

Chief Editor

Dr. A. Singaraj, M.A., M.Phil., Ph.D.

Editor

Mrs.M.Josephin Immaculate Ruba

EDITORIAL ADVISORS

1. Prof. Dr.Said I.Shalaby, MD,Ph.D.
Professor & Vice President
Tropical Medicine,
Hepatology & Gastroenterology, NRC,
Academy of Scientific Research and Technology,
Cairo, Egypt.
2. Dr. Mussie T. Tessema,
Associate Professor,
Department of Business Administration,
Winona State University, MN,
United States of America,
3. Dr. Mengsteab Tesfayohannes,
Associate Professor,
Department of Management,
Sigmund Weis School of Business,
Susquehanna University,
Selinsgrove, PENN,
United States of America,
4. Dr. Ahmed Sebihi
Associate Professor
Islamic Culture and Social Sciences (ICSS),
Department of General Education (DGE),
Gulf Medical University (GMU),
UAE.
5. Dr. Anne Maduka,
Assistant Professor,
Department of Economics,
Anambra State University,
Igbariam Campus,
Nigeria.
6. Dr. D.K. Awasthi, M.Sc., Ph.D.
Associate Professor
Department of Chemistry,
Sri J.N.P.G. College,
Charbagh, Lucknow,
Uttar Pradesh. India
7. Dr. Tirtharaj Bhoi, M.A, Ph.D,
Assistant Professor,
School of Social Science,
University of Jammu,
Jammu, Jammu & Kashmir, India.
8. Dr. Pradeep Kumar Choudhury,
Assistant Professor,
Institute for Studies in Industrial Development,
An ICSSR Research Institute,
New Delhi- 110070, India.
9. Dr. Gyanendra Awasthi, M.Sc., Ph.D., NET
Associate Professor & HOD
Department of Biochemistry,
Dolphin (PG) Institute of Biomedical & Natural
Sciences,
Dehradun, Uttarakhand, India.
10. Dr. C. Satapathy,
Director,
Amity Humanity Foundation,
Amity Business School, Bhubaneswar,
Orissa, India.



ISSN (Online): 2455-7838

SJIF Impact Factor (2016): 4.144

EPRA International Journal of

Research & Development (IJRD)

Monthly Peer Reviewed & Indexed
International Online Journal

Volume:2, Issue:3, March 2017



Published By :
EPRA Journals

CC License





SCREENING OF *Chenopodium album* L. FOR ALLELOPATHIC ACTIVITY

Mohamed A. Alaib¹

¹Professor, Botany Department, Faculty of Science- Benghazi University, Libya.

Majda F. Sahbi²

²Researcher, Libyan Academy of Higher studies, Benghazi, Libya.

Salem A. El shatshat³

³Associate Professor, Botany Department, Faculty of Science- Benghazi University, Libya.

ABSTRACT

The present work was conducted to investigate the allelopathic activity of (*Chenopodium album* L.) growing in Benghazi agricultural fields on seed germination and seedling development of Radish (*Raphanus sativus* L.). Flowers, leaves, stems and roots aqueous extracts of *Chenopodium album* L. at 1%, 5% and 10% concentrations were applied to determine their effect on seed germination, germination index (GI), speed/rate of germination (SG/RG), seedling vigor index (SVI), root length (RL), hypocotyle length (HL), seedlings fresh weight (FW) and seedlings dry weight (DW) of tested plant under laboratory conditions. The aqueous extracts of all plant parts caused inhibitory effects on all measurement, which increased progressively on increasing the concentration of extracts. On the other hand, at low concentration (1%) stimulation of some traits of different plant parts was recorded. These results could be explained in the light of the facts that a higher plants release a diversity of allelochemicals into the environment, which include phenolics, alkaloids, long-chain fatty acids, terpenoids, and flavanoids. The compounds exhibit a wide range of mechanisms of action effect on DNA (alkaloids), photosynthetic and mitochondrial function (quinines), phytohormone activity, ion uptake and water balance (phenolics)

KEYWORDS: Allelopathic activity, *Chenopodium album* L., *Raphanus sativus* L., germination

INTRODUCTION

Allelopathy is derived from the Greek words *allelon* “of each other” and *pathos* “to suffer” (Rizvi, Haque, Singh & Rizvi, 1992). Rice (1974) defines allelopathy as any direct or indirect effect by one plant, including microorganisms, on another through the production of chemical compounds that escape into the environment and subsequently influence the growth and development of neighboring plants. These effects can be harmful or beneficial (Rice, 1984). Allelopathy is an important mechanism of plant interference

mediated by the addition of plant-produced secondary products to the soil rhizosphere (Weston, 2005). The beneficial or harmful effects of one plant on another plant both crop and weed species, take place by the release of chemicals from plant parts by leaching, root exudation, volatilization, residue decomposition and other processes in both natural and agricultural systems (Ferguson & Rathinasabapathi, 2009).

Because of human population increase in recent years, the demand on food has also increased. The weed competition is one of the

major constraints in food production due to its inhibition of seed germination and seedling growth of crop species through allelopathy and therefore reducing yield. On the other side allelopathy offer potential for biological control of weeds, through production and release of allelochemicals from flowers, leaves, stems, and roots of living or decomposing plant materials (Patil, 2007). Under suitable environments, allelochemicals may produced in quantity, which inhibit the growth and development of weed seedlings similar to herbicides (Weston, 1996). Many researchers (e.g. Weston, 2005; Khan, 2005 & Patil *et.al.*, 2007), have suggested that, this phenomenon can be employed in weed management programmers, in particular, allelochemicals may used as alternative to synthetic herbicides.

In this work we evaluated the ability of extracts of *Chenopodium album* L. which growing in agriculture fields in Benghazi, Libya, to find out whether it inhibit or suppress the growth and development of other plants.

MATERIALS AND METHODS

Laboratory experiments were conducted to investigate the allelopathic activity of *Chenopodium album* L. The experiments were conducted in Main Research Laboratory, University of Benghazi, Faculty of Science, Botany Department.

Chenopodium album L. was collected from its natural habitat during the flowering stage to test the allelopathic activities of the aqueous extract of flowers, leaves, stems and roots. The collected materials were dried in oven at 60 °C for 24 hours then ground and stored in glass jars until used. To obtain different concentrations (W/V) of flowers, leaves, stems and roots; 1, 5 and 10 grams of *Chenopodium album* L. were soaked in 100 ml of distilled water for 24 hours at room temperature and stored in the refrigerator at 4°C until used. Growth chamber conditions for germination were 25 °C, in dark, and relative humidity 65 %.

Seeds of Radish (*Raphanus sativus* L.) which used as the recipient, were obtained from local market. They were kept and stored in the laboratory at room temperature until they used. Twenty seeds were sown onto 9 cm Petri-dishes lined with one layer of Whatman No. 1 filter paper. 5 ml of each extract from different concentrations were delivered to each petri-dish and 5 ml of distilled water was used as control. Germinated seeds with a radical were recorded and root and shoot lengths and fresh and dry weights of seedling were measured after 5 days of sowing. A number of parameters were used in this work to assess the effects of weed extracts on seed germination and seedlings development of test species. These parameters included:

1. Percent of seed germination

$$\% \text{Germination} = \frac{\text{No. of seeds with extended radicals}}{\text{Total number of seeds}} \times 100$$

2. Seed germination index (SGI)

Seed germination index (SGI) was calculated according to the following equation (Scott *et al.*, 1984).

$$\text{SGI} = \sum \frac{Ti}{Ni} / S$$

Where,

Ti = is the number of days after sowing *Ni* = is the number of seed germinated on day, *S* = is the total number of seeds planted.

3. Speed of germination/ Rate of germination:

Speed or rate of germination was computed by using the following formula, (Patil, 2007).

$$\text{SG/RG} = \frac{N_1}{D_1} + \frac{N_2}{D_2} + \frac{N_3}{D_3} + \dots + \frac{N_n}{D_n}$$

Where,

SG = Speed of germination

RG = Rate of germination

N₁, N₂, N₃,.....N_n = Number of seedling emerged on *D₁, D₂, D₃,.....D_n* days after sowing.

4. Seedling vigor index (SVI)

The seedling vigor index was calculated by using Abdul-Baki and Anderson (1973) formulae.

$$\text{SVI} = (\text{Shoot length} + \text{Root length}) \times \text{Germination percentage.}$$

5. Root and shoot length:

Length of roots and shoots, were measured in cm using a ruler

6. Fresh weight:

The fresh weight of the whole Seedling was recorded by weighing small tins empty after drying for a few minutes at 80°C in an oven and then with the amount of fresh sample.

7. Dry weight:

Samples were dried for 24 hours in an oven at 80 °C, the tins were removed from the oven closed allowed to cool, weighed and put back in the oven for further 24 hours periods until constant weight was reached.

8. Inhibition of growth:

Relative reduction or stimulation of seed germination, root length, shoot length and fresh weight and dry weight as affected by the allelopathic substance were calculated according to the general equations, (Nesrine *et al.*, 2011).

$$[1 - (\text{allelopathic/control}) \times 100]$$

Statistical analysis:

Data were subjected to standard one-way analysis of variance (ANOVA) using the COSTAT, 2.00 statistical analysis soft were manufactured by CoHort Software Company (1986).

RESULTS**1. Percent of Germination:**

Extracts from different plant parts of *C. album* L. at 1% concentration had no significant effect on seed germination of Radish. At 5% concentration, only extract of leaves decreased germination percentage significantly (48%) compared to control (99%). At 10% concentration, all plant part extracts reduced percentage of seed germination significantly, especially leaves extract (7%) in comparison with control (99%) and there was no effect for root extracts (Fig. 1).

2. Germination Index (GI):

Extracts of all plant parts at 1% concentration had no significant effect on GI. At 5% concentration, however, extract of leaves only significantly reduced GI (1.40) compared to control (3.00). Extracts of all plant parts of *C. album* L. at 10% concentration significantly decreased GI especially leaves extract (0.22) compared to control (3.00). While roots extract at 10% had no significant effect on GI (Fig. 2).

3. Speed /Rate of Germination (SG/RG):

Data of speed/rate of germination indicated that all extracts of different plant parts of *C. album* L. at all used concentration, reduced rate of seed germination of Radish. At 1% concentration flowers extract only recorded significant decrease in rate of seed germination (32.90) compared to

control (45.30). On other hand, extract of leaves at 5% showed significant reduction in rate of germination (19.30) in comparison with control (45.30). Extracts of all plant parts at 10% concentration significantly reduced rate of seed germination in Radish. The highest reduction recorded for leaves extract (2.50) compared to control (45.30) (Fig. 3).

4. Seedling Vigor Index (SVI):

Seedling vigor index (SVI) reduced by 1% concentration of all plant parts extracts especially flowers extract (1032) compared to control (1871). While roots extract increased SVI significantly (2405) compared to control (1871). At 5% & 10% concentrations all plant parts extracts significantly reduced SVI to zero except roots extracts which decreased SVI significantly (1060 & 715, respectively) compared to control (1871) (Fig. 4).

5. Root Length:

Result indicated that extracts of all part of *C. album* L. at 1% concentration significantly reduced root elongation of Radish seedlings with the highest inhibition caused by extract of flowers (67%) compared to control. While roots extract significantly stimulated root elongation (20%) in comparison with control. At 5% and 10% concentrations different plant parts extracts significantly inhibited root elongation completely with exception of roots extracts that reduced root elongation significantly (54% & 63%, respectively) (Fig. 5 & 6).

Fig (1)

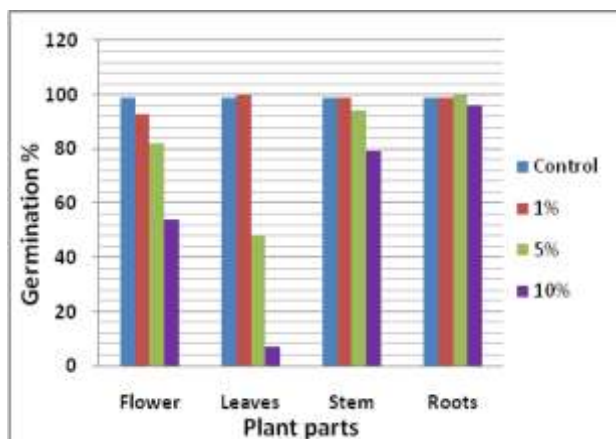


Fig (2)

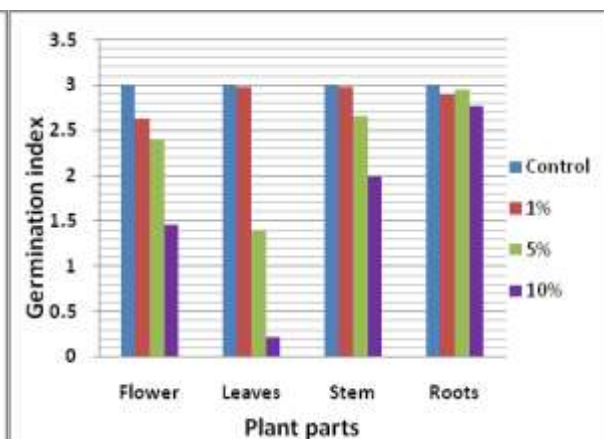


Fig (3)

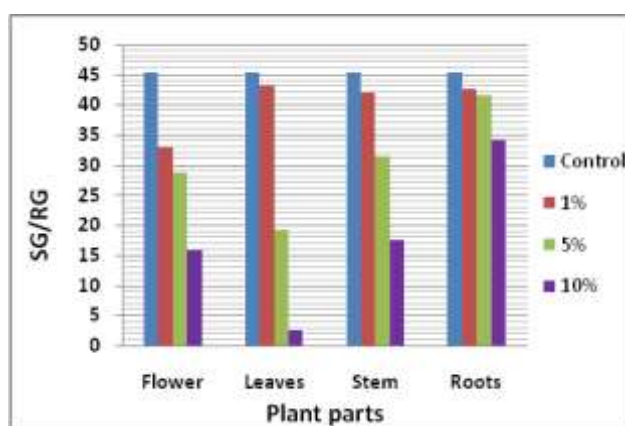
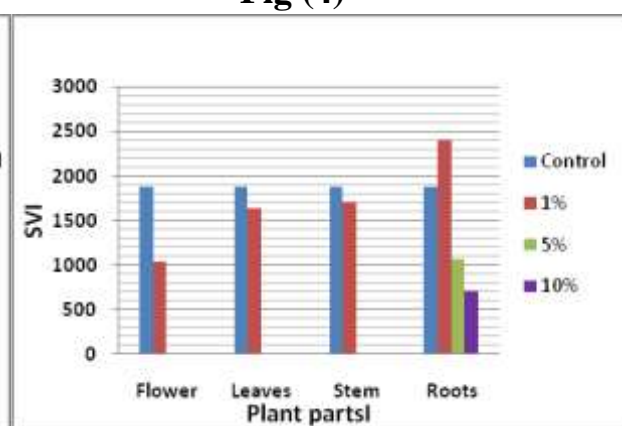


Fig (4)



Allelopathic activity of *Chenopodium Album L.* aqueous extracts at different concentrations of different plant parts on seed germination (Fig.1), germination index (Fig.2), speed/rate of germination (Fig.3), and seedling vigor index (Fig.4) of Radish (*Raphanus sativus L.*) 5 days after planting.

6. Hypocotyle Length:

The obtained data (fig.7 & 8) showed that extracts of all plant parts of *C. album L.* at 1% stimulated hypocotyle elongation significantly especially roots extract (41%). Flowers extract at this concentration however, had no significant effect on hypocotyle elongation of Radish seedlings. At 5% & 10% concentrations all extracts completely inhibited hypocotyle elongation except extracts of roots only recorded significant decrease in hypocotyle length (27% & 57% respectively).

7. Fresh Weight:

Different extracts of *C. album L.* showed inhibitory effect for flowers and leaves extracts at 1% concentration with the highest effect recorded for flowers extract on fresh weight (36%). In contrast, extracts of stems and roots recorded stimulatory effect on seedlings fresh weight. The stimulatory effect was higher for roots extract (29%). For 5% and 10% all extracts showed complete inhibition except roots extracts significantly reduced fresh weight (36% & 66% respectively) (Fig. 9 & 10).

8. Dry Weight:

1% of flowers and leaves extracts showed inhibitory effect of dry weight of receptor plant. the highest effect recorded for flowers extract and it was (35%). In contrast, extracts of stems and roots recorded stimulatory effect on seedlings dry weight. At 5% and 10% concentrations, all extracts of different plant parts completely reduced dry weight of seedlings except roots extracts which significantly increased radish seedling dry weight (20% & 17%, respectively) (Fig. 11 & 12).

Fig (5)

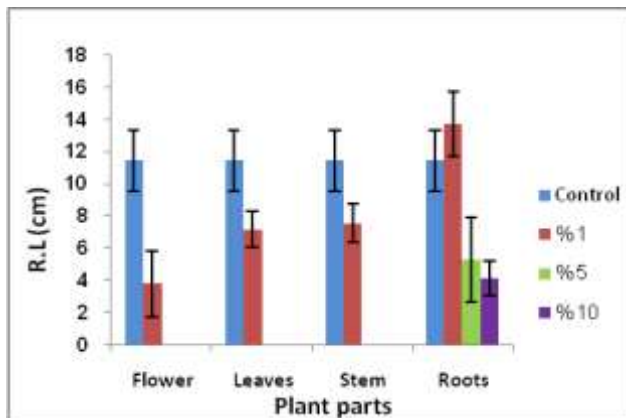


Fig (6)

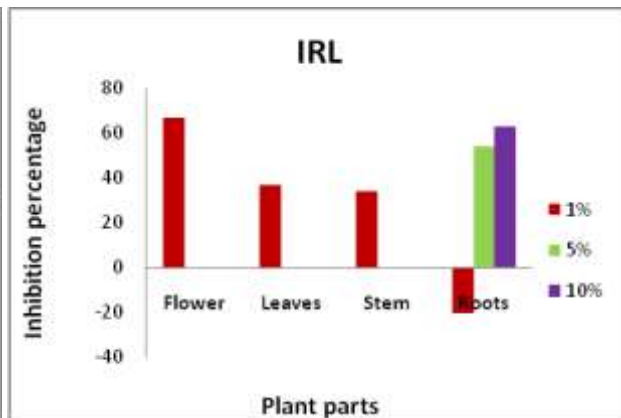


Fig (7)

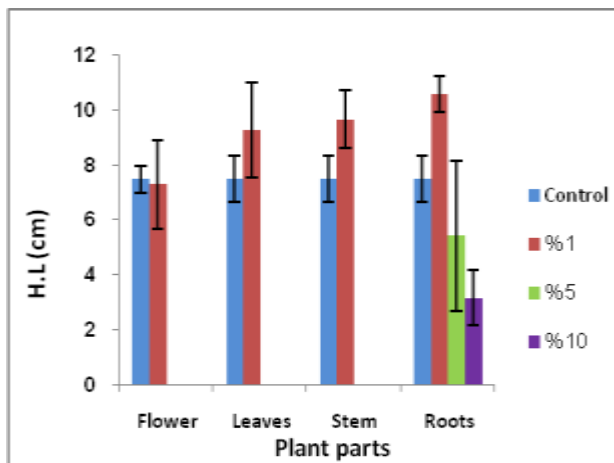
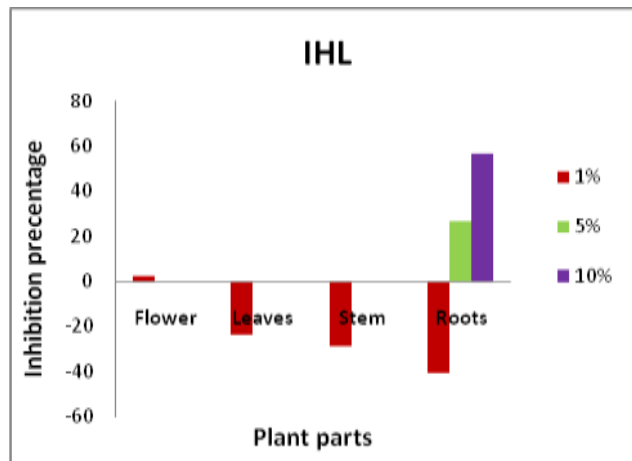


Fig (8)



Allelopathic activity of *Chenopodium Album* L. aqueous extracts at different concentrations of different plant parts on RL (Fig. 5), percentage IRL (Fig. 6), HL (Fig. 7) and percentage IHL (Fig. 8) of Radish (*Raphanus sativus* L.) 5 days after planting.

Fig (9)

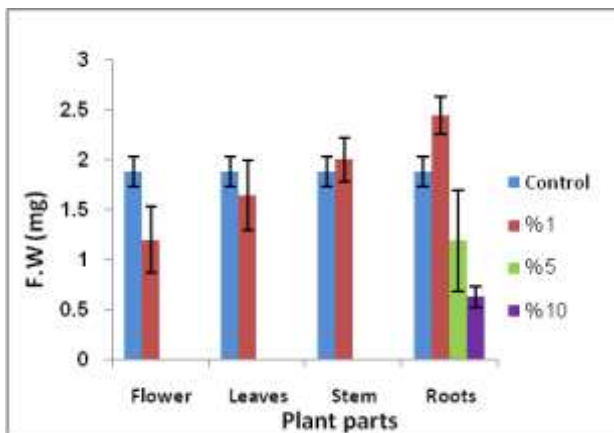


Fig (10)

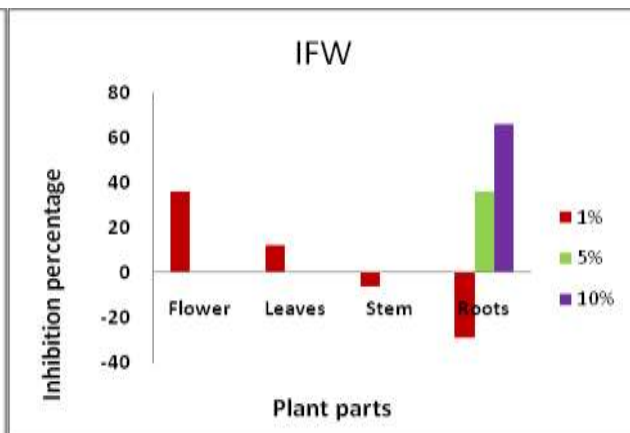


Fig (11)

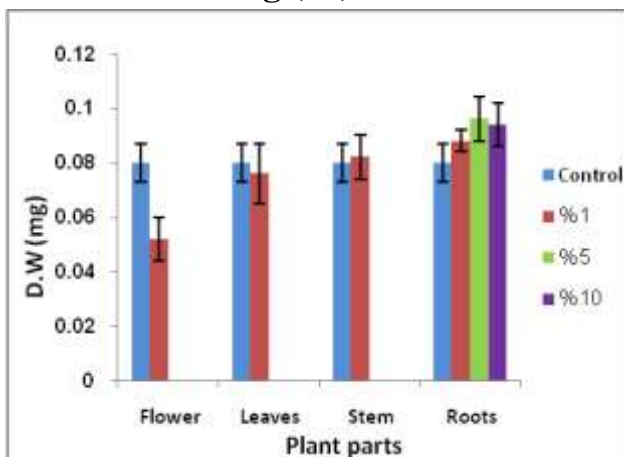
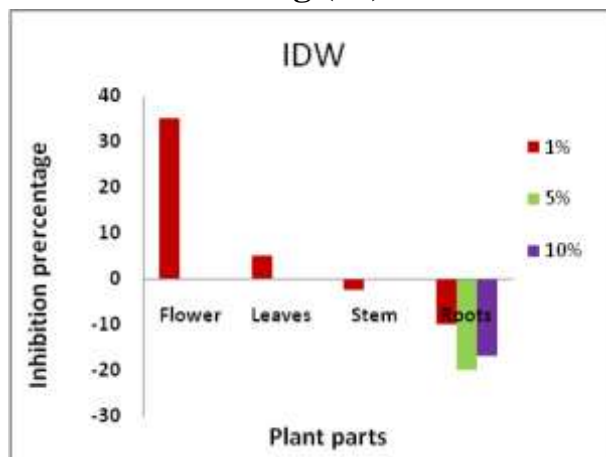
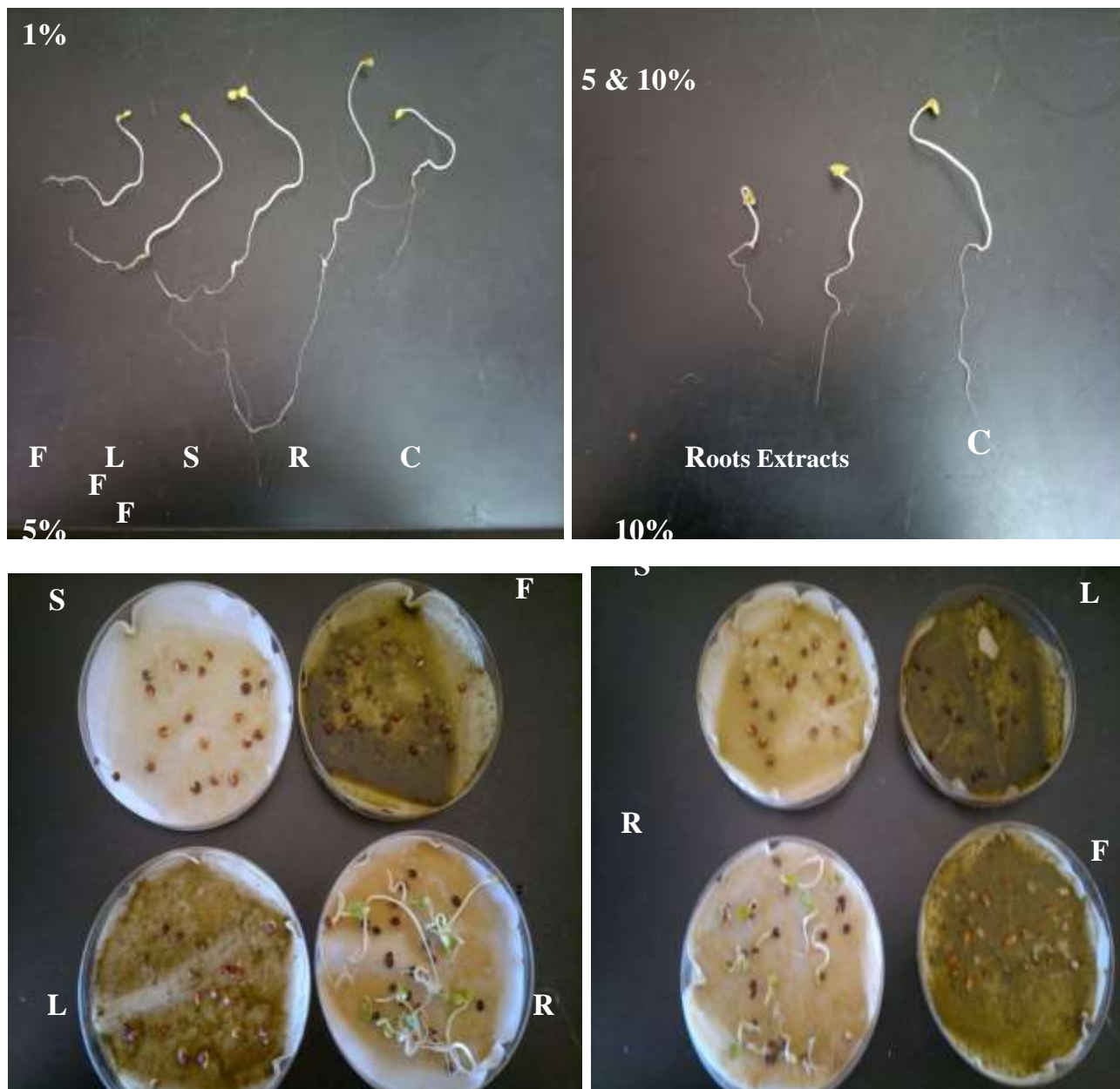


Fig (12)



Allelopathic activity of *Chenopodium Album* L. aqueous extracts at different concentrations of different plant parts on FW (Fig. 9), percentage IFW (Fig. 10), DW (Fig. 11) and percentage IDW (Fig. 12) of Radish (*Raphanus sativus* L.) 5 days after planting



C- Control F- Flower L- Leaves S- Stems R- Roots

Plate. Allelopathic activity of *Chenopodium Album L.* aqueous extracts at different concentrations of different plant parts on Radish (*Raphanus sativus L.*) 5 days after planting.

DISCUSSION

It is clear from the results that allelopathic effects of aqueous extracts of different parts of (*Chenopodium album L.*) were occurred on seed germination and seedling development of Radish (*Raphanus sativus L.*). According to ANOVA test the results showed that germination percentage, germination index (GI), speed/rate of

germination (SG/RG), seedlings vigor index (SVI), root length, hypocotyle length, fresh weight and dry weight were significantly affected. Analysis of data suggests that the allelopathic compounds of *C. album L.* had significant effect on seed germination and seedling development of Radish. These results similar to the results obtain by other workers (e.g. Bagheri *et.al*; 2013; Abdul

Majeed, 2012). The results showed stimulatory effects (at lower 1% concentration) and inhibitory effects (at higher concentrations 5% and 10%) on all growth parameters. The highest effect recorded for leaves and flowers extracts. These effects may be due to the presence of many allelochemicals such as alkaloids, aldehyde, flavonoids and Saponins (Rezaei *et.al*, 2008). The data showed that the effect of extracts was plant part and concentration dependent. Thus, using the right part and right concentration is an important factor when these results will suggested to use in weed control. In addition, further and more investigations most take in account using other plant receptors, and also the auto toxicity of *C. album* L. its self.

REFERENCES

1. **Abdul-Baki, A.A. and Anderson, J.D. (1973).** Vigor determination in soybean by multiple criteria. *Crop Science*.13:630-637.
2. **Abdul-Majeed., Zubeda C and Zahir M. (2012).** Allelopathic assessment of fresh aqueous extracts of *Chenopodium album* L. For growth and yield of wheat (*Triticum Aestivum* L.). *Pak. J.Bot.*, 44(1): 165-167.
3. **Bagheri, A., Rezaei M., Eivazi A.R.(2013).** Allelopathic properties of *Chenopodium Album* on seedling related traits of sorghum cultivars. *International. J.of Agron and Plant Prod. Vol.*, 4(S), 3743-3747.
4. **Ferguson, J.J and Rathinasabapathi B. (2009)** Allelopathy: How plants suppress other plants. *Horticultural Sciences Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.*
5. **Khan, M., Marwat K.B., Hassan G and Hussain Z. (2005).** Bioherbicidal effects of tree extracts on seed germination and growth of crops and weeds. *Pak.J. Weed Sci. Res.* 11(3-4): 89-94.
6. **Nesrine, S., Salama M., EL-Darier and Halilat M. EL-Taher. (2011)** Allelopathic effect of some medicinal plants on germination of two dominant weeds in Algeria. *Advances in*
7. **Patil, Chandrashekhar K. (2007)** Allelopathic effect of botanicals on major weeds of onion (*Allium cepa* L.) Msc.thesis. University of Agriculture Sciences Department of Crop Physiology, Dharwad, India.
8. **Rezaie, F., Yarnia M., Mirshekari B. (2008).** Allopathic effects of *Chenopodium album*, *Amaranthus retroflexus* and *Cinodon dactylon* on germination and growth of rapeseed. *Modern science of sustainable agriculture.* 4:41-55.(in Persian).
9. **Rice, E.L. (1984)** Allelopathy, 2nd ed., Academic Press, Orlando.
10. **Rice, E.L. (1974)** Allelopathy. New York: Academic Press.
11. **Rizvi, S.J.H., Haque H., Singh V.K. and Rizvi V. (1992)** A discipline called allelopathy. In: S.J.H. Rizvi, & V. Rizvi (eds.). *Allelopathy: Basic and applied aspects.* Chapman & Hall publishers. 1-8.
12. **Scott, S.J., Jones R.A. and Williams W.A. (1984)** Review of data analysis methods for seed germination. *Crop Science*, 24: 1192-1199.
13. **Weston, L.A. (2005).** History and current trends in the use of allelopathy for weed management *Hort. Technol.* 13: 529-534.
14. **Weston, L.A. (1996).** Utilization of allelopathy for weed management in agroecosystems, *Agron. J.* 88, 860-866.