Allelopathic Effect of Bindweed (*Convolvulus arvensis* L.) on the Germination and Growth of *Zea mays* L.

Sana Naseer[*], Salman Khan[†], Saman[‡], Aiman Sharif[§], Khalil Ur Rahman[**]

Abstract

Convolvulus arvensis L., has both competitive and invasive properties that can directly or indirectly damage the other plants by production of carbon-based chemicals known as allelochemicals. The goal of the current investigation is to find the allelopathic capability of Convolvulus arvensis L. against Zea mays L. Leaves of Convolvulus arvensis L., 5g, 10g, 15g of both fresh and dry are immersed in distilled water (100 ml) for 24, 48, and 72 hours. For examination of growth factors such as radicle and plumule length, germination potential, and germination percentage. Zea mays seeds are taken and consequently treated with the extract of Convolvulus arvensis. The findings showed that the germination potential and germination percentage are affected more by dry leaves and fresh leaves extract respectively at 48hrs soaking duration and both showed 64% comparable to control. The length of the radicle is affected more by soaking duration of 48hrs dry leaves extract of C. arvensis L., and the highest decrease recorded is 188.37%. The plumule length is affected more by a soaking duration of 48 hours dry leaves extract of C. arvensis L., and the maximum reduction recorded is 231.8%. The fresh weight of seedlings is impacted more by 48hrs soaking duration of fresh leaves extract of C. arvensis L., and the maximum decrease recorded is 47.6%. The dry weight of seedling is affected more by 72hrs the soaking duration of fresh leaves extract of C. arvensis L., and the maximum decrease recorded is 100.93%. The findings indicate that Convolvulus arvensis L., both fresh and dry leaf extract, strongly impacted Zea mays growth and germination percentage which may indicate that allelochemicals are present in the plants.

Keywords**:** Bioactive Compounds; *Zea mays L.*; *Convolvulus arvensis L.*

Introduction

The species dispersion and abundance to the success of invasive plants in plant communities are relevant, in consideration of the allelopathic collaboration as one of the noteworthy factors (Ain et al.,

[*]Department of Botany, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan, sananaseer542@gmail.com

[†]Corresponding Author: Department of Biotechnology, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan, salmankhanmrd48@gmail.com

[‡]Department of Biotechnology, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan, samanmahab6@gmail.com

[§]Department of Botany, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan, aimansharif191@gmail.com

[**]Department of Biotechnology, Abdul Wali Khan University Mardan, Mardan 23200, Pakistan, khalilurrahman@awkum.edu.pk

2023; Cheng & Cheng, 2015). A plant may interfere with the growth and establishment of neighboring plants through competition, allelopathy, or both (Xu et al., 2023). The interconnection between the invasive and native species results from the prosperous invasion by a species. Non-native plants occupy new habitats successfully due to a mechanism of allelopathy (Wang et al., 2015). Currently, allelopathy is considered an important factor for the composition and dynamics of communities, viewed as the aggressive advantage of exotic plants in their introduced ranges(Sotomayor & Lortie, 2015). Allelopathy is the mechanism of intervention in which plant materials that are living or dead, release chemical substances, called allelochemicals, which inhibit or stimulate the related plant growth (Mushtaq et al., 2020; Bojović & Jakovljević, 2015). Allelochemicals are found almost in all plant organs (Tanveer et al., 2012). The collective action of groups of allelochemicals interferes with numerous physiological processes, hence changing the patterns of plant development that ultimately result in allelopathic inhibitory effects. Allelochemicals can have effects on different processes, such as respiration, photosynthesis, enzyme activity, availability, cell elongation and division, and the construction and permeability of cell walls and membranes(Gatti et al., 2010). Progressive weed control methods based on ecological principles are needed very much in modern agriculture as the growth of such weeds showing resistance to synthetic pesticides causes enormous losses in economy (Kostina-Bednarz et al., 2023).

Globally, *Zea mays* L. is a significant and valuable crop widely grown in different countries. In Pakistan, Punjab and Khyber Pakhtunkhwa contribute 98% of maize production which covers 1.11 Million Hectares area and annually 4.92 Million Tons of maize are annually produced(Ahmed et al., 2018). Globally, the most frequently cultivated cereal crop is highly valuable in terms of nutrition (Dowswell, 2019). The maize crop contains different vitamins, such as (Vitamin K, E, C, and B-complex) (Kumar & Jhariya, 2013). Through the wet-crushing method, 35-36% oil is obtained from corn germ (Ni et al., 2016). Medicinally maize crop is an important crop enriched in nutrients. Decoction methods used to treat bladder problems, vomiting, and nausea obtained from leaves, roots, and silk. (Kumar & Jhariya, 2013).

Bindweed, or *C. arvensis*, is a native herbaceous perennial of Eurasia that climbs. Due to unintentional introductions, this species has extended to most regions of the world where it has contaminated horticultural and agricultural seeds. *C. arvensis* yields up to 500 seeds per plant and a long-lived root system. This species can spread quickly in areas where it faces competition for nutrients, moisture, light, and space from horticultural and agricultural crops as well as native plants. As a result,

nearby plants might suffocate one another, which would lower crop productivity and biodiversity. Controlling this species is challenging because small rhizome fragments can produce new shoots and seeds of this species can stay in the soil bank for up to 20 years(DiTomaso et al., 2013).

C. arvensis is a perennial herbaceous plant with deeply rooted roots. On the deep root system, adventitious buds give rise to shoots at nearly any depth, even as low as 1 m. The stems twine to trail or ascend above the earth. It is a somewhat slender vine extending about 1.5 meters in length and twining anticlockwise. Leaves are petiolate, alternate, lanceolate to ovate or narrow-oblong pointed at the apex, and usually hastate-sagittate at the base, having smooth or slightly hairy surfaces. Flowers are usually axillary, solitary, or in cymes.

Materials and Methods

Sample Collection and Extract Preparation

The allelopathic capability of *Convolvulus arvensis* L. is investigated in the current experiment. Healthy leaves of *Convolvulus arvensis* are collected from Takht Bhai, Mardan Region. Leaves extract of *Convolvulus arvensis* is tested on germination potential and percentage, radical, and plumule length of *Zea mays* L. Extracts are prepared from fresh and dry leaves using different soaking periods (24, 48, and 72 hrs). Healthy fresh leaves are chopped in the chopper while the remaining leaves are dried at room temperature. After 6 days when the leaves get dried completely and are ready to be powdered, the dry leaves are powdered in a grinder. In 100 ml of distilled water, the extracts of both fresh and dry leaves are made. The filtration of extracts is performed by using Whatman No.1 filter paper after 24 hours (5g, 10g, 15g) of preparation. The extract is stored in the refrigerator of the lab at the Department of Botany, Islamia College University Peshawar, and is used as a stock solution (Baličević et al., 2014; Rahman et al., 2023).

Seed Collection, Sterilization, and Viability Test

Zea Mays L. is obtained from the cereal crop research institute Pirsabak Nowshera. Before use, the *Zea mays* seeds underwent a viability test. A viability test is utilized for this purpose. In petri dishes, five seeds are placed with two filter paper layers that had been dipped in distilled water. The temperature of these petri plates is set to 26ºC in the incubator (Rahman et al., 2023).

Laboratory Work

Three replicate petri dishes (A, B, C) have double-layer filter paper for each treatment. Three replicates of each treatment i.e., 5g/24hrs, 5g/48hrs, 5g/72hrs, 10g/24hrs, 10g/48hrs, 10g/72hrs, 15g/24hrs, 15g/48hrs and 72g/48hrs are prepared for each fresh and dry leaves extract. Three sterile petri dishes are used in a control series that ran concurrently with the experiment. Each *Zea Mays* petri dish in the test and control series had five seeds spaced equally apart. Petri dishes are stored in a controlled environment of 26 ºC in an incubator.

Germination Potential

The germination potential is then determined using the expression below:

Germination Potential = germinated seeds number within 3 days/test seeds amount x 100) (Gharoobi et al., 2012).

Germination Percentage

The germination percentage is determined using the expression below:

Germination Percentage = germinated seeds amount within 7 days/test seeds x 100(Sher et al., 2023).

Length of Radical and Plumule

The radicle and plumule lengths of seeds germinated are noted through the use of a ruler in cm. Mean values are taken based on recorded data(Menges, 1991).

Statistical Investigation

The experiment is arranged with 3 replications. The analysis of data is done by using One way ANOVA followed by the Least significant difference at P= 0.05 through IBM SPSS statistics software 20.

Results

Fresh Leaves Extract

Significance of Seed Germination Capacity Under 24 hours Soaking Duration of Extract

Figure 1 (a) illustrates the capacity of *Zea mays* to germinate under the influence of a 24-hour soaked extract of *Convolvulus arvensis*. The graph shows that the capacity of germination decreased significantly in 5g extract (T1) while lower reduction is noted in 15g extract of fresh leaves (T3) as compared to controlled plants.

Significance of Seed Germination Capacity Under 48 Hours Soaking Duration of Extract

Figure 1 (b) illustrates the capacity of *Zea mays* to germinate under the influence of a 48-hour soaked extract of *Convolvulus arvensis*. The graph shows that the capacity of germination decreased significantly (20%) in 5g extract (T1) while a lower reduction of 10% is noted in 10g extract of fresh leaves (T2) as compared to controlled plants.

Significance of Seed Germination Capacity Under 72 Hours Soaking Duration of Extract

Figure 1 (c) illustrates the capacity of *Zea mays* to germinate under the influence of 72 hours of soaked extract of *Convolvulus arvensis*. The graph shows that the capacity of germination decreased significantly (20%) in 15g extract (T3) while a lower reduction of 6% is noted in 5g extract of fresh leaves (T1) as compared to controlled plants.

Significance of Seed Germination Percentage Under 24 Hours Soaking Duration of Extract

Figure 1 (d) illustrates the range germination percentage of *Zea mays* under the influence of a 24-hour soaked extract of *Convolvulus arvensis*. The graph shows that germination percentage majorly decreased (25%) in 5g fresh leaves extract (T1) while a lower reduction of 16% is noted in 15g extract of fresh leaves (T3) as compared to controlled plants.

Significance of Seed Germination Percentage Under 48 Hours Soaking Duration of Extract

Figure 1 (e) illustrates the range germination percentage of *Zea mays* under the influence of a 48-hour soaked extract of *Convolvulus arvensis*. The graph shows that germination percentage considerably decreased (30%) in 15g extract of fresh leaves (T3) while a lower reduction of 20% is noted in 5g extract of leaves fresh (T1) as compared to controlled plants.

Significance of Seed Germination Percentage Under 72 Hours Soaking Duration of Extract

Figure 1 (f) illustrates the range germination percentage of *Zea Mays* under the influence of 72 hours of soaked extract of *Convolvulus arvensis*. The graph shows that germination percentage greatly decreased (22%) in 15g fresh leaves extract (T3) while the least decrease of 5% is noted in (T1) which shows 5g fresh leaves extract as compared to controlled plants.

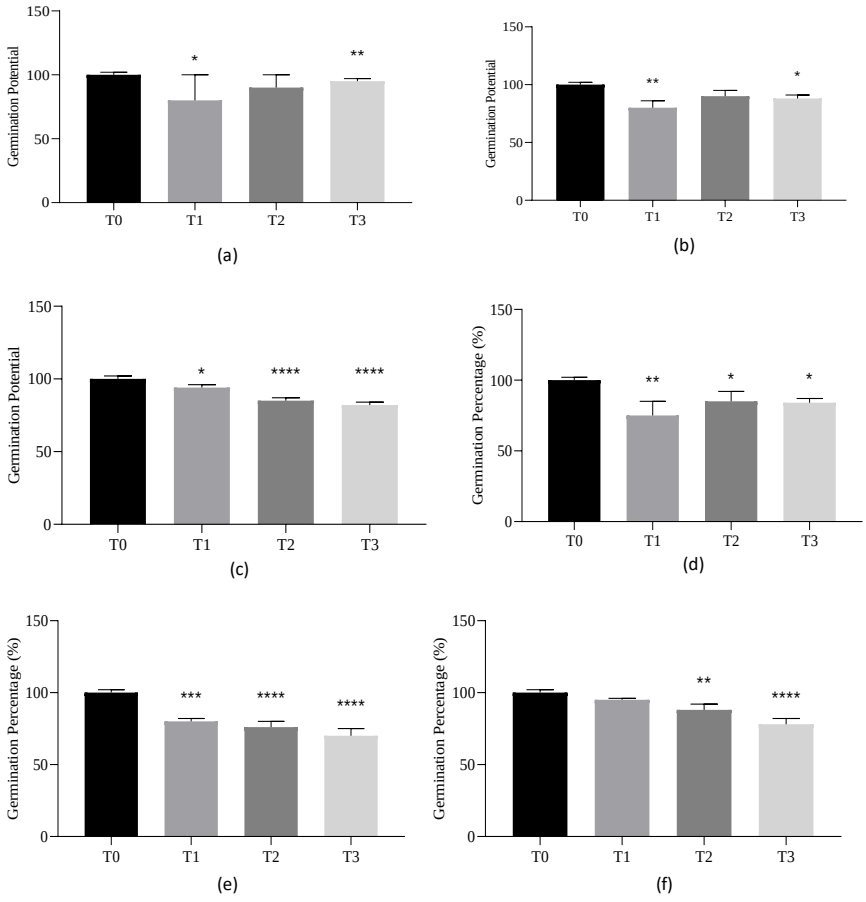

Figure 1: Effect of extract on germination capacity (A represents 24 hours, B represents 48 hours, C represents 72 hours) Effect of extract on Germination percentage (D represents 24 hours, E represents 48 hours, F represents 72 hours) T0 displays controlled group, T1 displays 5g extract, T2 displays 10g extract, T3 displays 15g of extract. Bars with no asterisks shows non-significancy, **= shows significancy at P ≤ 0.01, *= shows significancy at P ≤ 0.05.

Response of Radicle Length to 24 Hours Soaking Duration of Extract

Figure 2 (a) illustrates the impact of extract soaked for 24 hours on the length of *Zea mays* radicle. The graph shows that radicle length is majorly inhibited at 25.4% in 5g extract of fresh leaves (T1) while lower inhibition of 6.25% is found in 10g extract of fresh leaves (T2) as compared to controlled groups.

Response of Radicle Length to 48 Hours Soaking Period of Extract

The Figure 2 (b) illustrate the impact of extract soaked for 48 hours on the length of *Zea mays* radicle. The graph shows that radicle length majorly inhibited at 5.35% in 15g extract of fresh leaves (T3) while lower inhibition of 3.12% is found in 10g extract of fresh leaves (T2) as compared to controlled groups.

Response of Radicle Length to 72 Hours Soaking Period of Extract

Figure 2 (c) illustrates the impact of extract soaked for 72 hours on the length of *Zea mays* radicle. The graph shows that radicle length is significantly inhibited at 6.69% in 15g extract of fresh leaves (T3) while no detrimental effects are found in 5g and 10g extract of fresh leaves as compared to controlled groups.

Response of Plumule Length to 24 Hours Soaking Period of Extract

Figure 2 (d) illustrates the impact of extract soaked for 24 hours on the length of *Zea mays* plumule. The graph shows that plumule length displayed the highest reduction at 23.86% in 5g extract of fresh leaves (T1) while a decreased reduction of 15.90% is found in 10g extract of fresh leaves (T2) as compared to controlled groups.

Response of Plumule Length to 48 Hours Soaking Period of Extract

Figure 2 (e) illustrates the impact of extract soaked for 48 hours on the length of *Zea mays* plumule. The graph shows that plumule length indicates the highest reduction at 29.54% in 15g extract of fresh leaves (T3) while a decreased reduction of 17.04% is found in 10g extract of fresh leaves (T2) as compared to controlled groups.

Response of Plumule Length to 72 Hours Soaking Period of Extract

Figure 2 (f) illustrates the impact of extract soaked for 72 hours on the length of *Zea mays* plumule. The graph shows that plumule length highest reduction at 26.13% in the 15g extract of fresh leaves (T3) while a decreased reduction of 15.90% is found in the 10g extract of fresh leaves (T2) as compared to controlled groups.

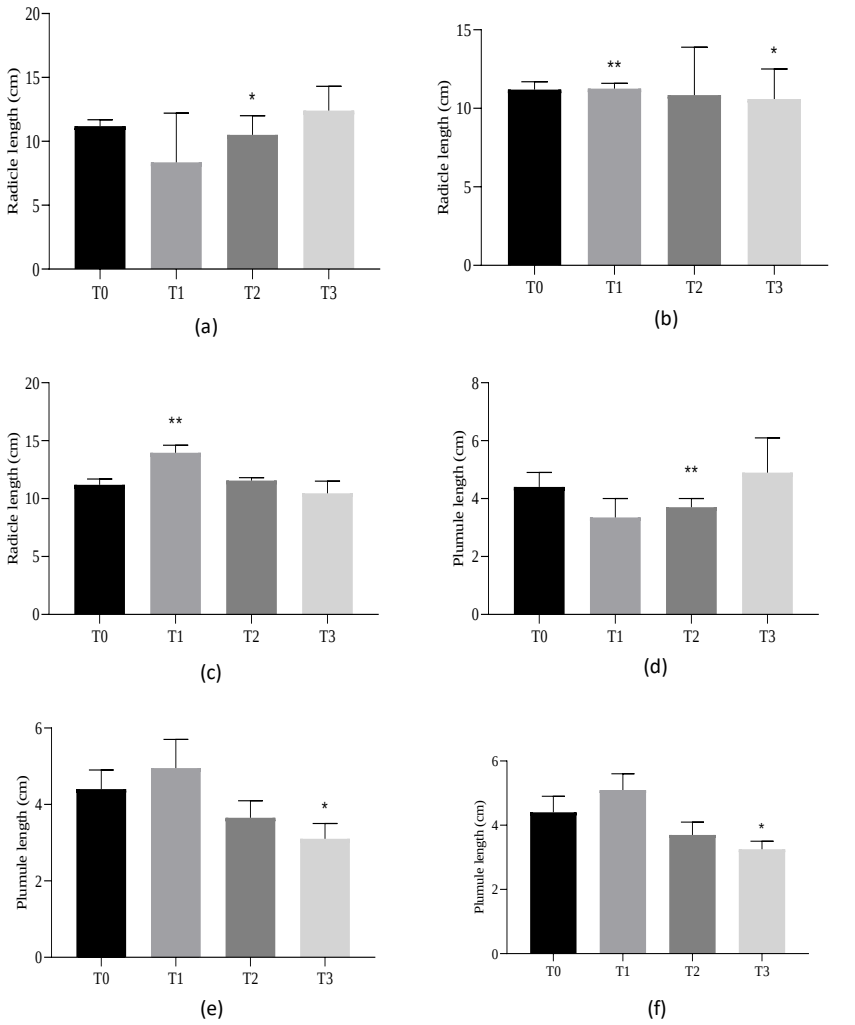

Figure 2 Response of radicle length to extract (A represents 24 hours, B represents 48 hours, C represents 72 hours). Response of plumule length to extract (D represents 24 hours, E represents 48 hours, F represents 72 hours) T0 displays the controlled group, T1 displays 5g extract, T2 displays 10g extract, T3 displays 15g of extract. Bars with no asterisks show non-significance, **= shows significance at $P \leq 0.01$, and *= shows significance at $P \leq 0.05$.

Influence of 24 Hours Soaked Extract on Fresh Weight of Zea Mays

Graph 3 (a) illustrates the effect of 24 24-hour soaked extract of *Convolvulus arvensis* on the fresh weight of seedlings *Zea mays*. The results show the highest decrease in the fresh weight of *Zea mays* under

15g extract of fresh leaves at 8.79% while 5g extract of fresh leaves showed a 0.79% decrease in the fresh weight of *Zea mays* seedlings.

Influence of 48 Hours Soaked Extract on Fresh Weight of Zea Mays

Graph 3 (b) illustrates the effect of 48 hours of soaked extract of *Convolvulus arvensis* on the fresh weight of seedlings *Zea mays*. The results show the highest reduction in fresh weight of *Zea mays* under 15g extract of fresh leaves at 12.69% while 5g extract of fresh leaves showed a 7.93% decrease in fresh weight of *Zea mays* seedlings as compared to controlled groups.

Influence of 72 Hours Soaked Extract on Fresh Weight of Zea Mays

Graph 3 (c) illustrates the effect of 72 hours of soaked extract of *Convolvulus arvensis* on the fresh weight of seedlings *Zea mays*. The results show a maximum decrease in the fresh weight of *Zea mays* under 15g extract of fresh leaves at 7.93% while 10g extract of fresh leaves showed a 3.17% decrease in the fresh weight of *Zea mays* seedlings as compared to controlled groups.

Influence of 24 Hours Soaked Extract on Dry Weight of Zea Mays

Graph 3 (d) illustrates the effect of a 24-hour soaked extract of *Convolvulus arvensis* on the dry weight of seedlings *Zea mays*. The results show the highest decrease in dry weight of *Zea mays* under 15g extract of fresh leaves at 35.84% while 10g extract of fresh leaves showed a 10.37% decrease in dry weight of *Zea mays* seedlings as comparable to controlled groups.

Influence of 48 Hours Soaked Extract on Dry Weight of Zea Mays

Graph 3 (e) illustrates the effect of 48 hours of soaked extract of *Convolvulus arvensis* on the dry weight of seedlings *Zea mays*. The results show the highest reduction in dry weight of *Zea mays* under 15g extract of fresh leaves at 33.01% while 5g extract of fresh leaves showed a 26.41% decrease in dry weight of *Zea mays* seedlings as compared to controlled groups.

Influence of 72 Hours Soaked Extract on Dry Weight of Zea Mays

Graph 3 (f) illustrates the effect of 72 hours of soaked extract of *Convolvulus arvensis* on the dry weight of seedlings of *Zea mays*. The results show a maximum decrease in the dry weight of *Zea mays* under 15g extract of fresh leaves at 55.66% while 5g extract of fresh leaves showed 17.92% decrease in dry weight of *Zea mays* seedlings as compared to controlled groups.

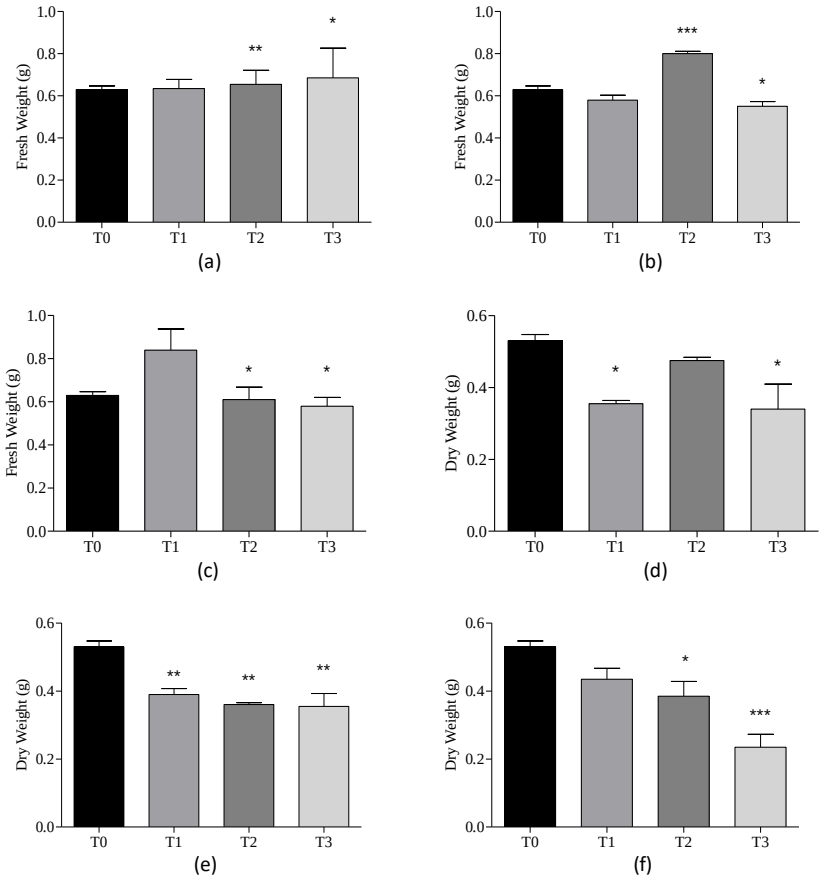

Figure 3: Influence of extract of Convolvulus arvensis* (A represents 24 hours, B represents 48 hours, C represents 72 hours) *on fresh weight of seedlings of Zea mays* (D represents 24 hours, E represents 48 hours, F represents 72 hours) *.T0 displays Control, T1 displays 5g of extract, T2 displays 10g of extract, T3 displays 15g of extract. Bars with no asterisks show non-significance, **= shows significance at P ≤ 0.01, and *= shows significance at P ≤ 0.05.

Extract of Dry Leaves

Significance of Seed Germination Capacity Under 24 Hours Soaking Duration of Extract

Figure 4 (a) illustrates the capacity of *Zea mays* to germinate under the influence of a 24-hour soaked extract of *Convolvulus arvensis*. The graph shows that the capacity of germination decreased significantly in

15g extract (T3) at 8% while a lower reduction (3%) is noted in 10g extract of dry leaves (T2) as compared to controlled plants.

Significance of Seed Germination Capacity Under 48 Hours Soaking Duration of Extract

Figure 4 (b) illustrates the capacity of *Zea mays* to germinate under the influence of 48 48-hour soaked extract of *Convolvulus arvensis*. The graph shows that the capacity of germination decreased significantly (40%) in 10g extract (T2) while a lower reduction of 4% is noted in 5g extract of dry leaves (T1) as compared to controlled plants.

Significance of Seed Germination Capacity Under 72 Hours Soaking Duration of Extract

Figure 4 (c) illustrates the capacity of *Zea mays* to germinate under the influence of 72 hours of soaked extract of *Convolvulus arvensis*. The graph shows that the capacity of germination decreased significantly (9%) in 5g extract (T1) while a lower reduction of 2% is noted in 15g extract of dry leaves (T3) as compared to controlled plants.

Significance of Seed Germination Percentage Under 24 Hours Soaking Duration of Extract

Figure 4 (d) illustrates the range germination percentage of *Zea mays* under the influence of a 24-hour soaked extract of *Convolvulus arvensis*. The graph shows that germination percentage majorly decreased (20%) in 15g dry leaves extract (T3) while a lower reduction of 5% is noted in 5g extract of dry leaves (T1) as compared to controlled plants.

Significance of Seed Germination Percentage Under 48 Hours Soaking Duration of Extract

Figure 4 (e) illustrates the range germination percentage of *Zea mays* under the influence of 48-hour soaked extract of *Convolvulus arvensis*. The graph shows that germination percentage majorly decreased (40%) in 10g dry leaves extract (T2) while a lower reduction of 1% is noted in 5g extract of dry leaves (T1) as compared to controlled plants.

Significance of Seed Germination Percentage Under 72 Hours Soaking Duration of Extract

Figure 4 (f) illustrates the range germination percentage of *Zea mays* under the influence of 72 hours of soaked extract of *Convolvulus arvensis*. The graph shows that germination percentage majorly decreased (30%) in 15g dry leaves extract (T3) while a lower reduction of 9% is noted in 10g extract of dry leaves (T2) as compared to controlled plants.

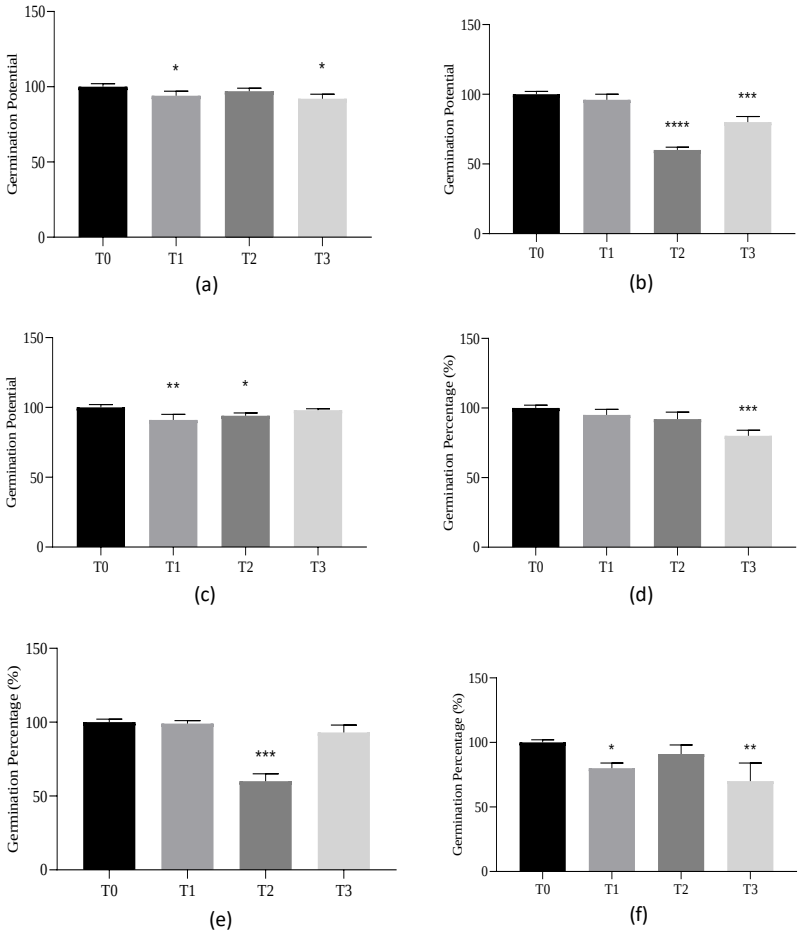

Figure 4: Influence of extract of Convolvulus arvensis (24 hours soaking duration) on germination potential of seedlings of Zea mays. T0 shows Control, T1 shows 5g of dry leaves extract, T2 shows 10g of dry leaves extract, and T3 shows 15g of dry leaves extract. Bars with no asterisks show non-significancy, **= shows significance at P ≤ 0.01, and *= shows significance at P ≤ 0.05.

Response of Radicle Length to 24 Hours Soaking Period of Extract

Figure 5 (a) illustrates the impact of extract soaked for 24 hours on the length of *Zea mays* radicle. The graph shows that radicle length is majorly inhibited at 38.83% in 10g extract of dry leaves (T2) while lower inhibition of 11.60% is found in 15g extract of dry leaves (T3) as compared to controlled groups.

Response of Radicle Length to 48 Hours Soaking Period of Extract

Figure 5 (b) illustrates the impact of extract soaked for 48 hours on the length of *Zea mays* radicle. The graph shows that radicle length is majorly inhibited at 72.76% in 10g extract of dry leaves (T2) while lower inhibition of 51.33% is found in 5g extract of dry leaves (T1) as compared to controlled groups.

Response of Radicle Length to 72 Hours Soaking Period of Extract

Figure 5 (c) illustrates the impact of extract soaked for 72 hours on the length of *Zea mays* radicle. The graph shows that radicle length is majorly inhibited at 62.94% in 15g extract of dry leaves (T3) while lower inhibition of 19.19% is found in 5g extract of dry leaves (T1) as compared to controlled groups.

Response of Plumule Length to 24 Hours Soaking Period of Extract

Figure 5 (d) illustrates the impact of extract soaked for 24 hours on the length of *Zea mays* plumule. The graph shows that plumule length displayed the highest reduction at 69.31% in 15g extract of dry leaves (T3) while a decreased reduction of 65.90% is found in 10g extract of dry leaves (T2) as compared to controlled groups.

Response of Plumule Length to 48 Hours Soaking Period of Extract

Figure 5 (e) illustrates the impact of extract soaked for 48 hours on the length of *Zea mays* plumule. The graph shows that plumule length showed the highest reduction at 90.90% in 15g extract of dry leaves (T3) while a decreased reduction of 47.72% is found in 5g extract of dry leaves (T1) as compared to controlled groups.

Response of Plumule Length to 72 Hours Soaking Period of Extract

Figure 5 (f) illustrates the impact of extract soaked for 72 hours on the length of *Zea mays* plumule. The graph shows that plumule length exhibited the highest reduction at 94.31% in 15g extract of dry leaves (T3) while a decreased reduction of 63.63% is found in 5g extract of dry leaves (T1) as compared to controlled groups.

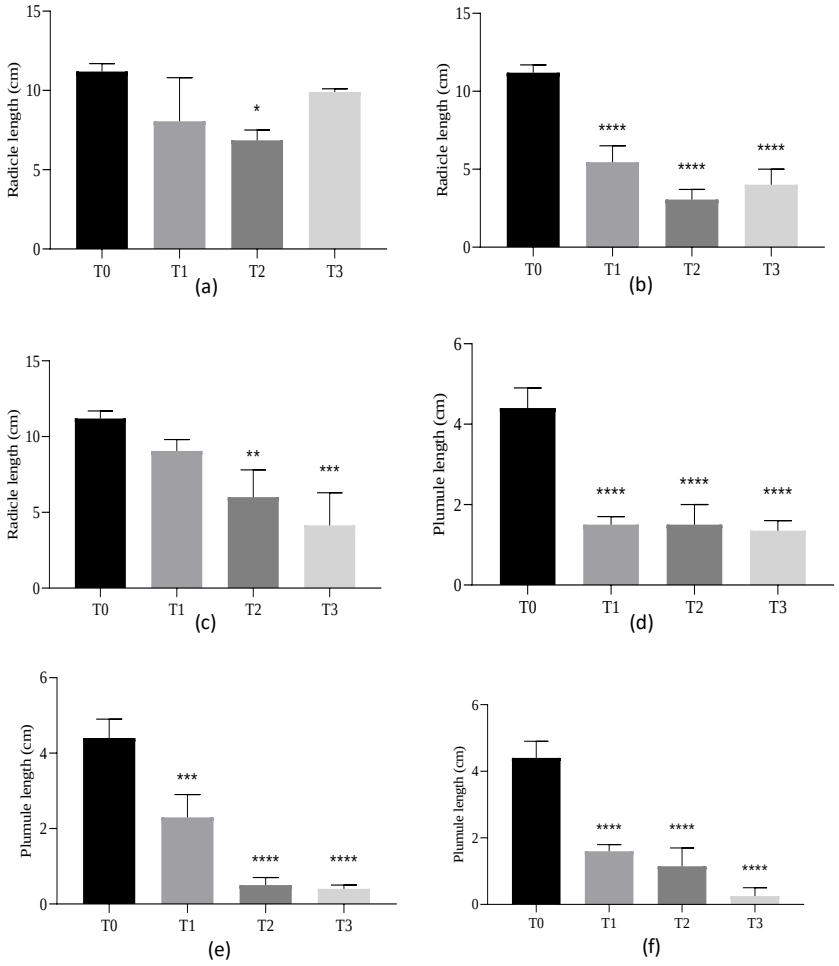

Figure 5: Influence of extract of Convolvulus arvensis (A represents 24 hours, B represents 48 hours, C represents 72 hours) on length of the radicle of Zea mays. D represents 24 hours, E represents 48 hours, F represents 72 hours) on the plumule length of Zea mays. T0 shows Control, T1 shows 5g of dry leaves extract, T2 shows 10g of dry leaves extract, and T3 shows 15g of dry leaves extract. Bars with no asterisks = non-significant, * shows significance at P ≤ 0.05.

Influence of 24 Hours Soaked Extract on Fresh Weight of Zea Mays

Graph 6 (a) illustrates the effect of 24 hours of soaked extract of *Convolvulus arvensis* on the fresh weight of seedlings *Zea mays*. The results show a decrease in the fresh weight of *Zea mays* under a 15g extract of dry leaves at 10.09% while a 5g extract of dry leaves showed 11% and

a 10g extract of dry leaves showed a 22.93% decrease in fresh weight of *Zea mays* seedlings as compared to controlled groups.

Influence of 48 Hours Soaked Extract on Fresh Weight of Zea Mays

The graph 6 (b) illustrates the effect of 48 hours soaked extract of *Convolvulus arvensis* on the fresh weight of seedlings *Zea mays*. The results show the highest decrease in fresh weight of *Zea mays* under 5g extract of dry leaves at 19.26% while 10g extract of dry leaves showed a 10.09% decrease in fresh weight of *Zea mays* seedlings comparable to controlled groups.

Influence of 72 Hours Soaked Extract on Fresh Weight of Zea Mays

Graph 6 (c) illustrates the effect of 72 hours of soaked extract of *Convolvulus arvensis* on the fresh weight of seedlings *Zea mays*. The results show a significant decrease in the fresh weight of *Zea mays* under 10g extract of dry leaves at 1.83% while 15g extract of dry leaves showed no change in the fresh weight of *Zea mays* seedlings.

Influence of 24 Hours Soaked Extract on Dry Weight of Zea Mays

Graph 6 (d) illustrates the effect of a 24-hour soaked extract of *Convolvulus arvensis* on the dry weight of seedlings Zea mays. The results show the highest decrease in the dry weight of *Zea mays* under 15g extract of dry leaves at 35.77% while 10g extract of dry leaves showed a 15.59% decrease in the dry weight of *Zea mays* seedlings as comparable to controlled groups.

Influence of 48 Hours Soaked Extract on Dry Weight of Zea Mays

Graph 6 (e) illustrates the effect of 48 hours of soaked extract of *Convolvulus arvensis* on the dry weight of seedlings *Zea mays*. The results show the highest decrease in dry weight of *Zea mays* under 15g extract of dry leaves at 35.77% while 10g extract of dry leaves showed a 23.84% decrease in dry weight of *Zea mays* seedlings as comparable to controlled groups.

Influence of 72 Hours Soaked Extract on Dry Weight of Zea Mays

Graph 6 (f) illustrates the effect of 72 hours of soaked extract of *Convolvulus arvensis* on the dry weight of seedlings *Zea mays*. The results show the highest decrease in the dry weight of *Zea mays* under 15g extract of dry leaves at 50.45% while both 10g and 5g extract of dry leaves showed a 21.10% decrease in dry weight of *Zea mays* seedlings as comparable to controlled groups.

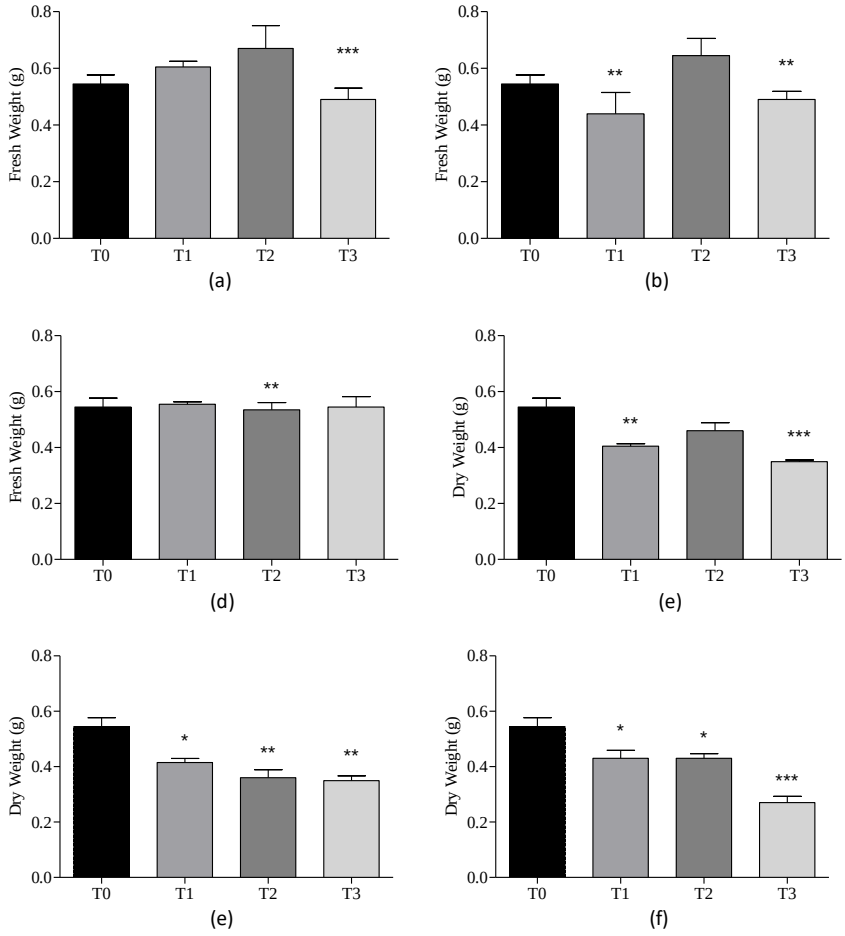

Figure 6: Impact of extract of Convolvulus arvensis (A represents 24 hours, B represents 48 hours, C represents 72 hours) on fresh weight of Zea mays. (D represents 24 hours, E represents 48 hours, F represents 72 hours) on dry weight of Zea mays. T0 shows Control, T1 shows 5g of dry leaves extract, T2 shows 10g of dry leaves extract, T3 shows 15g of dry leaves extract. Bars with no asterisks = non-significant, ***Significance at P ≤ 0.0001.

Discussion

In the bioassays, the allelopathic capability of *Convolvulus arvensis* L. extracts is investigated on the *Zea mays* L. plant's ability to germinate and grow. These results suggested that the extracts contained certain inhibitory compounds depending on different concentrations of the extracts, could prevent germination and reduce plant seedling growth. The collected results demonstrate that there is a substantial change between the

treated and control samples concerning germination potential, germination percentage, length of radicle, length of plumule, and both the fresh and dry weights of *Zea mays* L. In comparison to controlled groups, a drop in the germination potential and percentage is noted. Our findings are aligned with the results of Fateh et al., (2012) study on allelopathic effects of bindweed on basil and millet. Based on the findings, they deduced that the percentage of germination declined for both millet and basil seeds as extract concentrations increased. *Convolvulus arvensis* L. fresh and dry leaf extract suppressed *Zea mays* L. radicle length relative to control. The obtained results are consistent with the results of Golubinova and Ilieva (2014), who investigated the allelopathic impacts of *Convolvulus arvensis* L., *Sorghum halepense* (L.) *Pers*., and *Cirsium arvense Scop* extracts on the growth of early seedlings of certain leguminous crops. Their findings indicate that weed extracts significantly reduced the ratio of germination, the length and weight (cm and g) of the tested species, as well as the seed vigor index (SVI1 and SVI2).

When compared to the control, the plumule length of seeds treated with *Convolvulus arvensis* L. fresh and dried leaf extract is shorter. Our results collaborated with the results of Baličević et al. (2014), who investigated the inhibitory effects of water extracts of bindweed on early growth and germination of maize. According to their findings, depending on the plant part, concentration, and hybridization of maize, field bindweed water extracts can have stimulatory as well as impacts of inhibition on properties of germination and growth.

Zea mays L. seedlings' fresh and dry weights are noticeably influenced and decreased in comparison to the control group. The outcomes are comparable to those of Shahrokhi et al. (2011), who investigated the effects of varying applications of bindweed (*Convolvulus arvensis*) water extract on the Abidar barley (*Hordeum vulgare*) early-growth cultivar in a greenhouse. Based on their findings, they deduced that the bindweed's various organ extracts had similar toxic impacts on both the fresh and dry weight as well as on the germination rate of barley seedlings.

Conclusion

According to the study's findings, *Convolvulus arvensis* L. has certain allelochemicals that may prevent *Zea mays* seedling germination and growth. Additionally, the study showed that fresh leaf extract had less inhibitory effect on *Zea mays* L. than dry leaf extract. It is found that plumule length is more impacted than radicle length. Additionally, the dependence of the inhibitory action on concentration and soaking time is examined. In comparison to the control, the adverse impact on the test

species increased from 5g to 15g treatment. Based on the above observations and results, the findings suggested that the growth of radicle and plumule along with germination capacity and percentage in *Zea mays* is significantly decreased by the allelopathic ability of *Convolvulus arvensis* L. According to available data, allelochemicals that inhibit *Zea mays* L. germination and growth may be found in the leaf extract of *Convolvulus arvensis* L.

References

Ahmed, I., ur Rahman, M. H., Ahmed, S., Hussain, J., Ullah, A., & Judge, J. (2018). Assessing the impact of climate variability on maize using simulation modeling under semi-arid environment of Punjab, Pakistan. *Environmental Science and Pollution Research*, *25*, 28413-28430.

Ain, Q., Mushtaq, W., Shadab, M., Siddiqui, M. J. P., & Plants, M. B. o. (2023). Allelopathy: an alternative tool for sustainable agriculture. *29*(4), 495-511.

Baličević, R., Ravlić, M., Knežević, M., & Serezlija, I. (2014). Allelopathic effect of field bindweed (Convolvulus arvensis L.) water extracts on germination and initial growth of maize.

Bojović, B. M., & Jakovljević, D. Z. J. K. J. o. S. (2015). Allelopathic relations of selected cereal and vegetable species during seed germination and seedling growth. (37), 135-142.

Cheng, F., & Cheng, Z. J. F. i. p. s. (2015). Research progress on the use of plant allelopathy in agriculture and the physiological and ecological mechanisms of allelopathy. *6*, 1020.

DiTomaso, J. M., Kyser, G., Oneto, S., Wilson, R., Orloff, S., Anderson, L.,…Information Center, U. o. C. (2013). Weed control in natural areas in the western United States. *544*.

Dowswell, C. (2019). *Maize in the third world*. CRC press.

Gatti, A. B., Ferreira, A. G., Arduin, M., & Perez, S. C. G. d. A. J. A. B. B. (2010). Allelopathic effects of aqueous extracts of Artistolochia esperanzae O. Kuntze on development of Sesamum indicum L. seedlings. *24*, 454-461.

Gharoobi, B., Ghorbani, M., & GHASEMI, N. M. (2012). Effects of different levels of osmotic potential on germination percentage and germination rate of barley, corn and canola.

Kumar, D., & Jhariya, A. N. (2013). Nutritional, medicinal and economical importance of corn: A mini review. *Res J Pharm Sci*, *2319*, 555X.

Menges, E. S. J. C. b. (1991). Seed germination percentage increases with population size in a fragmented prairie species. *5*(2), 158-164.

Mushtaq, W., Siddiqui, M. B., & Hakeem, K. R. (2020). *Allelopathy*. Springer.

Ni, S., Zhao, W., Zhang, Y., Gasmalla, M. A., & Yang, R. (2016). Efficient and eco-friendly extraction of corn germ oil using aqueous ethanol solution assisted by steam explosion. *Journal of food science and technology*, *53*, 2108-2116.

Rahman, K. U., Ali, K., Rauf, M., & Arif, M. J. M. (2023). Aspergillus nomiae and fumigatus Ameliorating the Hypoxic Stress Induced by Waterlogging through Ethylene Metabolism in Zea mays L. *11*(8), 2025.

Sher, B., Asrar, M., Leghari, S. K., Gul, S., Khattaak, M. I., & Wali, S. J. P. J. B. (2023). Influence of native weeds species on germination, growth performance and survival of barley seedlings. *55*(3), 925-931.

Sotomayor, D. A., & Lortie, C. J. J. E. (2015). Indirect interactions in terrestrial plant communities: emerging patterns and research gaps. *6*(6), 1-23.

Tanveer, A., Jabbar, M. K., Kahliq, A., Matloob, A., Abbas, R., & Javaid, M. M. J. C. j. o. a. r. (2012). Allelopathic effects of aqueous and organic fractions of Euphorbia dracunculoides Lam. on germination and seedling growth of chickpea and wheat. *72*(4), 495-501.

Wang, W. Q., Sardans, J., Wang, C., Zeng, C. S., Tong, C., Asensio, D., & Penuelas, J. J. P. E. (2015). Ecological stoichiometry of C, N, and P of invasive Phragmites australis and native Cyperus malaccensis species in the Minjiang River tidal estuarine wetlands of China. *216*, 809-822.

Xu, Y., Chen, X., Ding, L. and Kong, C.H., 2023. Allelopathy and allelochemicals in grasslands and forests. *Forests*, *14*(3), p.562.