of leaves have notably inhibited seed germination of sorghum with application of *Parthenium hysterophorus* (Murthy *et al*., 1995), *Ipomoea cornea* (Jadhav *et al*., 1997) *Commelina bengahalensis* and *Cyperus rotundus* (Channappagoudar *et al*., 2003) and *Eucalyptus camaldulensis* (Mohamadi and Rajaie, 2009).

Mohamadi and Rajaie, (2009) showed that the effects of allelochemicals on seeds germination appear to be mediated through a disruption of normal cellular metabolism rather than through damage or organelles. The extract concentrations of allelochemcial will reduce sorghum seeds germination and ultimately results in reduction in yield. These results are in agreement with

those of Singh *et al*. (1992), Nandal *et al*. (1999 a, b) and Patel *et al*. (2002) who all observed reduction in germination percentage with extract/ leachates application to wheat seed.

Mubarak *et al*., (2009) studied an agreement with other studies which showed that sorghum seeds germination was significantly reduced when treated with *Eucaliptus camaldulensis* (Mohamadi and Rajaie, 2009) and *Spina christi*, *Sesbania sesban* and *Tamarindus indica.*

Singh *et al*. (1992) reported that aqueous extracts of air dried leaf litter of *E. citirodora* had inhibitory effect on the seed germination, in wheat, mustard and gram.

Yang *et al.* (2002) observed that aqueous Eucalyptus extract of various concentrations inhibited the germination of twelve wheat varieties and also negatively affected their fresh weights. Similar results were obtained after treatment of rice plant with three allelopathic phenolics.

Zakaria and Razak, (1990) revealed that the differences in the germination percentage between the cultivars could be attributed to differences in the selective permeability of the seeds coat of sorghum to inhibitory substances. *Moringa oleifera*, *Khaya senegalensis* and *Albizia lebek* leaf extracts found to have no significant effects on seed germination of sorghum (Mubarak *et al*., 2009; Phiri, 2010).

2.2 Phytotoxicity on seedling growth:

Anjum and Bajwa, (2008) while studying the allelopathy influence of the sunflower on some weeds indicated the strong suppressive potential of this plant on some growth and physiological parameters of the tested plants. Allelochemicals emancipated as residues, exudates and leaches by many plants from leaves, stem, roots, fruit and seeds reported to interfere with growth of other plants (Asgharipour and Armin, 2010). These chemicals products mainly affect plants at

seed emergence and seedling levels (Alam and Islam, 2002; Hussain *et al*., 2007; Mohamadi and Rajaie, 2009; Naseem *et al*., 2009).

Arshad and Frankenberger, (1998) found that allelochemicals have shown far-reaching effects on the growth and development of plants even at low concentration. A number of laboratory-based experiments have focused on the effects of leaf sap, volatile compounds, foliage decomposition and root exudation on seed germination and the early growth stages of various receptor species (Molina *et al.,* 1991; Lisanework and Michelsen, 1993; Fang *et al.,* 2009). This is in agreement with past studies which found that seedlings planted in Eucalyptus plantations were affected by allelopathic chemicals from volatilization, leaching, foliage litter decomposition and root exudation (May and Ash, 1990; Sasikumar *et al*., 2001).

Asgharipour and Armin, (2010) observed that allelochemicals might affect both crop and weeds when found together. The crop was distress directly or indirectly by the allelochemicals and lead to either stimulation or inhibition of growth.

Biodiversity reduction in fast-growing Eucalyptus plantations has been a crucial issue for the long-term sustainability of native ecosystems and allelopathy has been considered a factor for the loss of biodiversity in Eucalyptus plantations (Sasikumar *et al*., 2001; Ahmed et al., 2008; Zhang and Fu, 2009).

Chatiyanon *et al.* (2012) reported that the water and methanol extract of the leaves of *H. suaveolens* has allelopathic effects on the germination and seedling growth of *Pennisetum setosum and Mimosa invisa*. Similar findings were also reported by Kapoor (2011) who worked with dry leaf residue of *H. suaveolens* and observed inhibitory activity on the growth and physiological parameters of *Parthenium hysterophorus* L.

Chung *et al*. (2001) assessed the allelopathic potential of 44 rice cultivars (*Oryza sativa* L.) on barnyard grass. All 44 cultivars exhibited marked differences in the inhibition of barnyard grass growth and development.

Colquhoun (2006) evaluated that allelopathic compounds, often considered plant-produced herbicides, can inhibit growth of nearby plants. These compounds could be an alternative weed management strategy for crop production and can offer environmental benefits.

Dawar *et al.* (2007) observed that aqueous Eucalyptus extract was effective in general to cause growth inhibition. But all plants of same species were not equally susceptible to aqueous extracts of Eucalyptus.

Dhima *et al*. (2009) indicated that green manure of aromatic plants, such as anise, dill; oregano or lacy phacelia could be used for the suppression of barnyard grass and some broadleaf weeds in maize which consequently minimize herbicide usage.

Einhelling and Leather, (1988) studied that there are about 400,000 secondary metabolites in plants with allelopathic activities (Swain, 1977), of which only a few have been examined. The rest of the compounds, might contain very promising growth inhibitors are still unknown. Since about 12.5% of the total plants species of the world are considered as medicinal plants (Wakdikar, 2004), therefore, they could be served as important candidates for allelopathic research. Isolation and characterization of that unknown allelochemicals from medicinal plants might provide the chemical basis for new natural herbicides developments.

Fujii (2001) assessed 53 cover crop plant species (including 26 leguminous, 19 graminaceous, and 8 others) for their allelopathic activity. It was found those leguminous cover crops such as

hairy vetch and velvetbean, and graminaceous cover crops, such as oat (*Avena sativa* L.) and rye (*Secale cereale* L.) as well as certain cultivars of wheat (*Triticum aestivum* L.) and barley (*Hordeum vulgare* L.) showed high allelopathic potential. *Nerium oleander* extract was reported to have rutin, quercetin (flavonoids), oleandrin, neriine (cardiac glycosides), rosagenin, folinerin, neritaloside and other compounds (Rajyalakshmi *et al*. 2011).

Naseem *et al*., (2009) studied that today; allelopathy is recognized as appropriate potential technology to control weeds using chemicals released from decomposed plant parts of various species.

Patel *et al*., (2002) studied the effects of leaf extracts of Eucalyptus and other species on wheat and mungbean. He reported that the extract inhibited the rooting rate of wheat cuttings by 100%. Harmful effects of Eucalyptus did not degrade under field conditions. He observed reduction in germination percentage with Eucalyptus extract/leachates application to wheat seed.

Phiri, (2010) carried out an experiment on effect of *M. oleifera* leaf extracts on sorghum indicated 15.3% reduction in survival seedlings. The leaches of *E. camaldulensis* (Mohamadi and Rajaie, 2009) and many plant extracts (Mubarak *et al*., 2009) were also reported to reduce seedlings growth of sorghum.

Rice, (1984) found that allelochemicals cause germination and growth inhibition, and influence a wide variety of metabolic processes. These substances can be isolated from plant tissues. Allelochemicals can be found in numerous parts of a plant such as roots, rhizomes, leaves, stems, pollen, seed, and flowers, and are usually products of secondary plant metabolism. Weeds account for more than 1% of the total plant species on earth, but cause great damage by

interfering with food production, health, economic stability and welfare (Qasem and Foy, 2001). They may be defined as plants with little economic value and possessing the potential to colonize disturbed habitats or those modified by human activities (Macias *et al*., 2004). Simply put, weeds are often plants that are uniquely adapted to a wide range of environmental conditions, and they did not acquire problem status until humans developed agriculture. Therefore, it is up to humans to find a solution to the problems weeds cause in agriculture.

Rice, (1984) observed that a number of abnormalities have been found when the test species are subjected to allelochemicals, and is the plausible cause for their growth inhibition. For example, allelochemicals inhibit the process of cell division, elongation and expansion rate, (Ortega *et al.,* 1988; Einhellig, 1996; Jacob and Sarada, 2012), respiration process (Inderjit and Keating, 1999), ion absorption process (Qasem and Hill, 1989), enzyme activity (Sato *et al.*, 1982), plant endogenous hormones and protein synthesis (Jacob and Sarada, 2012), alteration of the phytochrome control of germination (Leather and Einhellig, 1988) and consequently, arrested the plant growth.

Rice, (1974) reported that allelochemicals can stimulate the seedlings growth at very low concentrations but inhibit the seedlings growth at high concentrations. In devising laboratory and greenhouse studies, efforts have been made to assure that the biological activities obtained are indeed due to the extracellular toxins by the donor plants (Qasem and Foy, 2001). For example, Belz *et al*. (2009) conducted a study to investigate whether or not the plant metabolite parthenin is sufficiently persistent, phytotoxic, and bioavailable in soils to cause an allelopathic effect that makes it attributable to the invasive success of the weed *P. hysterophorus*. In this study, parthenin was found to be quickly degraded without any evident accumulation to toxic

levels over time and therefore; the hypothesis that parthenin contributes to the invasiveness of *P. hysterophorus* was rejected. Rice, 1979 and Qasem, (2002) stated that the aqueous extract of the donor plants showed a wide range of activities from partial and complete inhibition to stimulation which may indicate the presence of certain allelochemicals causing inhibition. Many researches around the world show their keen interest on medicinal plants for searching new novel compounds and reported that medicinal plants have growth inhibitory effects on different noxious weed species and have the potentiality to use them in the crop fields either directly or as a natural herbicides (Lin *et al.,* 2003, 2004; Han *et al.,* 2008; Sodaeizadeh *et al*., 2009; Li *et al*., 2009). Moreover, it was reported that screening of allelopathic plant from medicinal plants species is easier than other plants (Fujii *et al*., 2003) possibly due to their existed certain metabolic compounds which was used for curing many diseases of both animal and human being.

Salam and Kato-Noguchi (2010) also reported that roots were more sensitive to the allelochemicals than hypocotyls/coleoptiles because the roots are the first organ to absorb allelochemicals from the environment. Whereas, Nishida *et al.* (2005) stated that the permeability of allelochemicals into root tissue is higher than the shoot tissue.

Xuan *et al*. (2004) reported that aqueous extract of neem (*Azadirachta indica* A. Juss.) had phytotoxic potential and inhibited growth of *E. crus-galli, Monochoria vaginalis* (Burm. f.), and *Aeschynomene indica* L.

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted during the period of January-June 2017, to study the phytotoxic effects of some medicinal plants on germination and seedling growth of some selective plants. The materials and methods describe a short description of the experimental site, experimental materials, treatments and design, data collection procedure and data analysis. The detailed materials and methods that were used to conduct the study are presented below under the following headings:

3.1 Description of the experimental site

3.1.1 Location

The experiment was conducted at the Agricultural Chemistry Laboratory and net house, Department of Agricultural Chemistry, Sher-e-Bangla Agricultural University (SAU), Sher-e-Bangla Nagar, Dhaka-1207. It was located in $23^0$41' N latitude and $90^0$22' E longitude at a height of 8.6 m above the sea level.

3.1.2 Condition of net house (experimental field)

The temperature and relative humidity of the net house were recorded during the study period in the SAU weather station. The average minimum and maximum temperature during the study

periods of the field was 15.4 ^{0}C to 38.20 ^{0}C, respectively and average minimum and maximum relative humidity was 30.3% and 80.20%, respectively.

3.2 Test crops

Five test species i.e. cauliflower, broccoli and tomato, foxtail millet and barnyard grass were used for this experiment. These seeds (cauliflower, broccoli, tomato, and foxtail millet) were collected from Bangladesh Agricultural Research Institute (BARI) and barnyard grass was brought from Japan by my honorable Co-Supervisor. The collected seed species were free from any visible defects, disease symptoms and insect infestations and transported to the laboratory of the Department of Agricultural Chemistry, SAU, Dhaka-1207, with careful handling to avoid disease and injury.

3.3 Experimental materials

Petri dish, filter paper, forceps, oven, rotary evaporator (HS-2005S), growth chamber, 5 test species-2 monocot (barnyard grass, foxtail millet) and 3 dicot (cauliflower, broccoli, tomato) were used for this study.

3.4 Solution Preparation

Leaf and flower of ten medicinal plant samples were collected from various places at SAU campus, Dhaka and from Nuhaspolli, Gazipur with the help of my honorable Supervisor and Co-supervisor. The samples were washed in tap water and air-dried. Then the samples were dried in an oven for few days at 60^{0}c until constant weight was gained. The samples were then grinded to make fine uniform texture and kept in air tight polybag until use.

List of the 10 medicinal plants are given below-

English Name	Scientific Name	Family
1. Cirota	*Swertia perennis*	Gentianaceae
2. Bohera	*Terminalia bellirica*	Combretaceae
3. Anantamul	*Hemidesmus indicus*	Apocynaceae
4. Nagesshor	*Mesua serreal*	Guttiferae
5. Ashok	*Saraca asoca*	Caesalpiniaceae
6. Arjun	*Terminalia arjuna*	Combretaceae
7. Bashok	*Justicia adhatoda*	Acanthaceae
8. Akandho	*Calotropis procera*	Asclepiadaceae
9. Darucini	*Cinnamomum verum*	Lauraceae
10. Rosundi	*Mansoa alliacea*	Bignoniaceae

A. Aqueous solution preparation

10 g of each samples were taken in a several conical flask and added 80 ml methanol 20 ml distilled water. Then stirred and was covered by aluminium foil for keeping it 24 hours. Finally extracted in aqueous solution for 48 hours. The extract was then filtered through one layer of filter paper. The residue was re-extracted with equal amount of water for 72 hours. filtering was done with filter paper whatman 1. Then, 50ml methanol was added to plant extract for further filteration to acquire maximum phytotoxicity while in the field condition there was no methanol added to the solution.

50 ml sample extract was found separately and kept for few days. Evaporation was done by rotary evaporator (HS-2005S) at 40^0 C for 30 minutes to remain 30ml of water and sample material. Again 20 ml methanol was added to each sample extract and shaken for sometimes.

3.5 Phytotoxic assessment

0.001, 0.003, 0.01, 0.03, 0.1 g/ml concentrated extract with few drops of Tween 20T was added with dissolved water to the petri dish. Placed all petridish in growth chamber under 25^0 C temperature with 2500 lux light intensity and added some water every alternative day.

3.6 Treatments

There were 6 levels of aqueous solution of 5 selected plants for laboratory condition. There are-

1. T_1= 0 g/ml
2. T_2= 0.001 g/ml
3. T_3= 0.003 g/ml
4. T_4= 0.01 g/ml
5. T_5= 0.03 g/ml
6. T_6= 0.1 g/ml

There were 6 levels of aqueous solution of 5 selected plants for field condition. There are-

1. T_1= 0 ppm
2. T_2= 1 ppm
3. T_3= 2 ppm
4. T_4= 3 ppm
5. T_5= 4 ppm
6. T_6= 5 ppm

3.7 Data collection heads

The following data was collected

1. Germination percentage
2. Plumule length
3. Radicle length
4. Dry weight

3.8 Data collection Method

3.8.1 Total germination (TG %)

The standard germination test was performed by placing randomly selected 20 seeds in the petri dish. Experimental units were arranged in a completely randomized design with three replications. Germination was considered to have occurred when radicles were 2 mm long (Akbari *et al.,* 2007). Germination progress was inspected and data were collected at every 24 hr intervals and continued up to 7 days. The seedlings with short, thick and spiral formed hypocotyls and stunted primary root were considered as abnormally germinated seeds (ISTA, 2003). These types of abnormal or dead seedlings were excluded during counting. At the end of germination test (7 days), 6 seedlings from each of the treatments were selected randomly and roots and shoots were cut from the cotyledons and were transferred to brown paper. Then these seedlings were dried in an oven at 75°C for 48 hours. Total germination (TG) was calculated as the number of seeds which was germinated within total days as a proportion of number of seeds shown in each treatment expressed as a percentage (Othman *et al.,* 2006).

$$\mathbf{TG}\ (\%) = \frac{\mathbf{Number\ of\ germinated\ seed}}{\mathbf{Total\ number\ of\ seed\ set\ for\ germination}} \times \mathbf{100}$$

3.8.2 Shoot length and root length

Randomly selected seedlings from each treatment were collected and cotyledons were removed from them. Shoot and root length were measured with a ruler and accuracy of measurement was 1 mm.

3.8.3 Shoot dry weight and root dry weight

The dried radicles and shoots were weighted to the milligram (mg) and converted to milligram. The mean radicle and shoot dry weight were determined with an electric balance. Then it was converted to total dry weight.

3.9 Statistical analysis

The data obtained for different parameters were statistically analyzed to observe the significant difference among the treatments. The mean value of all the parameters was calculated and analysis of variance was performed. The significance of difference among the treatments means was estimated by the using Turkey's test at 5% level of significance. Computer software Statistic 10 was used to carry out the statistical analysis.

CHAPTER IV

RESULTS & DISCUSTION

4.1 Effect of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) on germination percentage (GP)

Wide range of variability was observed in respect of the effect of rosundi (leaf & flower) aqueous extract on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass (Figure 1). The attained germination percentage of cauliflower values at control conditions (97.85%) was decreased upon applying at 0.001, 0.003, 0.01 g/ml concentrationsts to 89.61, 82.40, 78.28 respectively. However, this current motivation goes to a marked reduction at 0.03 and 0.1g/ml concentrations (61.80 and 56.65% respectively). The results indicate germination percentage of broccoli seeds were apparently varied with different concentrations of rosundi extract. The germination percentage values of broccoli at control conditions was 92.96 %, this value was decreased to 85.13% at 0.001 g/ml concentrations on the other hand were also decreased upon applying 0.003. 0.01, 0.03 and 0.1 g/ml concentrations (78.28, 74.37, 58.71 and 53.82%). Similarly the germination percentage (GP) of tomato, foxtail millet and barnyard grass seeds were apparently varied with different concentrations of rosundi (leaf & flower) aqueous extract which is supported statistically. From the figure, it was revealed that in all plants the maximum value of germination percentage was found from the control treatment which was statistically superior to the rest of the treatments. As the treatment concentration value increased, the germination percentage value of the plants were decreased in

consistent and the least value of germination percentage was found from 0.1 g/mg treatment while the other germination percentage took intermediate positions and they were statistically different among themselves.

Based on different treatment effect of five selective plants, vast treatment effect was observed in the monocot plant eg. foxtail millet and barnyard grass and comparatively less effect were shown in dicot plants eg. cauliflower, broccoli and tomato. On the other hand, among the dicot plant tomato plant showed much less effect followed by cauliflower and broccoli. It's may be due to the size of the tomato seed as the size of the tomato seed is comparatively bigger than other four plants and we know that treatment concentration was negatively correlated with seed size.

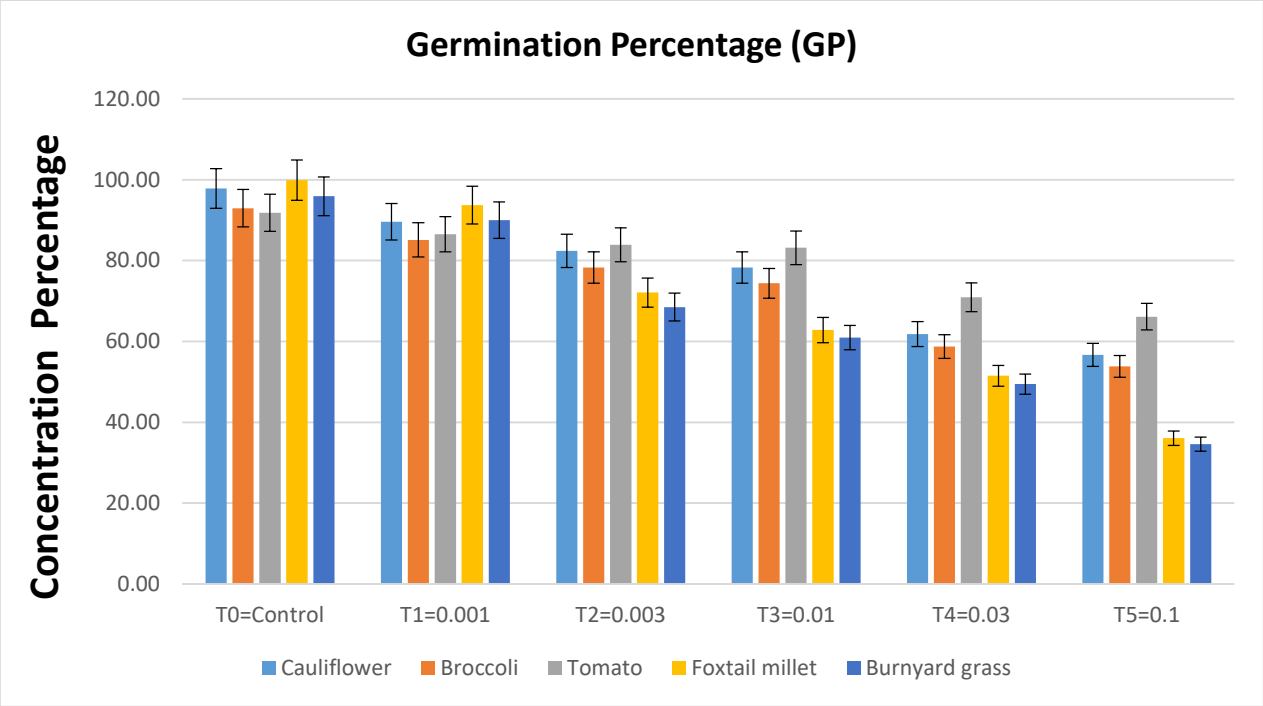

Figure 1: Variation in the germination percentage (GP) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of rosundi (*Mansoa alliacea*) aqueous extract (leaf & flower)

4.2 Effect of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) on plumule length (PL)

Plumule length (PL) was significant indicating considerable differences among the treatments studied. The demonstrated data pointed up that plumule length of plants was significantly affected by each treatment especially to the monocot plants than the dicot. There was a reduction on the values of plumule length in cauliflower, the control value was about 1.80 cm decreased to 1.75, 1.65, 1.40, 1.34 and 1.15 cm at 0.001, 0.003, 0.01, 0.03 and 0.1g/ml concentrations respectively. The plumule length data of other four plants eg. broccoli, tomato, foxtail millet and barnyard grass showed significantly affected in different concentration. There was a noticed reduction in values of plumule length with increasing treatment concentration. Among all the treatments in all the plants maximum plumule length was found in the control treatment and the value were about 1.71, 1.69, 1.61 and 1.55 cm in broccoli, tomato, foxtail millet and barnyard grass respectively. Whether the shortest length of plumule was from 0.1 g/ml concentration and the value were about 1.15, 1.10, 1.25, 0.27 and 0.26 cm in cauliflower, broccoli, tomato, foxtail millet and barnyard grass respectively. The remaining treatments were intermediate in this regard (Table 1). Statistically Barnyard grass produced minimum plumule length than rest of the line.

4.3 Effect of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) on radicle length (RL)

The length of radicle produced by five selective plants was recorded and the effect of rosundi (leaf & flower) aqueous extract on radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass presented in Table 3. Evaluation of radicle length (RL) correlated with

higher concentrations has demonstrated their depressing influence on cauliflower growth process. Furthermore, concentration was affecting radicle length at the control the value was about 2.65 cm. At at 0.001, 0.003, 0.01, 0.03 and 0.1 g/ml concentrations there have been a marked reduction in radicle length (2.58, 2.26, 2.24, 2.04 and 1.75 cm, respectively). Similarly the concentrations and interaction were significantly affecting the radicle length of barnyard grass and foxtail millet.

Radicle length values were found to decrease with increasing treatment concentration in all the plants. The highest length of radicle (2.65, 2.51, 2.48, 2.37 and 2.27 cm) was attained from cauliflower, broccoli, tomato, foxtail millet and barnyard grass in control treatment whereas the lowest radicle length (RL) (1.75, 1.66, 1.65, 0.40 and 0.38 cm) was attained at higher concentration (0.1g/ml). While the varieties in other treatments took intermediate positions and they were statistically different among themselves. Here among the five plants, barnyard grass was affected more than all other.

Table 1: Effect of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.80	1.71	1.69	1.61	1.55
T_1=0.001	1.75	1.66	1.63	1.16	1.11
T_2=0.003	1.65	1.57	1.53	0.98	0.94
T_3=0.01	1.40	1.33	1.41	1.07	1.02
T_4=0.03	1.34	1.27	1.34	0.44	0.43
T_5=0.1	1.15	1.10	1.25	0.27	0.26

Table 2: Effect of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.65	2.51	2.48	2.37	2.27
T_1=0.001	2.58	2.45	2.40	1.70	1.63
T_2=0.003	2.26	2.14	2.10	1.44	1.38
T_3=0.01	2.24	2.12	2.08	1.57	1.50
T_4=0.03	2.04	1.94	1.90	0.65	0.62
T_5=0.1	1.75	1.66	1.65	0.40	0.38

4.4 Interaction effect of increasing concentration of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) with different plants

The data on interaction effect of rosundi (leaf & flower) aqueous extracts on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass indicated considerable differences due to different treatment concentrations (Table 3). The maximum length of both plumule (1.81cm) and radicle (2.65cm) were recorded in cauliflower from control treatment, whereas the minimum plumule length (0.2600cm) and radicle length (0.3800) were attained in barnyard grass and from 0.1g/ml aqueous rosundi extracts which was the highest concentration among all the treatments. Thus the data found in this table indicated that the increasing treatment concentration has vast negative impact on plumule length and radicle length performance.

Table 3: Interaction effect of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass with treatments

Combined interaction	**Plumule**	**Radicle**
T_0=Control × Broccoli	1.7100 c	2.5150 c
T_0=Control × Barnyard grass	1.5450 h	2.2750 g
T_0=Control × Cauliflower	1.8050 a	2.6450 a
T_0=Control × Foxtail millet	1.6150 g	2.3700 f
T_0=Control × Tomato	1.6900 cd	2.4850 cd
T_1=0.001 × Broccoli	1.6650 de	2.4500 de
T_1=0.001 × Barnyard grass	1.1100 m	1.6300 n
T_1=0.001 × Cauliflower	1.7500 b	2.5750 b
T1=0.001 × Foxtail millet	1.1550 l	1.7000 lm
T_1=0.001 × Tomato	1.6300 fg	2.4000 ef
T_2=0.003 × Broccoli	1.5650 h	2.1450 h
T_2=0.003 × Barnyard grass	0.9400 q	1.3800 r
T_2=0.003 × Cauliflower	1.6500 ef	2.2550 g
T_2=0.003 × Foxtail millet	0.9800 p	1.4400 q
T_2=0.003 × Tomato	1.5350 h	2.1000 hi
T_3=0.01 × Broccoli	1.3300 j	2.1250 hi
T_3=0.01 × Barnyard grass	1.0200 o	1.5050 p
T_3=0.01 × Cauliflower	1.4000 i	2.2350 g
T_3=0.01 × Foxtail millet	1.0700 n	1.5650 o
T_3=0.01 × Tomato	1.4100 i	2.0800 ij
T_4=0.03 × Broccoli	1.2750 k	1.9350 k
T_4=0.03 × Barnyard grass	0.4250 r	0.6250 s
T_4=0.03 × Cauliflower	1.3400 j	2.0400 j
T_4=0.03 × Foxtail millet	0.4450 r	0.6500 s
T_4=0.03 × Tomato	1.3400 j	1.8950 k
T_5=0.1 × Broccoli	1.0950 mn	1.6650
T_5=0.1 × Barnyard grass	0.2600 s	0.3800 t
T_5=0.1 × Cauliflower	1.1550 l	1.7500 l
T_5=0.1 × Foxtail millet	0.2700 s	0.4000 t
T_5=0.1 × Tomato	1.2500 k	1.6450 mn
cv	7.2	6.5
lsd	0.034	0.0551

4.5 Effect of rosundi (*Mansoa alliacea)* aqueous extracts (leaf & flower) on dry weight (DW)

The effect of rosundi (leaf & flower) aqueous extract on dry weight of five selective plants exhibited wide variation. Dry weight inhibition was increased when the extract concentration was increased (Figure 2). The control showed 0.053, 0.050, 0.049, 0.047 and 0.045g for cauliflower, broccoli, tomato, foxtail millet and barnyard grass dry weight which was the highest value among all. On a dry weight basis, the most reduction was recorded when selected plants were treated with an extract of rosundi at 0.1 g/ml concentration. From the table it was observed that, the higher concentration of rosundi (leaf & flower) aqueous extract reveal negative effects on dry weight but with variation among the five plants. The dry weight of all but barnyard grass was significantly inhibited by the extracts at any concentrations of rosundi. Maximum value was observed in foxtail millet and barnyard grass followed by cauliflower, broccoli and tomato with the effect of rosundi (leaf & flower) aqueous extract that indicates significant impact on monot than dicot.

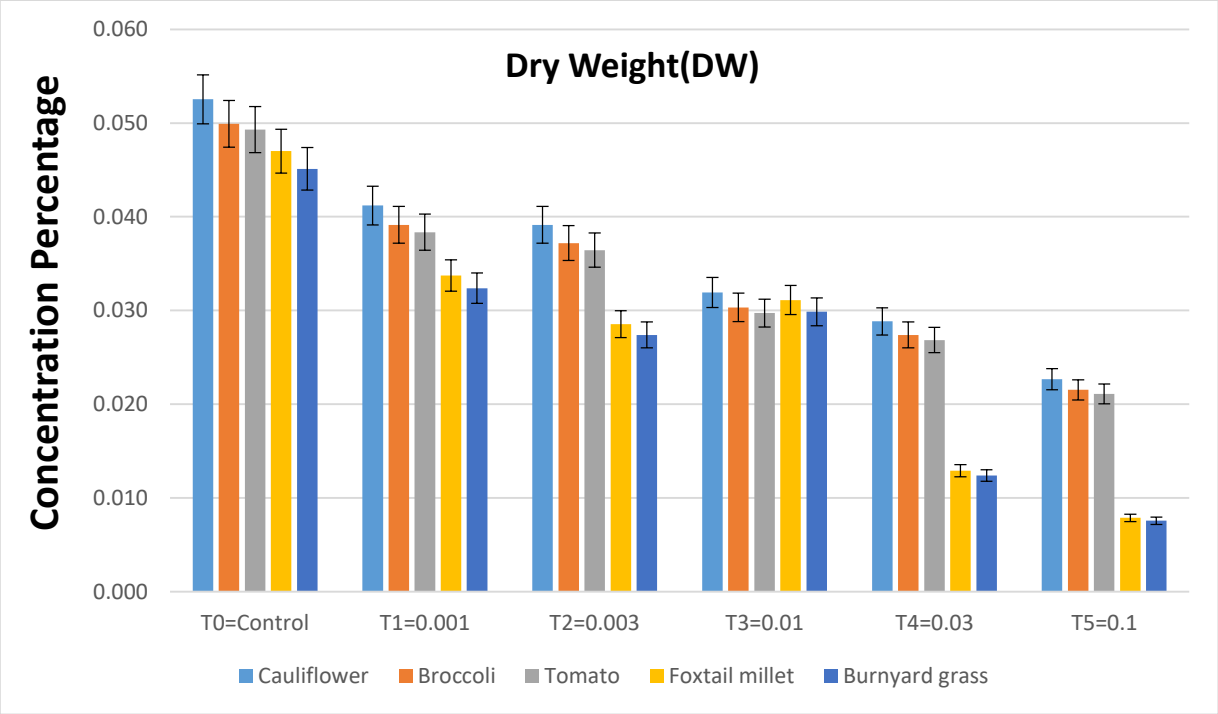

Figure 2: Variation in the dry weight (DW) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of rosundi (*Mansoa alliacea*) aqueous extracts (leaf & flower)

4.6 Effect of cirota (*Swertia perennis)* aqueous extracts (leaf & flower) on germination percentage (GP)

Wide range of variability was observed in respect of the effect of cirota (leaf & flower) aqueous extract on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass (Figure 3). The attained germination percentage of cauliflower values at control conditions (93.25 %) was decreased upon applying at 0.001, 0.003, 0.01 g/ml concentrations 85.50, 80.75, 72.20, 64.60, 57.95 respectively. However, this current motivation goes to a marked reduction at 0.03 and 0.1g/ml concentrations (64.60 & 57.95% respectively). The results indicate germination percentage of broccoli seeds were apparently varied with different concentrations of cirota extract. The germination percentage values of broccoli at control conditions was 84.74 %, this value was decreased to 81.23% at 0.001 g/ml concentrations on the other hand were also decreased upon applying 0.003. 0.01, 0.03 and 0.1 g/ml concentrations (76.71, 68.59, 61.37 & 55.05% respectively). Similarly the germination percentage (GP) of tomato, foxtail millet and barnyard grass seeds were apparently varied with different concentrations of cirota (leaf & flower) aqueous extract which is supported statistically. From the figure, it was revealed that in all plants the maximum value of germination percentage was found from the control treatment which was statistically superior to the rest of the treatments. As the treatment concentration value increased, the germination percentage value of the plants were decreased in consistent and the least value of germination percentage was found from 0.1 g/mg treatment while the other germination percentage took intermediate positions and they were statistically different among themselves.

Based on different treatment effect of five selective plants, vast treatment effect was observed in the monocot plant eg. foxtail millet and barnyard grass and comparatively less effect were shown in dicot plants eg. cauliflower, broccoli and tomato. On the other hand, among the dicot plant tomato plant showed much less effect followed by cauliflower and broccoli. It's may be due to the size of the tomato seed as the size of the tomato seed is comparatively bigger than other four plants and we know that treatment concentration was negatively correlated with seed size.

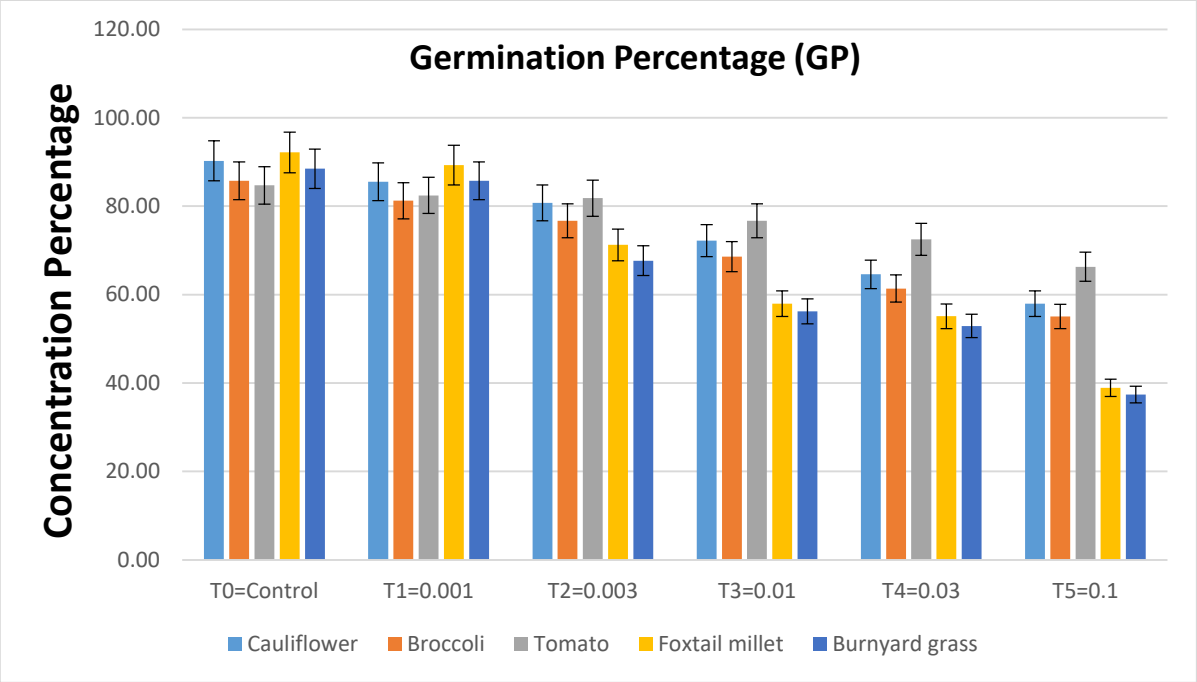

Figure 3: Variation in the germination percentage (GP) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of cirota (*Swertia perennis)* aqueous extract (leaf & flower)

4.7 Effect of cirota (*Swertia perennis)* aqueous extracts (leaf & flower) on plumule length (PL)

Plumule length (PL) was significant indicating considerable differences among the treatments studied. The demonstrated data pointed up that plumule length of plants was significantly affected by each treatment especially to the monocot plants than the dicot. There was a reduction on the values of plumule length in Barnyard grass, the control value was about 1.70 cm decreased to 1.62, 1.47, 1.33, 1.31 & 1.14 cm at 0.001, 0.003, 0.01, 0.03 and 0.1g/ml concentrations respectively. The plumule length data of other four plants eg. cauliflower, broccoli, tomato, foxtail millet and barnyard grass showed significantly affected in different concentration. The remaining treatments were intermediate in this regard (Table 4). Statistically barnyard grass produced minimum plumule length than rest of the line.

4.8 Effect of cirota (*Swertia perennis)* aqueous extracts (leaf & flower) on radicle length (RL)

The length of radicle produced by five selective plants was recorded and the effect of cirota (leaf & flower) aqueous extract on radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass presented in Table 5. The concentrations and interaction were significantly affecting the radicle length of foxtail millet and barnyard grass than cauliflower, broccoli, and tomato. The highest length of radicle (2.44, 2.32, 2.29, 2.18 & 2.18 cm) was attained from cauliflower, broccoli, tomato, foxtail millet and barnyard grass in control treatment whereas the lowest radicle length (RL) (1.75, 1.66, 1.65, 0.40 and 0.38 cm) was attained at higher concentration (0.1g/ml). While the varieties in other treatments took intermediate positions and

they were statistically different among themselves. Here among the five plants, barnyard grass was affected more than the others.

Table 4: Effect cirota (*Swertia perennis)* aqueous extracts (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.70	1.58	1.56	1.49	1.43
T_1=0.001	1.62	1.53	1.50	1.07	1.02
T_2=0.003	1.47	1.40	1.37	0.90	0.87
T_3=0.01	1.33	1.26	1.33	0.98	0.95
T_4=0.03	1.31	1.25	1.31	0.41	0.39
T_5=0.1	1.14	1.08	1.22	0.25	0.24

Table 5: Effect of cirota (*Swertia perennis)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.44	2.32	2.29	2.18	2.18
T_1=0.001	2.38	2.26	2.21	1.57	1.50
T_2=0.003	2.28	2.17	2.12	1.33	1.27
T_3=0.01	2.06	1.96	1.92	1.45	1.39
T_4=0.03	2.03	1.93	1.89	0.60	0.58
T_5=0.1	1.81	1.71	1.70	0.37	0.35

4.9 Interaction effect of increasing concentration of cirota (*Swertia perennis)* aqueous extracts (leaf & flower) with different plants

The data on interaction effect of cirota (leaf & flower) aqueous extracts on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass indicated considerable differences due to different treatment concentrations (Table 6). The maximum length of both plumule (1.71cm) and radicle (2.44cm) were recorded in cauliflower from control treatment, whereas the minimum plumule length (0.2450cm) and radicle length (0.35cm) were attained in barnyard grass and from 0.1g/ml aqueous cirota extracts which was the highest concentration among all the treatments. Thus the data found in this table indicated that the increasing treatment concentration has vast negative impact on plumule length and radicle length performance.

Table 6: Interaction effect of cirota (*Swertia perennis)* aqueous extracts (leaf & flower) on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass with treatments

Combined interaction	**Plumule**	**Radicle**
T_0=Control × Broccoli	1.6200 b	2.3200 bc
T_0=Control × Barnyard grass	1.4650 f	2.1000 gh
T_0=Control × Cauliflower	1.7050 a	2.4400 a
T_0=Control × Foxtail millet	1.5300 de	2.1850 efg
T_0=Control × Tomato	1.6000 b	2.2900 bcd
T_1=0.001 × Broccoli	1.5900 bc	2.2600 cde
T_1=0.001 × Barnyard grass	1.0500 l	1.5050 no
T_1=0.001 × Cauliflower	1.6750 a	2.3750 ab
T_1=0.001 × Foxtail millet	1.0950 k	1.5700 n
T_1=0.001 × Tomato	1.5600 cd	2.2100 def
T_2=0.003 × Broccoli	1.5300 de	2.1650 fg
T_2=0.003 × Barnyard grass	0.8900 p	1.2750 r
T_2=0.003 × Cauliflower	1.6100 b	2.2800 cd
T_2=0.003 × Foxtail millet	0.9250 o	1.3300 qr
T_2=0.003 × Tomato	1.5000 e	2.1200 fgh
T_3=0.01 × Broccoli	1.3900 gh	1.9600 ij
T_3=0.01 × Barnyard grass	0.9700 n	1.3850 pq
T_3=0.01 × Cauliflower	1.4650 f	2.0600 h
T_3=0.01 × Foxtail millet	1.0100 m	1.4450 op
T_3=0.01 × Tomato	1.4600 f	1.9200 j
T_4=0.03 × Broccoli	1.3900 gh	1.9300 j
T_4=0.03 × Barnyard grass	0.4000 q	0.5800 s
T_4=0.03 × Cauliflower	1.4650 f	2.0350 hi
T_4=0.03 × Foxtail millet	0.4200 q	0.6000 s
T_4=0.03 × Tomato	1.4100 g	1.8900 jk
T_5=0.1 × Broccoli	1.2500 j	1.7150 lm
T_5=0.1 × Barnyard grass	0.2450 r	0.3500 t
T_5=0.1 × Cauliflower	1.3150 i	1.8050 kl
T_5=0.1 × Foxtail millet	0.2550 r	0.3700 t
T_5=0.1 × Tomato	1.3750 h	1.7000 m
cv	3.15	9.23
lsd	0.034	0.0918

4.10 Effect of cirota (*Swertia perennis)* aqueous extract (leaf & flower) on dry weight (DW)

The effect of cirota (leaf & flower) aqueous extract on dry weight of five selective plants exhibited wide variation. Dry weight inhibition was increased when the extract concentration was increased (Figure 4). The control showed 0.048, 0.046, 0.045, 0.043 & 0.042 for cauliflower, broccoli, tomato, foxtail millet and barnyard grass dry weight which was the highest value among all. On a dry weight basis, the most reduction was recorded when selected plants were treated with an extract of cirota at 0.1 g/ml concentration. From the table it was observed that, the higher concentration of cirota (leaf & flower) aqueous extract reveal negative effects on dry weight but with variation among the five plants. The dry weight of all but barnyard grass was significantly inhibited by the extracts at any concentrations of cirota. Maximum value was observed in foxtail millet and barnyard grass followed by cauliflower, broccoli and tomato with the effect of cirota (leaf & flower) aqueous extract that indicates significant impact on monot than dicot.

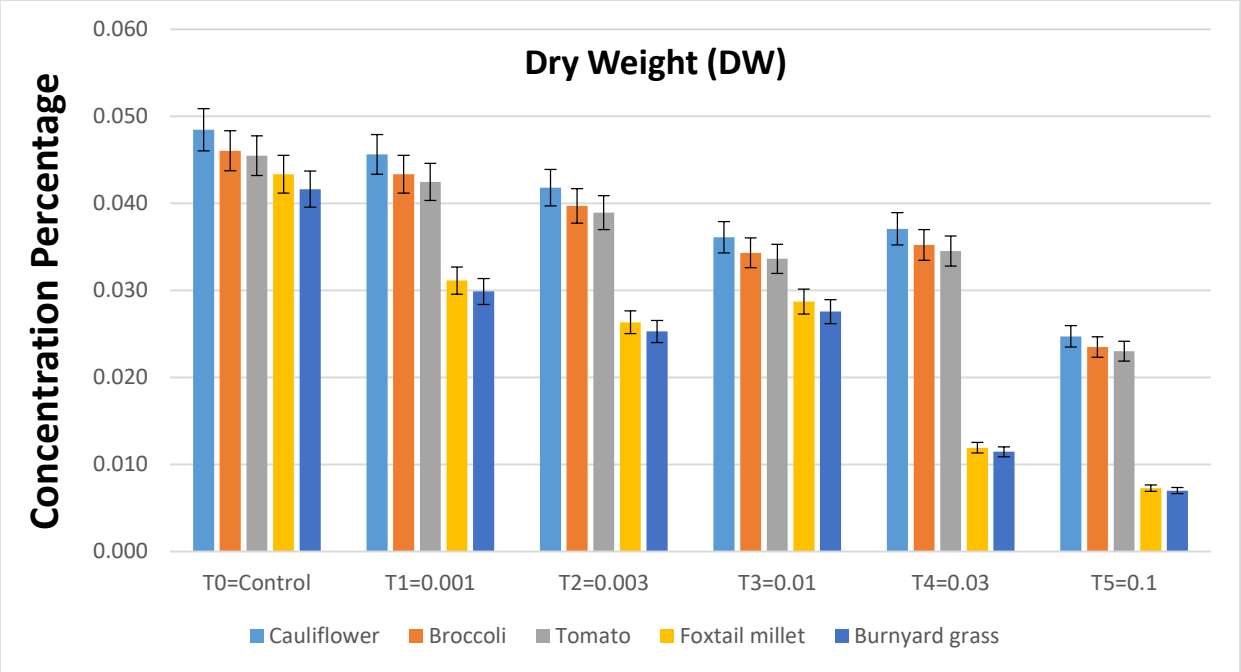

Figure 4: Variation in the dry weight (DW) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of cirota (*Swertia perennis)* aqueous extract (leaf & flower)

4.11 Effect of bashok *(Justicia adhatoda)* aqueous extracts (leaf & flower) on germination percentage (GP)

Wide range of variability was observed in respect of the effect of bashok (leaf & flower) aqueous extract on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass (Figure 5). The attained germination percentage of cauliflower values at control conditions (95.48%) was decreased upon applying at 0.001, 0.003, 0.01 g/ml concentrations to 88.44, 82.41, 76.38 respectively. However, this current motivation goes to a marked reduction at 0.03 and 0.1g/ml concentrations (63.32 and 58.29% respectively). The results indicate germination percentage of broccoli seeds were apparently varied with different concentrations of bashok extract. The germination percentage values of Broccoli at control conditions was 90.70 %, this value was decreased to 84.02 % at 0.001 g/ml concentrations on the other hand were also decreased upon applying 0.003. 0.01, 0.03 and 0.1 g/ml concentrations (78.29, 72.56, 60.15 & 55.38%). Similarly the germination percentage (GP) of tomato, foxtail millet and barnyard grass seeds were apparently varied with different concentrations of bashok (leaf & flower) aqueous extract which is supported statistically. From the figure, it was revealed that in all plants the maximum value of germination percentage was found from the control treatment which was statistically superior to the rest of the treatments. As the treatment concentration value increased, the germination percentage value of the plants were decreased in consistent and the least value of germination percentage was found from 0.1 g/mg treatment while the other germination percentage took intermediate positions and they were statistically different among themselves.

Based on different treatment effect of five selective plants, vast treatment effect was observed in the monocot plant eg. foxtail millet and barnyard grass and comparatively less effect were shown in dicot plants eg. cauliflower, broccoli and tomato. On the other hand, among the dicot plant cauliflower showed much less effect followed by Broccoli and Tomato. It's may be due to the size of the seed. We know that treatment concentration was negatively correlated with seed size.

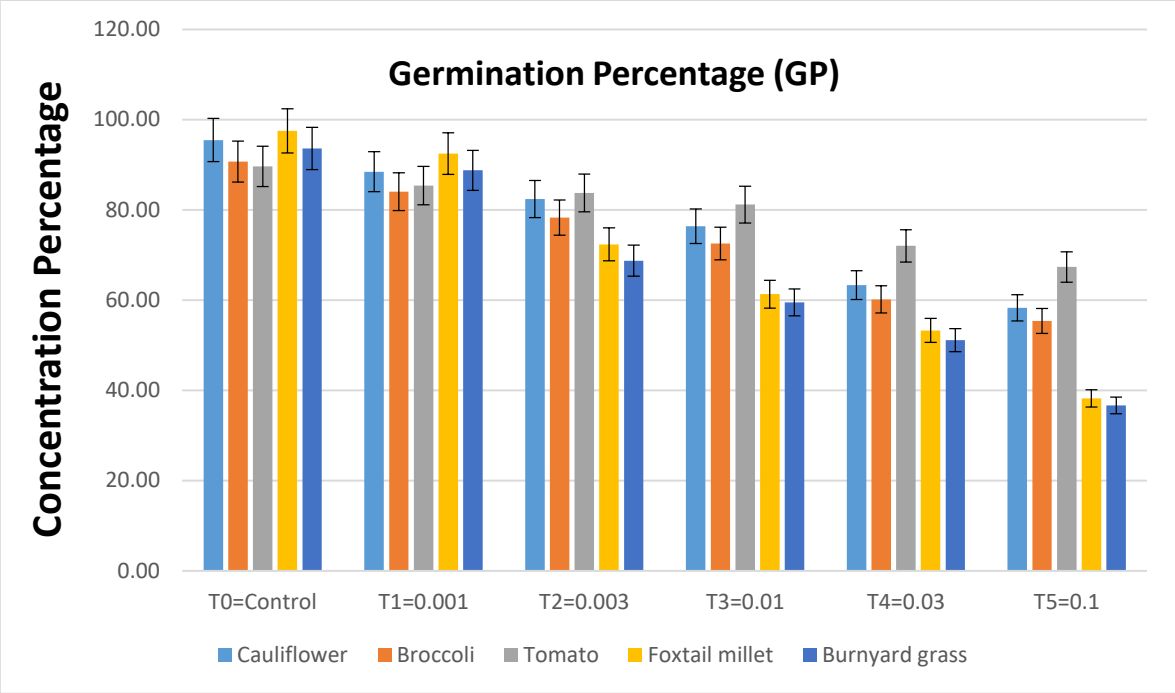

Figure 5: Variation in the germination percentage (GP) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of bashok *(Justicia adhatoda)* aqueous extract (leaf & flower)

4.12 Effect of bashok *(Justicia adhatoda)* aqueous extracts (leaf & flower) on Plumule length (PL)

Plumule length (PL) was significant indicating considerable differences among the treatments studied. The demonstrated data pointed up that plumule length of plants was significantly affected by each treatment especially to the monocot plants than the dicot. There was a reduction on the values of plumule length in cauliflower, the control value was about 1.76 cm decreased to 1.69, 1.56, 1.37, 1.34 & 1.20 cm at 0.001, 0.003, 0.01, 0.03 and 0.1g/ml concentrations respectively. There was a noticed reduction in values of plumule length with increasing treatment concentration. Among all the treatments in all the plants maximum plumule length was found in the control treatment and the value were about 1.67, 1.65, 1.57 & 1.51 cm in broccoli, tomato, foxtail millet and barnyard grass respectively. Whether the shortest length of plumule was from 0.1 g/ml concentration and the value were about 1.14, 1.28, 0.26 & 0.25 cm in cauliflower, broccoli, tomato, foxtail millet and barnyard grass respectively. The remaining treatments were intermediate in this regard (Table 7). Statistically Barnyard grass produced minimum plumule length than rest of the line.

4.13 Effect of bashok *(Justicia adhatoda)* aqueous extracts (leaf & flower) on radicle length (RL)

The length of radicle produced by five selective plants was recorded and the effect of bashok (leaf & flower) aqueous extract on radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass presented in Table 8. Evaluation of radicle length (RL) correlated with higher concentrations has demonstrated their depressing influence on different plant growth process. The concentrations and interaction were significantly affecting the radicle length of

foxtail millet and barnyard grass than cauliflower, broccoli, and tomato. Radicle length values were found to decrease with increasing treatment concentration in all the plants. The highest length of radicle (2.58, 2.45, 2.42, 2.31 & 2.22 cm) was attained from cauliflower, broccoli, tomato, foxtail millet and barnyard grass in control treatment whereas the lowest radicle length (RL) (1.81, 1.72, 1.70, 0.39 & 0.37cm) was attained at higher concentration (0.1g/ml). While the varieties in other treatments took intermediate positions and they were statistically different among themselves. Here among the five plants, barnyard grass gives least value than all other.

Table 7: Effect bashok *(Justicia adhatoda)* aqueous extract (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.76	1.67	1.65	1.57	1.51
T_1=0.001	1.69	1.60	1.57	1.13	1.08
T_2=0.003	1.56	1.48	1.45	0.96	0.92
T_3=0.01	1.37	1.30	1.37	1.04	1.00
T_4=0.03	1.34	1.27	1.33	0.43	0.42
T_5=0.1	1.20	1.14	1.28	0.26	0.25

Table 8: Effect of bashok *(Justicia adhatoda)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.58	2.45	2.42	2.31	2.22
T_1=0.001	2.51	2.39	2.34	1.66	1.59
T_2=0.003	2.22	2.11	2.07	1.40	1.35
T_3=0.01	2.18	2.07	2.03	1.33	1.27
T_4=0.03	2.11	2.00	1.96	0.64	0.61
T_5=0.1	1.81	1.72	1.70	0.39	0.37

4.14 Interaction effect of increasing concentration of bashok *(Justicia adhatoda)* aqueous extracts (leaf & flower) with different plants

The data on interaction effect of bashok (leaf & flower) aqueous extracts on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass indicated considerable differences due to different treatment concentrations (Table 9). The maximum length of both plumule (1.64cm) and radicle (2.59cm) were recorded in cauliflower from control treatment, whereas the minimum plumule length (0.24cm) and radicle length (0.37cm) were attained in barnyard grass and foxtail millet (respectively) from 0.1g/ml aqueous bashok extracts which was the highest concentration among all the treatments. Thus the data found in this table indicated that the increasing treatment concentration has vast negative impact on plumule length and radicle length performance.

Table 9: Interaction effect of bashok *(Justicia adhatoda)* aqueous extracts (leaf & flower) on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass with treatments

Combined interaction	**Plumule**	**Radicle**
T_0=Control × Broccoli	1.5550 b	2.4550 c
T_0=Control × Barnyard grass	1.4050 efg	2.2200 h
T_0=Control × Cauliflower	1.6350 a	2.5850 a
T_0=Control × Foxtail millet	1.4650 cde	2.3100 g
T_0=Control × Tomato	1.5350 bc	2.4250 d
T_1=0.001 × Broccoli	1.4950 bcd	2.3900 e
T_1=0.001 × Barnyard grass	1.0100 no	1.5900 s
T_1=0.001 × Cauliflower	1.5700 ab	2.5150 b
T_1=0.001 × Foxtail millet	1.0500 mn	1.6600 r
T_1=0.001 × Tomato	1.4600 cde	2.3400 f
T_2=0.003 × Broccoli	1.3750 fg	2.1100 j
T_2=0.003 × Barnyard grass	0.8500 r	1.3450 j
T_2=0.003 × Cauliflower	1.4500 def	2.2200 w
T_2=0.003 × Foxtail millet	0.8900 qr	1.4050 v
T_2=0.003 × Tomato	1.3500 gh	2.0700 k
T_3=0.01 × Broccoli	1.2050 ijk	2.0700 k
T_3=0.01 × Barnyard grass	0.9300 pq	1.4700 u
T_3=0.01 × Cauliflower	1.2700 ij	2.1800 i
T_3=0.01 × Foxtail millet	0.9700 op	1.5300 t
T_3=0.01 × Tomato	1.2800 hi	2.0300 l
T_4=0.03 × Broccoli	1.1800 kl	2.0050 m
T_4=0.03 × Barnyard grass	0.3850 s	0.6100 y
T_4=0.03 × Cauliflower	1.2450 ijk	2.1100 j
T_4=0.03 × Foxtail millet	0.4000 s	0.6350 x
T_4=0.03 × Tomato	1.2450 ijk	1.9650 n
T_5=0.1 × Broccoli	1.0550 mn	1.7200 p
T_5=0.1 × Barnyard grass	0.2350 t	0.3900 z
T_5=0.1 × Cauliflower	1.1150 lm	1.8100 o
T_5=0.1 × Foxtail millet	0.2450 t	0.3700 z
T_5=0.1 × Tomato	1.1950 jk	1.7000 q
cv	3.9	4.56
lsd	0.56	0.011

4.15 Effect of bashok *(Justicia adhatoda)* aqueous extract (leaf & flower) on dry weight (DW)

The effect of bashok (leaf & flower) aqueous extract on dry weight of five selective plants exhibited wide variation. Dry weight inhibition was increased when the extract concentration was increased (Figure 6). The control showed 0.051, 0.049, 0.048, 0.046 & 0.044g for cauliflower, broccoli, tomato, foxtail millet and barnyard grass dry weight which was the highest value among all. On a dry weight basis, the most reduction was recorded when selected plants were treated with an extract of bashok at 0.1 g/ml concentration. From the table, it was observed that, the higher concentration of bashok (leaf & flower) aqueous extract reveal negative effects on dry weight but with variation among the five plants. The dry weight of all monocot was significantly inhibited by the extracts at any concentrations of bashok. Maximum value was observed in foxtail millet and barnyard grass followed by cauliflower, broccoli and tomato with the effect of bashok (leaf & flower) aqueous extract that indicates significant impact on monocot than dicot.

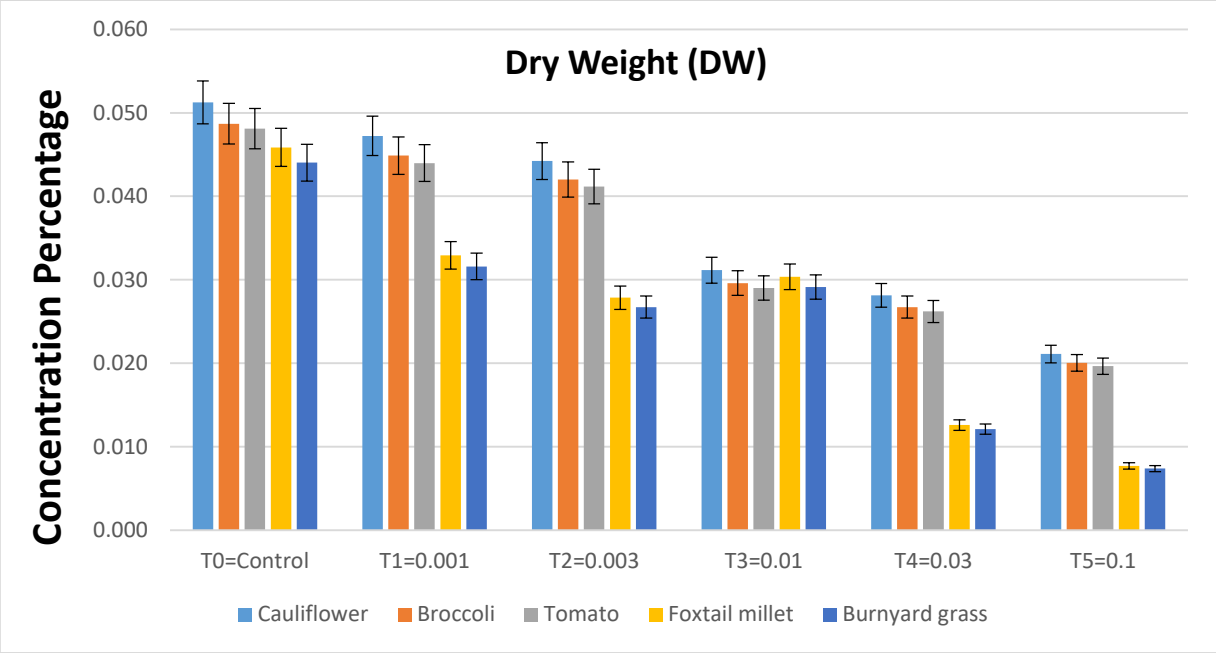

Figure 6: Variation in the dry weight (DW) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of bashok *(Justicia adhatoda)* aqueous extract (leaf & flower)

4.16 Effect of bohera *(Terminalia bellirica)* aqueous extracts (leaf & flower) on germination percentage (GP)

The effect of bohera (leaf & flower) aqueous extract on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass (Figure 7). The germination percentage (GP) of tomato, foxtail millet and barnyard grass seeds were apparently varied with different concentrations of bohera (leaf & flower) aqueous extract which is supported statistically. From the figure, it was revealed that in all plants the maximum value of germination percentage was found from the control treatment which was statistically superior to the rest of the treatments. As the treatment concentration value increased, the germination percentage value of the plants were decreased in consistent and the least value of germination percentage was found from 0.1 g/mg treatment while the other germination percentage took intermediate positions and they were statistically different among themselves but the rate of decrease in germination were not significant in dicot plants eg. cauliflower, broccoli and tomato. The rate of decrease was slightly increased in monocot plants eg. foxtail millet and barnyard grass.

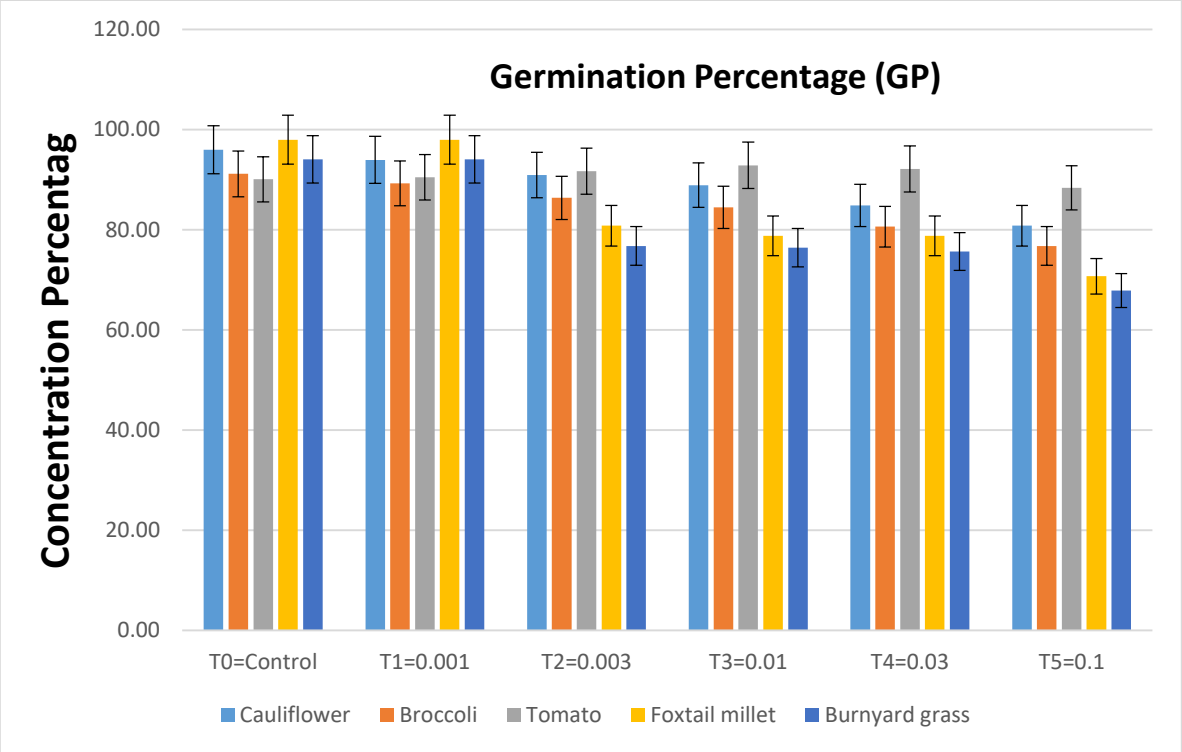

Figure 7: Variation in the germination percentage (GP) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of bohera *(Terminalia bellirica)* aqueous extract (leaf & flower)

4.17 Effect of bohera *(Terminalia bellirica)* aqueous extracts (leaf & flower) on plumule length (PL)

Plumule length (PL) was not significant indicating very little differences among the treatments studied. The demonstrated data pointed up that plumule length of plants was not significantly affected by each treatment but the rate of decresing of length of plumule in monocot is greater than the dicot. There was reduction in values of plumule length with increasing treatment concentration too. Among all the treatments in all the plants maximum plumule length was found in the control treatment and the value were about 1.77, 1.68, 1.66, 1.58 and 1.52cm in cauliflower, broccoli, tomato, foxtail millet and barnyard grass respectively. Whether the shortest length of plumule was from 0.1g/ml concentration and the value were about 1.60, 1.52, 1.57, 0.71 & 0.68cm in cauliflower, broccoli, tomato, foxtail millet and barnyard grass respectively (Table 10).

4.18 Effect of bohera *(Terminalia bellirica)* aqueous extracts (leaf & flower) on radicle length (RL)

The length of radicle produced by five selective plants was recorded and the effect of bohera (leaf & flower) aqueous extract on radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass presented in (Table 11). The concentrations and interaction were affecting the radicle length of foxtail millet and barnyard grass than cauliflower, broccoli, and tomato. Radicle length values were found to decrease with increasing treatment concentration in all the plants. The highest length of radicle (2.60, 2.47, 2.44, 2.32 & 2.23 cm) was attained from cauliflower, broccoli, tomato, foxtail millet and barnyard grass in control treatment whereas the

lowest radicle length (RL) (2.12, 2.01, 2.10, 1.04 & 1.00 cm) was attained at higher concentration (0.1g/ml).

Table 10: Effect of bohera *(Terminalia bellirica)* aqueous extract (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.77	1.68	1.66	1.58	1.52
T_1=0.001	1.76	1.67	1.66	1.40	1.34
T_2=0.003	1.72	1.63	1.63	1.23	1.18
T_3=0.01	1.67	1.58	1.61	1.14	1.09
T_4=0.03	1.67	1.58	1.60	0.79	0.76
T_5=0.1	1.60	1.52	1.57	0.71	0.68
lsd	NS	NS	NS		

Table 11: Effect bohera *(Terminalia bellirica)* aqueous extracts (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.60	2.47	2.44	2.32	2.23
T_1=0.001	2.60	2.47	2.44	2.06	1.97
T_2=0.003	2.54	2.41	2.41	1.80	1.73
T_3=0.01	2.53	2.40	2.39	1.67	1.60
T_4=0.03	2.24	2.13	2.29	1.16	1.11
T_5=0.1	2.12	2.01	2.10	1.04	1.00
lsd	NS	NS	NS		

4.19 Interaction effect of increasing concentration of bohera *(Terminalia bellirica)* aqueous extracts (leaf & flower) with different plants

The data on interaction effect of bohera (leaf & flower) aqueous extracts on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass indicated considerable differences due to different treatment concentrations. The maximum length of both plumule (1.77cm) and radicle (2.60cm) were recorded in cauliflower from control treatment, whereas the minimum plumule length (0.68cm) and radicle length (1.00 cm) were attained in barnyard grass and foxtail millet (respectively) from 0.1g/ml aqueous bohera extracts which was the highest concentration among all the treatments. Thus the data found in this table indicated that the increasing treatment concentration has some negative impact on plumule length and radicle length performance.

Table 12: Interaction effect of bohera *(Terminalia bellirica)* aqueous extracts (leaf & flower) on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass with treatments

Treatments	**Plumule**	**Radicle**
T_0=Control Broccoli	1.6800 d	2.4650 c
T_0=Control Burnyard grass	1.5150 m	2.2300 i
T_0=Control Cauliflower	1.7700 a	2.5950 a
T_0=Control Foxtail millet	1.5850 k	2.3250 g
T_0=Control Tomato	1.6600 ef	2.4350 d
T_1=0.001 Broccoli	1.6700 de	2.4650 c
T_1=0.001 Burnyard grass	1.3450 o	1.9700 n
T_1=0.001 Cauliflower	1.7550 b	2.5950 a
T_1=0.001 Foxtail millet	1.4000 n	2.0600 l
T_1=0.001 Tomato	1.6550 f	2.4350 d

T_2=0.003 Broccoli	1.6350 g	2.4050 e
T_2=0.003 Burnyard grass	1.1750 q	1.7250 p
T_2=0.003 Cauliflower	1.7150 c	2.5350 b
T_2=0.003 Foxtail millet	1.2250 p	1.8000 o
T_2=0.003 Tomato	1.6250 gh	2.4100 e
T_3=0.01 Broccoli	1.5850 k	2.4000 ef
T_3=0.01 Barnyard grass	1.0900 s	1.6000 r
T_3=0.01 Cauliflower	1.6650 ef	2.5250 b
T_3=0.01 Foxtail millet	1.1350 r	1.6650 q
T_3=0.01 Tomato	1.6150 hi	2.3900 f
T_4=0.03 Broccoli	1.5850 k	2.1300 j
T_4=0.03 Barnyard grass	0.7550 u	1.1100 t
T_4=0.03 Cauliflower	1.6650 ef	2.2400 i
T_4=0.03 Foxtail millet	0.7900 t	1.1600 s
T_4=0.03 Tomato	1.6050 ij	2.2900 h
T_5=0.1 Broccoli	1.5150 m	2.0150 m
T_5=0.1 Barnyard grass	0.6800 w	1.0000 v
T_5=0.1 Cauliflower	1.5950 jk	2.1200 j
T_5=0.1 Foxtail millet	0.7050 v	1.0000 v
T_5=0.1 Tomato	1.5650 l	2.1000 k
cv	NS	NS
lsd	0.01	0.014

4.20: Effect bohera *(Terminalia bellirica)* aqueous extracts (leaf & flower) on dry weight of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

The effect of bohera (leaf & flower) aqueous extract on dry weight of five selective plants exhibited wide variation. Dry weight inhibition was increased when the extract concentration was increased (Figure 8). The control showed 0.052, 0.049, 0.048, 0.046 & 0.044g for cauliflower, broccoli, tomato, foxtail millet and barnyard grass dry weight which was the highest value among all. On a dry weight basis, the most reduction was recorded when selected plants were treated with an extract of bohera at 0.1 g/ml concentration. From the figure, it was observed that, the higher concentration of bohera (leaf & flower) aqueous extract reveal negative effects on dry weight but with variation among the five plants. Maximum value was observed in foxtail millet and barnyard grass followed by cauliflower, broccoli and tomato with the effect of bohera (leaf & flower) aqueous extract that indicates more impact on monocot than dicot.

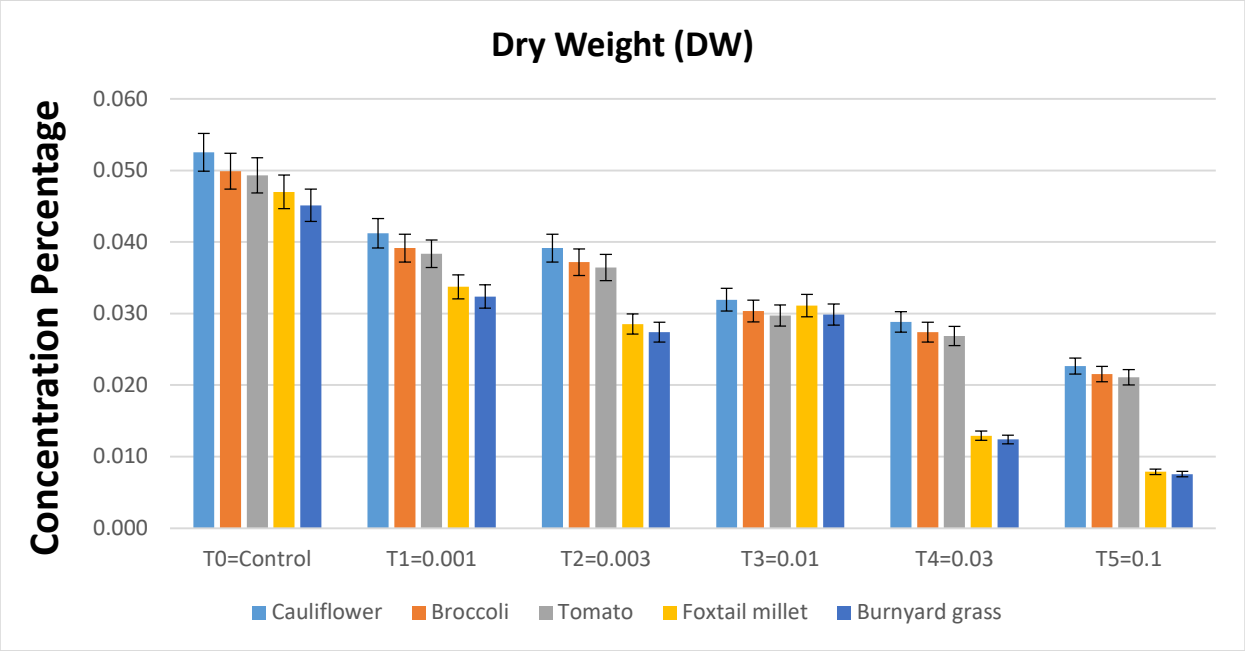

Figure 8: Variation in the dry weight (DW) of cauliflower, broccoli, tomato, foxtail millet & barnyard grass as affected by different concentrations of bohera *(Terminalia bellirica)* aqueous extract (leaf & flower)

4.21 Effect of akandho *(Calotropis procera)* aqueous extracts (leaf & flower) on germination percentage (GP)

The effect of akondha (leaf & flower) aqueous extract on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass (Table 13) . The germination percentage (GP) of tomato, foxtail millet and barnyard grass seeds were apparently varied with different concentrations of akandho (leaf & flower) aqueous extract which is supported statistically. From the table, it was revealed that in all plants the maximum value of germination percentage were found from the control treatment which were statistically superior to the rest of the treatments. As the treatment concentration value increased, the germination percentage value of the plants were decreased in consistent and the least value of germination percentage was found from 0.1 g/mg treatment while the other germination percentage took intermediate positions and they were statistically different among themselves but the rate of decrease in germination were not significant in dicot plants eg. cauliflower, broccoli and tomato. The rate of decrease was slightly increased in monocot plants eg. foxtail millet and barnyard grass.

4.22 Effect of akandho *(Calotropis procera)* aqueous extracts (leaf & flower) on Plumule length (PL)

The demonstrated data pointed up that plumule length of plants was not significantly affected by each treatment but the rate of decresing of length of plumule in momocot is greater than the dicot. There was reduction in values of plumule length with increasing treatment concentration too. Among all the treatments in all the plants maximum plumule length was found in the control treatment and the value were about 1.76, 1.74, 1.73, 1.73 & 1.71cm in cauliflower,

broccoli, tomato, foxtail millet and barnyard grass respectively. Whether the shortest length of plumule was from 0.1 g/ml concentration and the value were about 1.56, 1.54, 1.53, 1.53 & 1.52cm in cauliflower, broccoli, tomato, foxtail millet and barnyard grass respectively.

4.23 Effect of akandho *(Calotropis procera)* aqueous extracts (leaf & flower) on radicle length (RL)

The length of radicle produced by five selective plants was recorded and the effect of akandho (leaf & flower) aqueous extract on radicle length of cauliflower, broccoli, tomato, foxtail millet and Barnyard grass presented in (Table 15). The concentrations and interaction were affecting the radicle length of foxtail millet and barnyard grass than cauliflower, broccoli, and tomato. Radicle length values were found to decrease with increasing treatment concentration in all the plants. The highest length of radicle (2.58, 2.56, 2.54, 2.54, 2.52cm) was attained from cauliflower, broccoli, tomato, foxtail millet and barnyard grass in control treatment whereas the lowest radicle length (RL) (2.39, 2.37, 2.36, 2.36, 2.33cm) was attained at higher concentration (0.1g/ml).

Table 13: Effect of akandh *(Calotropis procera)* aqueous extract (leaf & flower) on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	95.48	94.52	94.05	97.49	94.56
T_1=0.001	95.48	94.52	94.05	96.48	93.59
T_2=0.003	93.47	92.53	92.07	84.42	81.89
T_3=0.01	90.45	89.55	89.10	81.41	78.96
T_4=0.03	87.44	86.56	86.13	75.38	73.11
T_5=0.1	83.42	82.58	82.17	73.37	71.16

Table 14: Effect akandho *(Calotropis procera)* aqueous extracts (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.76	1.74	1.73	1.73	1.71
T_1=0.001	1.76	1.74	1.73	1.73	1.71
T_2=0.003	1.77	1.75	1.74	1.74	1.72
T_3=0.01	1.69	1.67	1.66	1.66	1.65
T_4=0.03	1.60	1.58	1.57	1.57	1.56
T_5=0.1 lsd	1.56 NS	1.54 NS	1.53 NS	1.53 NS	1.52 NS

Table 15: Effect of akandho *(Calotropis procera)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.58	2.56	2.54	2.54	2.52
T_1=0.001	2.55	2.53	2.51	2.51	2.49
T_2=0.003	2.52	2.50	2.48	2.48	2.46
T_3=0.01	2.51	2.49	2.47	2.47	2.45
T_4=0.03	2.46	2.44	2.43	2.42	2.40
T_5=0.1 lsd	2.39 NS	2.37 NS	2.36 NS	2.36 NS	2.33 NS

4.24 The several effects of anantamul, arjun, ashok, darucini and nagesshor (leaf & flower) aqueous extract on germination percentage (GP)

The several effect of anantamul, arjun, ashok, darucini & nagesshor (leaf & flower) aqueous extract on germination percentage (GP) (leaf & flower) aqueous extract on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass was statistically more or less same (Table 16, Table 17, Table 18, Table 19, Table 20,) as same as the effect of bohera and akandho. The germination percentage (GP) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass seeds were apparently varied with different concentrations of anantamul, arjun, ashok, darucini & nagesshor (leaf & flower) aqueous extract which is supported statistically. From these table, it was revealed that in all plants the maximum value of germination percentage were found from the control treatment which were statistically superior to the rest of the treatments. As the treatment concentration value increased, the germination percentage value of the plants were decreased in consistent and the least value of germination percentage was found from 0.1 g/mg treatment while the other germination percentage took intermediate positions and they were statistically different among themselves but the rate of decrease in germination were not significant in dicot plants eg. cauliflower, broccoli and tomato. The rate of decrease was slightly increased in monocot plants eg. foxtail millet and barnyard grass.

Table 16: Effect of anantamul (*Hemidesmus indicus)* aqueous extract (leaf & flower) on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	95.48	90.70	89.61	97.49	93.59
T_1=0.001	95.48	90.70	88.89	99.50	95.52
T_2=0.003	92.46	87.84	86.08	82.41	78.29
T_3=0.01	92.46	87.84	86.08	82.41	79.94
T_4=0.03	90.45	85.93	84.21	84.42	81.04
T_5=0.1	85.43	81.15	80.34	75.38	72.36

Table 17: Effect of arjun (*Terminalia arjuna)* aqueous extract (leaf & flower) on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	95.48	94.52	94.05	97.49	94.56
T_1=0.001	94.47	93.53	93.06	95.48	92.61
T_2=0.003	93.47	92.53	92.07	84.42	81.89
T_3=0.01	90.45	89.55	89.10	81.41	78.96
T_4=0.03	88.44	87.56	87.12	76.38	74.09
T_5=0.1	84.42	83.58	83.16	74.37	72.14

18: Effect of ashok (*Saraca asoca)* aqueous extract (leaf & flower) on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	95.22	90.46	89.38	97.23	93.34
T_1=0.001	92.21	87.60	88.86	96.22	92.38
T_2=0.003	85.20	80.94	86.34	86.20	81.89
T_3=0.01	80.19	76.18	84.68	85.20	82.64
T_4=0.03	75.18	71.42	83.02	75.18	72.17
T_5=0.1	68.16	64.75	76.49	74.17	71.21

19: Effect of darucini *(Cinnamomum verum)* aqueous extract (leaf & flower) on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	95.48	94.52	94.05	97.49	94.56
T_1=0.001	93.47	92.53	92.07	94.47	91.64
T_2=0.003	91.46	90.54	90.09	82.41	79.94
T_3=0.01	85.43	84.57	84.15	76.38	74.09
T_4=0.03	85.43	84.57	84.15	73.37	71.16
T_5=0.1	83.42	82.58	82.17	68.34	66.29

20: Effect of nagesshor (*Mesua serreal)* aqueous extract (leaf & flower) on germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	95.48	94.52	94.05	97.49	94.56
T_1=0.001	95.48	94.52	94.05	96.48	93.59
T_2=0.003	91.46	90.54	90.09	82.41	79.94
T_3=0.01	91.46	90.54	90.09	82.41	79.94
T_4=0.03	90.45	89.55	89.10	78.39	76.04
T_5=0.1	84.42	83.58	83.16	74.37	72.14

4.25 The several effects of anantamul, arjun, ashok, darucini and nagesshor (leaf & flower) aqueous extract on plumule length (PL)

Plumule length (PL) was not significant indicating very little differences among the treatments studied under the effect of anantamul, arjun, ashok, darucini and nagesshor (leaf & flower) aqueous extract. The demonstrated data pointed up that plumule length of plants was not significantly affected by each treatment but the rate of decresing of length of plumule in monocot is greater than the dicot with rest of the five samples. There was reduction in values of plumule length with increasing treatment concentration too. Among all the treatments in all the plants maximum plumule length was found in the control treatment whether the shortest length of plumule was from 0.1 g/ml concentration in cauliflower, broccoli, tomato, foxtail millet and barnyard grass respectively (Table 21, 22, 23, 24 & 25).

4.26 The several effects of anantamul, arjun, ashok, darucini and nagesshor (leaf & flower) aqueous extract on radicle length (RL)

The length of radicle produced by five selective plants were recorded and the several effect of anantamul, arjun, ashok, darucini and nagesshor (leaf & flower) aqueous extract on radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass presented in (Table 26, 27, 28, 29 & 30). The concentrations and interaction were affecting the radicle length of Foxtail millet and Barnyard grass than cauliflower, broccoli, and tomato. Radicle length values were found to decrease with increasing treatment concentration in all the plants. The highest length of radicle was attained from cauliflower, broccoli, tomato, foxtail millet and barnyard grass in control treatment whereas the lowest radicle length (RL) (2.12, 2.01, 2.10, 1.04 & 1.00 cm) was attained at higher concentration (0.1g/ml) under the rest of five samples.

21: Effect of anantamul (*Hemidesmus indicus)* aqueous extract (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.76	1.67	1.65	1.66	1.60
T_1=0.001	1.75	1.66	1.65	1.66	1.59
T_2=0.003	1.75	1.66	1.66	1.57	1.51
T_3=0.01	1.71	1.62	1.65	1.57	1.51
T_4=0.03	1.71	1.62	1.64	1.49	1.43
T_5=0.1	1.70	1.61	1.66	1.41	1.35

22: Effect of arjun (*Terminalia arjuna)* aqueous extract (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.76	1.74	1.73	1.73	1.71
T_1=0.001	1.75	1.73	1.72	1.72	1.70
T_2=0.003	1.77	1.75	1.74	1.74	1.72
T_3=0.01	1.69	1.67	1.66	1.66	1.65
T_4=0.03	1.62	1.62	1.60	1.59	1.64
T_5=0.1	1.62	1.60	1.59	1.59	1.58

23: Effect of ashok (*Saraca asoca)* aqueous extract (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.75	1.67	1.65	1.57	1.51
T_1=0.001	1.72	1.64	1.61	1.13	1.08
T_2=0.003	1.65	1.57	1.54	0.95	0.91
T_3=0.01	1.50	1.43	1.50	1.04	1.00
T_4=0.03	1.50	1.43	1.45	0.43	0.41
T_5=0.1	1.35	1.29	1.41	0.26	0.25

24: Effect of darucini *(Cinnamomum verum)* aqueous extract (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	1.76	1.74	1.73	1.73	1.71
T_1=0.001	1.75	1.73	1.72	1.72	1.70
T_2=0.003	1.77	1.75	1.74	1.74	1.72
T_3=0.01	1.69	1.67	1.66	1.66	1.65
T_4=0.03	1.56	1.54	1.53	1.53	1.52
T_5=0.1	1.53 NS	1.51 NS	1.50 NS	1.50 NS	1.49 NS

25: Effect of nagesshor (*Mesua serreal)* aqueous extract (leaf & flower) on plumule length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	Cauliflower	Broccoli	Tomato	Foxtail millet	Burnyard grass
T0=Control	1.76	1.74	1.73	1.73	1.71
T1=0.001	1.75	1.73	1.72	1.72	1.70
T2=0.003	1.75	1.73	1.72	1.72	1.70
T3=0.01	1.69	1.67	1.66	1.66	1.65
T4=0.03	1.67	1.65	1.64	1.64	1.63
T5=0.1	1.62	1.60	1.59	1.59	1.58

26: Effect of anantamul (*Hemidesmus indicus)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.58	2.45	2.42	2.44	2.34
T_1=0.001	2.58	2.45	2.42	2.43	2.34
T_2=0.003	2.58	2.45	2.45	2.31	2.21
T_3=0.01	2.51	2.39	2.38	2.30	2.21
T_4=0.03	2.51	2.39	2.54	2.18	2.10
T_5=0.1	2.31	2.20	2.27	2.07	1.98

27: Effect of arjun (*Terminalia arjuna)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.58	2.56	2.54	2.54	2.52
T_1=0.001	2.56	2.54	2.52	2.52	2.50
T_2=0.003	2.52	2.50	2.48	2.48	2.46
T_3=0.01	2.51	2.49	2.47	2.47	2.45
T_4=0.03	2.51	2.49	2.47	2.47	2.45
T_5=0.1	2.39	2.37	2.36	2.36	2.33

28: Effect of ashok (*Saraca asoca)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.58	2.45	2.42	2.30	2.21
T_1=0.001	2.51	2.38	2.33	1.65	1.59
T_2=0.003	2.49	2.36	2.31	1.40	1.34
T_3=0.01	2.23	2.11	2.07	1.53	1.46
T_4=0.03	2.21	2.09	2.05	0.63	0.61
T_5=0.1	2.16	2.05	2.01	0.39	0.37

29: Effect of darucini *(Cinnamomum verum)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.58	2.56	2.54	2.54	2.52
T_1=0.001	2.55	2.53	2.51	2.51	2.49
T_2=0.003	2.52	2.50	2.48	2.48	2.46
T_3=0.01	2.49	2.47	2.46	2.45	2.43
T_4=0.03	2.46	2.44	2.43	2.42	2.40
T_5=0.1	2.30 NS	2.28 NS	2.27 NS	2.27 NS	2.24 NS

30: Effect of nagesshor (*Mesua serreal)* aqueous extract (leaf & flower) on radicle length (cm) of cauliflower, broccoli, tomato, foxtail millet and barnyard grass

Treatments	**Cauliflower**	**Broccoli**	**Tomato**	**Foxtail millet**	**Barnyard grass**
T_0=Control	2.58	2.56	2.54	2.54	2.52
T_1=0.001	2.58	2.56	2.54	2.54	2.52
T_2=0.003	2.57	2.55	2.53	2.53	2.51
T_3=0.01	2.52	2.50	2.48	2.48	2.46
T_4=0.03	2.51	2.49	2.47	2.47	2.45
T_5=0.1	2.41	2.39	2.38	2.38	2.35

CHAPTER IV

SUMMARY AND CONCLUSION

In order to evaluate the phytotoxic effect of some medicinal plants on germination and seedling growth of some selective plants, an experiment was conducted with five varieties in RCBD with six treatments during the period of January-June, 2017 in the Agricultural Chemistry Laboratory and net house (field condition) of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207. Amongst the five varieties used in this experiment, the monocot test species were foxtail millet and barnyard grass and the dicot test species were broccoli, cauliflower and tomato. The medicinal plant sample whose phytotoxic effect was studied was 10 in number and they were cirota, bohera, anantamul, nagesshor, ashok, arjun, bashok, akandho, darucini and rosundi.

In the study of the germination percentage of cauliflower, broccoli, tomato, foxtail millet and barnyard grass**,** the effect of the (leaf & flower) aqueous extract of ten medicinal plants shows wide range of variability. The results indicate that the germination percentage of test species was apparently varied with different concentrations of medicinal plant extract. The attained germination percentage values of five test species were recorded maximum at control conditions and were decreased upon applying at 0.001, 0.003, 0.01, 0.03 and 0.1 g/ml concentrations respectively. From the experiment, it was revealed that in all test species, the maximum value of germination percentage was found from the control treatment which was statistically superior to the rest of the treatments. As the treatment concentration value increased, the germination percentage value of the test species were decreased in consistent and the least value of germination percentage was found from 0.1 g/mg treatment while the other

germination percentage took intermediate positions and they were statistically different among themselves. Among ten medicinal plants cirota, bashok and rosundi gives significant variations and a wide range of effect was observed in germination percentage value of the test species. In this experiment, great treatment effects were found in the monocot plants eg. foxtail millet and barnyard grass and comparatively less effects were shown in dicot plants eg. cauliflower, broccoli and tomato. However, tomato plant showed much less treatment effect followed by cauliflower and broccoli among the three dicotyledonous plants. As the size of the tomato seed was much bigger than other four species, thus the treatment effect was comparatively less in tomato, cauliflower and broccoli species.

Findings of the present investigation indicated that the effect of medicinal plants (leaf & flower) aqueous extracts on plumule length and radicle length of cauliflower, broccoli, tomato, foxtail millet and barnyard grass indicated considerable differences due to different treatment concentrations. The maximum length of both plumule and radicle were recorded in five test species was from control treatment, whereas the minimum plumule length and radicle length were attained in 0.1g/ml aqueous medicinal plant extracts which was the highest concentration among all the treatments. Plumule length (PL) and radicle length (RL) was showed considerable differences among the treatments studied. But among all of them the demonstrated data pointed up that plumule and radicle length of five plants was significantly affected by cirota, bashok and rosundi. Evaluation of plumule length and radicle length correlated with higher concentrations has demonstrated their depressing influence on plants growth process.

Dry weight of five selective plants exhibited variation with different treatments. Different botanical extracts revealed different influence on dry weight of cauliflower, broccoli, tomato,

foxtail millet and barnyard grass. Among the botanical extracts, higher concentrated treatment (0.1g/ml) displayed the lowest dry weight where control gives the highest value. On a dry weight basis, the most variation was recorded when plants were treated with an extract of cirota, bashok and rosundi.

In net house, similar result was found as in the laboratory experiment. Greatest variation of germination and seedling growth was observed in foxtail millet and barnyard grass than other three plants. Here, bashok showed wide effect.

In conclusion, the present study indicates that reduction in germination and seedling growth was found to decrease with increasing treatment concentration in all the plants. The treatment concentration which caused the least inhibition of plants germination and seedling growth were at control. There was a clearly observed variation of treatment effect between the monocot and dicot plants where monocot plants (foxtail millet and barnyard grass) showed great treatment effects than dicot plants (cauliflower, broccoli and tomato) and out of three dicot plants, the least variation of treatment effect was found in tomato because of its larger seed size. Among the (leaf & flower) aqueous extract of ten medicinal plants, the treatment effect of cirota, bashok and rosundi caused the greatest variation in the germination percentages, plumule length, radicle length and dry weight of five selective plants but mostly in foxtail millet and barnyard grass. Thus, phototoxic effect of cirota, bashok and rosundi may reduce weed competition with crops by affecting the germination and seedling growth of foxtail millet and brnyard grass. Therefore, the study of phytotoxic effects of some medicinal plants on weeds or other plants species would be useful not only as a guide for organic culture but also for rotation programming in medicinal plants production.

CHAPTER VI

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CHAPTER VII

APPENDICES

CHAPTER VII

ANNEXURE

1. ANOVA Table (Ashok)

ANOVA Table for germination percentage

Source	DF	SS	MS	F	P
Replication	2	255.94	127.97		
Treatment	5	3590.62	718.12	7471.35	0.0000
Variety	4	348.19	87.048	905.65	0.0000
Treatment*Variety	20	295.57	14.779	153.76	0.0000
Error	58	2.79	0.0481		
Total	89	4493.11			

Grand Mean 80.545
CV 5.38

ANOVA Table for Plumule length

Source	DF	SS	MS	F	P
Replication	2	0.0608	0.0304		
Treatment	5	3.1864	0.6373	2325.15	0.0000
Variety	4	5.9518	1.488	5428.86	0.0000
Treatment*Variety	20	1.4979	0.0749	273.26	0.0000
Error	58	0.0079	0.0001		
Total	89	10.7048			

Grand Mean 1.2388
CV 3.34

ANOVA Table for radicale length

Source	DF	SS	MS	F	P
Replication	2	0.1316	0.0658		
Treatment	5	6.4676	1.2935	2428.23	0.0000
Variety	4	13.1346	3.2837	6164.14	0.0000
Treatment*Variety	20	3.4070	0.1704	319.79	0.0000
Error	58	0.0154	0.0003		
Total	89	23.1563			

Grand Mean 1.8255
CV 1.26

ANOVA Table for Dry weight

Source	**DF**	SS	MS	F	P
Replicati	2	4.002E-05	2.001E-05		
Treatment	5	5.226E-03	0.0010452	200.08	0.0000
Variety	4	2.492E-03	0.000623	119.29	0.0000
Treatment*Variety	20	8.182E-04	4.091E-05	7.83	0.0000
Error	58	1.515E-04	2.612E-06		
Total	89	8.728E-03			

Grand Mean 0.0332
CV 6.89

2. **ANOVA Table (cirota)**

Factorial ANOVA Table for germination percentage

Source	DF	SS	MS	F	P
Replicati	2	3617.2	1808.6		
Treatment	5	17060.0	3412	1276.71	0.0000
Variety	4	2218.2	554.55	207.50	0.0000
Treatment*Variety	20	2526.3	126.315	47.26	0.0000
Error	58	155.0	2.6724138		
Total	89	25576.6			

Grand Mean 75.176
CV 2.17

Factorial ANOVA Table for Plumule length

Source	DF	SS	MS	F	P
Replicati	2	0.9557	0.47785		
Treatment	5	6.2601	1.25202	655.51	0.0000
Variety	4	7.4026	1.85065	968.92	0.0000
Treatment*Variety	20	1.8567	0.092835	48.61	0.0000
Error	58	0.1108	0.0019103		
Total	89	16.5859			

Grand Mean 1.2283
CV 3.56

Factorial ANOVA Table for radicale length

Source	DF	SS	MS	F	P
Replicati	2	2.1479	1.07394		
Treatment	5	12.7124	2.54247	590.22	0.0000
Variety	4	17.9408	4.48519	1041.20	0.0000
Treatment*Variety	20	4.2190	0.21095	48.97	0.0000
Error	58	0.2498	0.00431		
Total	89	37.2698			

Grand Mean 1.8347
CV 3.58

Factorial ANOVA Table for Dry weight

Source	DF	SS	MS	F	P
Replicati	2	0.00082	4.078E-04		
Treatment	5	0.00777	1.554E-03	262.71	0.0000
Variety	4	0.00395	9.870E-04	166.88	0.0000
Treatment*Variety	20	0.00126	6.318E-05	10.68	0.0000
Error	58	0.00034	5.915E-06		
Total	89	0.01414			

Grand Mean 0.0338

CV 7.20

3. ANOVA Table (Basok*)*

Factorial AOV Table for germination percentage

Source	**DF**	**SS**	**MS**	**F**	**P**
Replicati	2	8.0	4		
Treatment	10	13049.3	2609.86	187678.72	0.0000
Variety	4	1495.9	373.975	26893.07	0.0000
Treatment*Variety	40	1700.9	85.045	6115.86	0.0000
Error	33	0.4	0.0068966		
Total	89	16254.5			

Grand Mean 73.268
CV 2.16

Factorial ANOVA Table for Plumule length

Source	**DF**	SS	MS	F	P
Replicati	2	0.0024	0.0012		
Treatment	10	4.3573	0.87146	51227.40	0.0000
Variety	4	4.6459	1.161475	68275.31	0.0000
Treatment*Variety	40	1.2076	0.06038	3549.25	0.0000
Error	33	0.0005	8.621E-06		
Total	89	10.2136			

Grand Mean 1.2197
CV 2.34

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.0047	0.00235		
Treatment	10	9.2650	1.853	55494.25	0.0000
Variety	4	10.6979	2.674475	80096.10	0.0000
Treatment*Variety	40	2.5047	0.125235	3750.56	0.0000
Error	33	0.0010	1.724E-05		
Total	89	22.4732			

Grand Mean 1.8078
CV 3.32

Factorial ANOVA Table for Dry weight

Source	**DF**	**SS**	**MS**	**F**	**P**
Replicati	2	1.350E-06	6.75E-07		
Treatment	10	7.022E-03	0.0014044	738.52	0.0000
Variety	4	1.489E-03	0.0003723	195.71	0.0000
Treatment*Variety	40	7.001E-04	3.501E-05	18.41	0.0000
Error	33	5.515E-05	9.509E-07		
Total	89	9.268E-03			

Grand Mean 0.0319
CV 4.33

4. ANOVA Table (Rasundi*)*

Factorial ANOVA Table for germination percentage

Source	**DF**	SS	MS	F	P
Replicati	2	275.7	137.85		
Treatment	10	15517.1	3103.42	5618.69	0.0000
Variety	4	1578.0	394.5	714.22	0.0000
Treatment*Variety	40	1795.0	89.75	162.49	0.0000
Error	33	16.0	0.2758621		
Total	89	19181.8			

Grand Mean 73.596
CV 1.01

Factorial ANOVA Table for Plumule length

Source	**DF**	SS	MS	F	P
Replicati	2	0.0821	0.04105		
Treatment	10	5.0927	1.01854	3491.47	0.0000
Variety	4	4.7986	1.19965	4112.30	0.0000
Treatment*Variety	40	1.1023	0.055115	188.93	0.0000
Error	33	0.0085	0.0001466		
Total	89	11.0843			

Grand Mean 1.2477
CV 1.37

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.1685	0.08425		
Treatment	10	11.0280	2.2056	3037.15	0.0000
Variety	4	10.2423	2.560575	3525.97	0.0000
Treatment*Variety	40	2.1078	0.10539	145.12	0.0000
Error	33	0.0211	0.0003638		
Total	89	23.5677			

Grand Mean 1.8287
CV 1.47

Factorial ANOVA Table for Dry weight

Source	DF	SS	MS	F	P
Replicati	2	4.682E-05	2.34E-05		
Treatment	10	6.605E-03	0.001321	4412.11	0.0000
Variety	4	1.025E-03	0.0002563	856.17	0.0000
Treatment*Variety	40	3.978E-04	1.989E-05	66.42	0.0000
Error	33	8.683E-06	1.497E-07		
Total	89	8.084E-03			

Grand Mean 0.0313
CV 1.75

5. **ANOVA Table (Bohera*)***

Factorial ANOVA Table for germination percentage

Source	DF	SS	MS	F	P
Replicati	2	43.49	2.17E+01		
Treatment	10	2116.26	423.252	32242.02	0.0000
Variety	4	799.17	199.7925	15219.51	0.0000
Treatment*Variety	40	945.78	47.289	3602.32	0.0000
Error	33	0.38	0.0065517		
Total	89	3905.08			

Grand Mean 85.972
CV 1.13

Factorial ANOVA Table for Plumule length

Source	DF	SS	MS	F	P
Replicati	2	0.01233	6.17E-03		
Treatment	10	1.35338	0.270676	10150.35	0.0000
Variety	4	4.03954	1.009885	37870.72	0.0000
Treatment*Variety	40	0.97594	0.048797	1829.88	0.0000
Error	33	0.00077	1.328E-05		
Total	89	6.38196			

Grand Mean 1.4320
CV 0.36

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.0236	1.18E-02		
Treatment	10	4.3673	0.87346	17489.12	0.0000
Variety	4	7.6623	1.915575	38355.39	0.0000
Treatment*Variety	40	1.3943	0.069715	1395.92	0.0000
Error	33	0.0014	2.414E-05		
Total	89	13.4489	1.18E-02		

Grand Mean 2.0745
CV 0.34

Factorial ANOVA Table for Dry weight

Source	**DF**	SS	MS	F	P
Replicati	2	8.067E-06	4.03E-06		
Treatment	10	3.934E-03	0.0007868	7779.25	0.0000
Variety	4	4.145E-03	0.0010363	10244.99	0.0000
Treatment*Variety	40	1.006E-03	0.0000503	497.04	0.0000
Error	33	2.933E-06	5.057E-08		
Total	89	9.096E-03			

Grand Mean 0.0360
CV 0.88

6. ANOVA Table (Anantamul*)*

Factorial ANOVA Table for germination percentage

Source	**DF**	SS	MS	F	P
Replicati	2	11.28	5.64E+00		
Treatment	10	1621.30	324.26	150903.33	0.0000
Variety	4	461.81	115.4525	53729.23	0.0000
Treatment*Variety	40	490.78	24.539	11420.01	0.0000
Error	33	0.06	0.0010345		
Total	89	2585.23			

Factorial ANOVA Table for Plumule length

Source	**DF**	SS	MS	F	P
Replicati	2	0.00486	2.43E-03		
Treatment	10	0.11198	0.022396	2706.18	0.0000
Variety	4	0.38929	0.0973225	11759.80	0.0000
Treatment*Variety	40	0.08827	0.0044135	533.30	0.0000
Error	33	0.00024	4.138E-06		
Total	89	0.59464			

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.00988	4.94E-03		
Treatment	10	0.54843	0.109686	8635.89	0.0000
Variety	4	0.71861	0.1796525	14144.59	0.0000
Treatment*Variety	40	0.13913	0.0069565	547.71	0.0000
Error	33	0.00037	6.379E-06		
Total	89	1.41642			

Factorial ANOVA Table for Dry weight

Source	**DF**	SS	MS	F	P
Replicati	2	1.667E-06	8.34E-07		
Treatment	10	1.671E-03	0.0003342	94.68	0.0000
Variety	4	2.372E-04	0.0000593	16.80	0.0000
Treatment*Variety	40	3.746E-04	1.873E-05	5.31	0.0000
Error	33	1.023E-04	1.764E-06		
Total	89	2.386E-03			

7. ANOVA Table (Nagesshore*)*

Factorial ANOVA Table for germination percentage

Source	**DF**	SS	MS	F	P
Replicati	2	11.53	5.77E+00		
Treatment	10	1836.87	367.374	147288.17	0.0000
Variety	4	700.22	175.055	70183.61	0.0000
Treatment*Variety	40	427.27	21.3635	8565.17	0.0000
Error	33	0.07	0.0012069		
Total	89	2975.97			

Factorial ANOVA Table for Plumule length

Source	**DF**	SS	MS	F	P
Replicati	2	0.00451	2.26E-03		
Treatment	10	0.15147	0.030294	2995.04	0.0000
Variety	4	0.01252	0.00313	309.53	0.0000
Treatment*Variety	40	0.00008	0.000004	0.38	0.9863
Error	33	0.00029	0.000005		
Total	89	0.16887			

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.01094	5.47E-03		
Treatment	10	0.21447	0.042894	3949.06	0.0000
Variety	4	0.02594	0.006485	597.03	0.0000
Treatment*Variety	40	0.00010	0.000005	0.46	0.9624
Error	33	0.00031	5.345E-06		
Total	89	0.25176			

Factorial ANOVA Table for Dry weight

Source	**DF**	SS	MS	F	P
Replicati	2	2.017E-06	1.01E-06		
Treatment	10	7.946E-04	0.0001589	80.17	0.0000
Variety	4	6.400E-06	0.0000016	0.81	0.5307
Treatment*Variety	40	3.320E-05	1.66E-06	0.84	0.6551
Error	33	5.748E-05	9.91E-07		
Total	89	8.937E-04			

8. ANOVA Table (Arjun*)*

Factorial ANOVA Table for germination percentage

Source	**DF**	SS	MS	F	P
Replicati	2	11.43	5.72E+00		
Treatment	10	1902.61	380.522	147894.18	0.0000
Variety	4	699.42	174.855	67959.91	0.0000
Treatment*Variety	40	427.30	21.365	8303.73	0.0000
Error	33	0.07	0.0012069		
Total	89	3040.84			

Factorial ANOVA Table for Plumule length

Source	**DF**	SS	MS	F	P
Replicati	2	0.00451	2.26E-03		
Treatment	10	0.22915	0.04583	4530.99	0.0000
Variety	4	0.01204	0.00301	297.58	0.0000
Treatment*Variety	40	0.00008	0.000004	0.40	0.9827
Error	33	0.00029	0.000005		
Total	89	0.24607			

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.01067	5.34E-03		
Treatment	10	0.21878	0.043756	3806.77	0.0000
Variety	4	0.02608	0.00652	567.17	0.0000
Treatment*Variety	40	0.00010	0.000005	0.45	0.9666
Error	33	0.00033	5.69E-06		
Total	89	0.25596			

Factorial ANOVA Table for Dry weight

Source	**DF**	SS	MS	F	P
Replicati	2	4.817E-06	2.41E-06		
Treatment	10	4.041E-04	8.082E-05	636.40	0.0000
Variety	4	1.207E-05	3.018E-06	23.75	0.0000
Treatment*Variety	40	9.333E-07	4.667E-08	0.37	0.9885
Error	33	3.683E-06	6.35E-08		
Total	89	4.257E-04			

9. ANOVA Table (Akandha*)*

Factorial ANOVA Table for germination percentage

Source	**DF**	SS	MS	F	P
Replicati	2	11.39	5.70E+00		
Treatment	10	2313.25	462.65	158081.02	0.0000
Variety	4	699.14	174.785	59721.49	0.0000
Treatment*Variety	40	426.85	21.3425	7292.45	0.0000
Error	33	0.08	0.0013793		
Total	89	3450.72			

Factorial ANOVA Table for Plumule length

Source	**DF**	SS	MS	F	P
Replicati	2	0.00451	2.26E-03		
Treatment	10	0.39892	0.079784	7887.74	0.0000
Variety	4	0.01204	0.00301	297.58	0.0000
Treatment*Variety	40	0.00008	0.000004	0.40	0.9827
Error	33	0.00029	0.000005		
Total	89	0.41584			

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.01040	5.20E-03		
Treatment	10	0.23101	0.046202	3846.45	0.0000
Variety	4	0.02541	0.0063525	528.80	0.0000
Treatment*Variety	40	0.00013	0.0000065	0.56	0.9128
Error	33	0.00035	6.034E-06		
Total	89	0.26730			

Factorial ANOVA Table for Dry weight

Source	**DF**	SS	MS	F	P
Replicati	2	0.00002	1.00E-05		
Treatment	10	1.33045	0.26609	204775.77	0.0000
Variety	4	0.00005	0.0000125	10.52	0.0000
Treatment*Variety	40	0.00010	0.000005	3.67	0.0008
Error	33	0.00004	6.897E-07		
Total	89	1.33066			

10. ANOVA Table (Daruchini*)*

Factorial ANOVA Table for germination percentage

Source	**DF**	SS	MS	F	P
Replicati	2	10.84	5.42		
Treatment	10	2841.58	284.16	156664.93	0.0000
Variety	4	862.85	215.71	59464.64	0.0000
Treatment*Variety	40	564.70	14.118	7783.40	0.0000
Error	33	0.11	0.0033		
Total	89	4280.07			

Factorial ANOVA Table for Plumule length

Source	**DF**	SS	MS	F	P
Replicati	2	0.00451	0.002255		
Treatment	10	0.54765	0.054765	10828.60	0.0000
Variety	4	0.01204	0.00301	297.58	0.0000
Treatment*Variety	40	0.00008	0.000002	0.40	0.9827
Error	33	0.00029	8.78788E-06		
Total	89	0.56457			

Factorial ANOVA Table for radicale length

Source	**DF**	SS	MS	F	P
Replicati	2	0.00988	0.00494		
Treatment	10	0.48967	0.048967	7710.72	0.0000
Variety	4	0.02466	0.006165	485.32	0.0000
Treatment*Variety	40	0.00018	0.0000045	0.72	0.7735
Error	33	0.00037	1.12121E-05		
Total	89	0.52476			

Factorial ANOVA Table for Dry weight

Source	**DF**	SS	MS	F	P
Replicati	2	4.817E-06	2.4085E-06		
Treatment	10	8.981E-04	0.00008981	1414.18	0.0000
Variety	4	1.027E-05	2.5675E-06	20.21	0.0000
Treatment*Variety	40	1.333E-06	3.3325E-08	0.52	0.9312
Error	33	3.683E-06	1.11606E-07		
Total	89	9.182E-04			

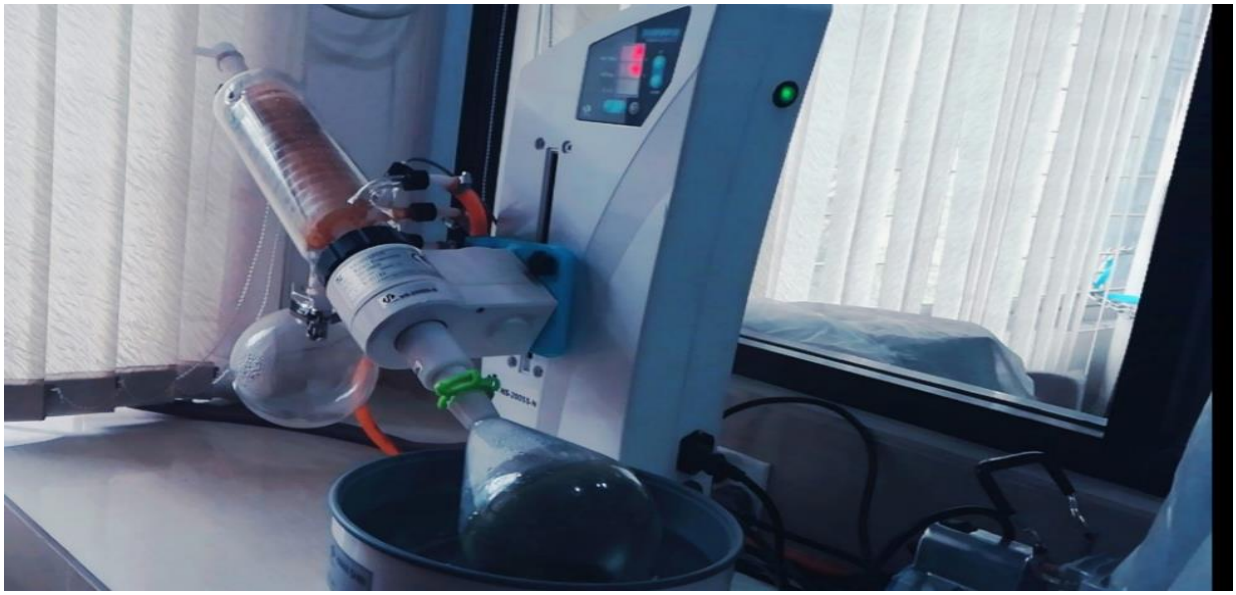

Figure 9: Evaporate the aqueous extract by rotary evaporator (HS-2005S) at 40^0 C for 30 minutes

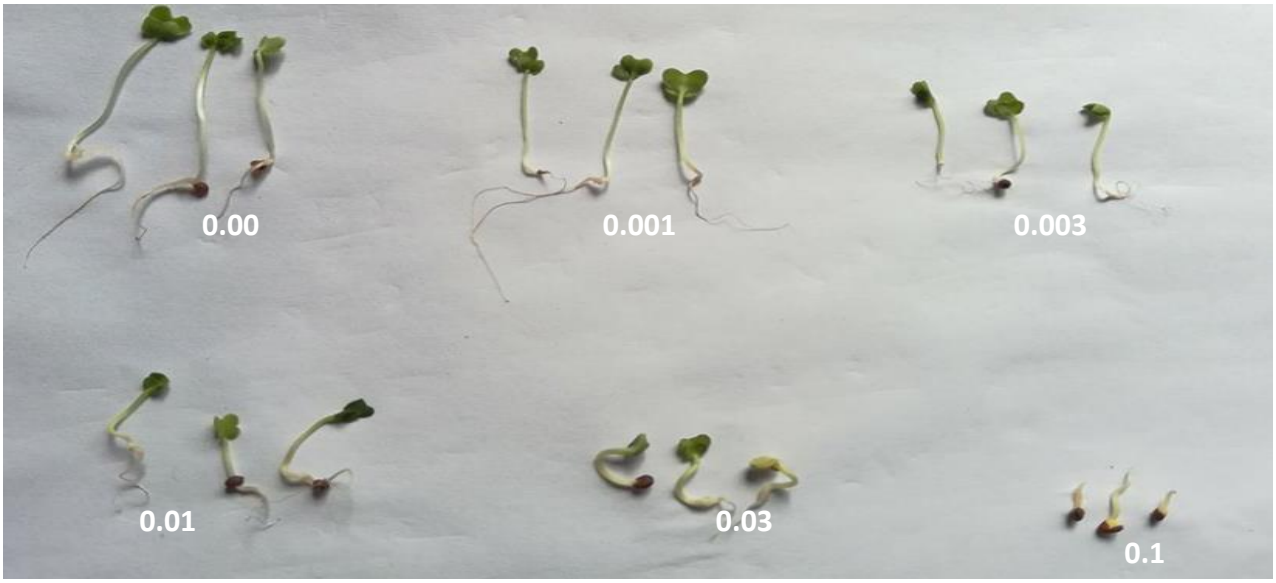

Figure 10: Variation in the germination percentage (GP), radicle length (RL) and plumule length (PL) of cauliflower as affected by different concentrations (ppm) of bashok (*Justicia adhatoda*) aqueous extract (leaf & flower) in the laboratory condition

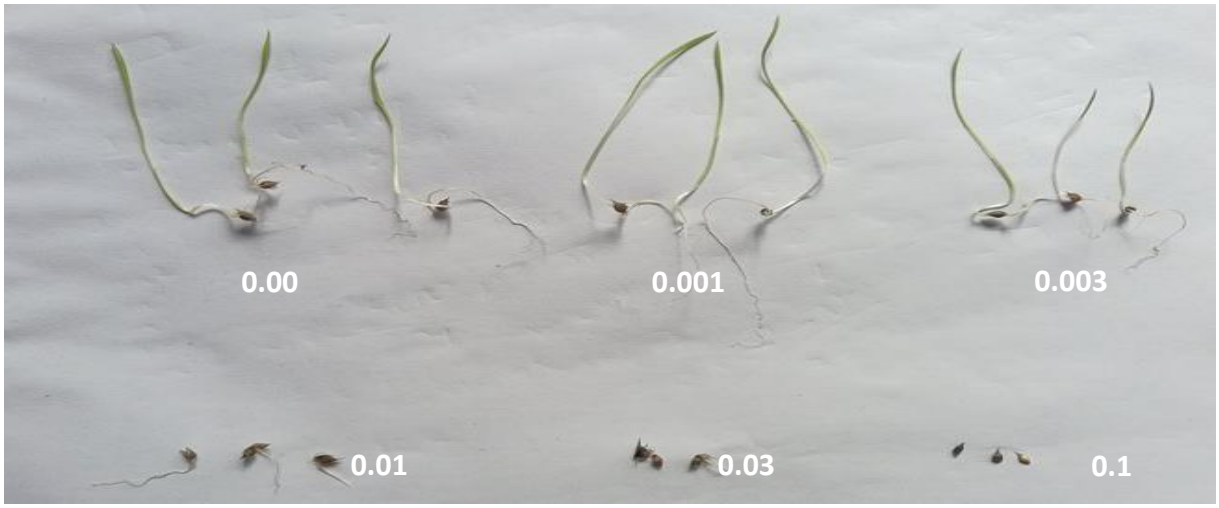

Figure 11: Variation in the germination percentage (GP), radicle lenth (RL) and plumule length (PL) of barnyard grass as affected by different concentrations (ppm) of bashok (*Justicia adhatoda*) aqueous extract (leaf & flower) in the laboratory condition

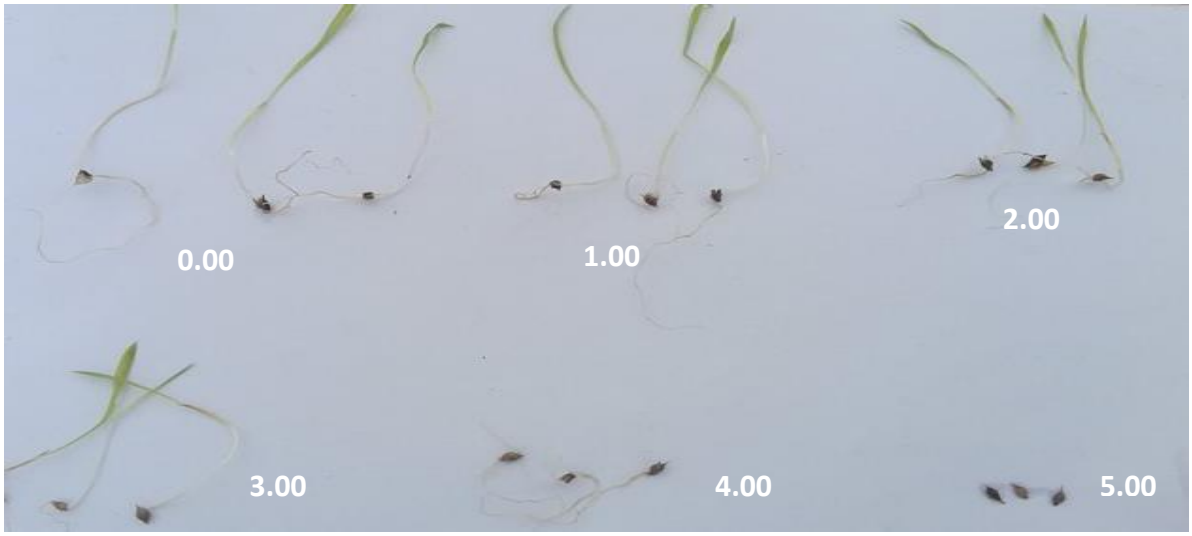

Figure 12: Variation in the germination percentage (GP), radicle length (RL) and plumule length (PL) of barnyard grass as affected by different concentrations (ppm) of bashok (*Justicia adhatoda*) aqueous extract (leaf & flower) in the net house (field condition)

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