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# Evaluation of allelopathic effect of *Carthamus Oxyacantha* against wheat and maize seed germination

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## ABSTRACT
Effect of *Carthamusoxyacantha* powder aqueous extract on seed germination of Wheat and Maize were studied. Powder extract of 3g, 6g and 9g of concentration were soaked in distilled water for 12 Hrs, 24 Hrs and 36 Hrs of time. The seeds of Wheat and Maize were germinated in Petri dishes. Control was maintained by watering the seeds with distilled water. The highest values for germination percentage, shoot length, root length, fresh weight, dry weight, seedling length, vigor index and seedling weight vigor index were recorded in control of wheat the above parameter decreased with increasing concentration and timing. While in maize highest values for the above parameters were recorded in treatments as compared to control.
**Keywords:** *Allelopathic potential; Carthamusoxyacantha; aqueous extract; Maize; Wheat; Sterilization.*

## 1. INTRODUCTION
The term allelopathy, first used by Molisch [1]. It is a biological interaction among plants and microorganisms as well [2]. It is concerned with any biological phenomenon regarding secondary metabolites of fungal, algal, bacterial or plant origin that influences the development and growth of agricultural and other biological systems in question (International Allelopathy Society 1996). Allelopathy is a lifelike phenomenon takes place both in terrestrial and aquatic natural world [3] comprehended such interactions with both beneficiary and detrimental multiplicative inverse biochemical mode of action. Later on, Researchers modified the definition. Rice initially utilized the term for any immediate or circuitous harmful consequence of one plant on another through the arrival of concoction mixes, all things being equal, he later landed back to Molisch's perused [2].

While the [4] put the term in a more extensive position, with the end goal that the other alternative parts of the common world are on the whole influenced by the arrival of allelochemicals from plants too. They utilized a development term 'allelochemicals connection' that incorporates (1) allelopathy, (2) work of allelochemicals discharged from plants in evolving Abiotic (inorganic and natural parts) and biotic segments of soils, and (3) rule of the social occasion and incomparable release of allelochemicals by abiotic and biotic segments of the biological system. Allelopathy still is a cutting edge subject, the artifact of allelopathy is tended to as right on time as 300 B. C. Rice, E. L. (1984). In any case, after 1980 progressed allelopathic study was expanded sensibly. Primarily, allelopathic look into was just founded on bioassays (e. g., watery leachate or concentrate bioassays in Petri dishes) despite the fact that there was some anticipating worthful natural work on allelopathy before to 1970. Since 1990's, allelopathic achieved new statures, moved from basic research facility work to a partner joining of field thinks about [4]. According to the level of environmental harshness the net result of positive and negative interactions may vary. With the level of abiotic stress the frequency and strength of positive interactions increase [5, 6].

However, under harsh conditions the synthesis, accumulation, release, and phytotoxicity of allelopathic chemicals may be enhanced, containing high temperature or intense solar radiation and water scarcity [7, 8]. Therefore, under more severe abiotic terms the potential benefits of the more benign microclimatic conditions that occur underneath allelopathic plants may be reduced or negated. But then, co-evolution may have passed to local adaptation of some species to their chemical neighbor [9, 10]. Thus, a net positive result from such collaborations may be workable for liberal species. Not withstanding these procedures working simultaneously, the job of substance obstruction managing the net association result for allelopathic bushes in semiarid and bone-dry conditions has been to a great extent unfamiliar.

Different research facility and nursery thinks about have bolstered the phytotoxicity of synthetic compounds discharged from allelopathic plants, and this has as a rule been taken as immediate demonstrate of allelopathy. In any case, test terms (for example types, presentation and focuses to allelopathic mixes, and the nonappearance of its microorganisms or potentially soil) are a long way from those found in nature, and likewise, field tests are expected to give a reasonable acknowledging of the significance of allelopathy under regular conditions [11]. However, to assess allelopathic interaction under natural conditions are challenging methods are required [12, 13]. To reduce the chemical interference of allelopathic plants Activated carbon (AC) usually used in positive way because of its prominent capacity to adsorb biochemical compounds [13, 14]. However, AC may alter nutrient concentrations or modify other characteristics of soil such as pH and water retention [11, 15, 16]. These outcomes can confound understanding of the helpful impacts of the arrival of substance impedance, and this conceivable activity should be painstakingly

estimated [15]. Also, in took care of environments a large portion of the couple of field examines on allelopathy have been doingfor example [3, 17] or networks attacked by extraordinary plant species [18, 19].

Allelochemicals are subset of helper metabolites not essential for absorption (improvement and progression) of allelopathic living beings. Allelochemicals with hazardous allelopathic impacts are a noteworthy bit of plant assurance against herbivory (i.e., animals eating plants as their fundamental sustenance) [20, 21].

Weeds are compromised in all yields as they vie for water, light and supplements and harbor infections and creepy crawlies. High volumes of weed executioner utilization cause numerous adjustments in plant development like foliar chlorosis, hindrance of development, putrefaction and albinism [22].Many herbicides continue in the earth and initiatebiomagnifications. So there is very need to create herbicides thatare biodegradable.Herbicides planned from the plants will be biodegradable and they are more secure. Allelopathy holds possibilities for particular organic weed administrations. The procedure of allelopathy notices to concoction collaborations inside a wide range of plants. In this procedure the compound discharged or leachates exudates from stems, leaves or foundations of a plant can smother the advancement of a contiguous one [23].

## 2. MATERIALS AND METHODS

The main objective of this study was to see the allelopathic potential of *Carthamusoxyacantha*on germination and early seedling growth of Maize (*Zea mays* L.) and Wheat (*Triticumaestivum*).

### 2.1. Sterilization.

All the apparatus such as Petri dishes, flasks, funnels, beakers and drapers were washed with water. After washing all the apparatus were sprayed with ethanol ($C_2H_6O$) as well as all the apparatus was also auto Claved at 72°C for 25 minutes in order to kill all the pathogens.

### 2.2. Plant collection, Drying and Grinding.

The experimental plant *Carthamus oxycantha*wascollected from local area of District Mardan (23200) Khyber PakhtunKhwa. The whole experimental Plant waswashed with tap water in order to remove dust and clay and kept in shade at room temperature for 30 days. The thoroughly air dried plant wascut into a small pieces and ground by grinder to fine powder.

### 2.3. Extract Preparation.

For the preparation of *Carthamusoxyacantha*aqueous extract, Powder of *C. oxyacantha* was put in the flask and 100ml of distilled water was added. The head of flask was tightly closed with rubber cork and shacked for several minutes. After shacking flasks were kept for particular time. Three different concentrations (3gm, 6gm and 9gm) of extract were prepared by the same process. Each of these extracts was kept for a different period of time such as (12hours/3gm, 6gm and 9gm), (24hours/3gm, 6gm and 9gm) and (36hours/3gm, 6gm and 9gm). Prepared extract filtered with Laboratory Mesh to remove dust, clay and large particles. The filtrate once again filtered with what's man No 1 filter paper in order to get clean, clear and fungi free extract.

### 2.4. Experimental species.

Wheat (*Triticumaestivum*) and Maize (*Zea mays* L.) were used as experimental species.

### 2.5. Selection of seeds and sterilization

The two species wheat and maize healthy and uniform size seeds were selected and ten seeds were put in each Petri dish. The seeds of wheat and maize were washed with water in order to remove dust and clay. After washing these seeds were treated with ethanol and then again washed with distilled water several times.

### 2.6. Preparation of specimen.

Filter paper was kept in the Petri dishes. Filter paper absorbed water or extract and keep moist the seeds. With the help of catcher 10 seeds of each experimental species were kept in each replica. The seeds of experimental species were kept in these Petri dishes at equal distance from one another. These Petri dishes were kept in Laboratory Incubator at 15-20°C for 7 days. After 7 days the germination % of seeds, plumule and radical length. Fresh and Dry weight were measured.

### 2.7. Parameters.

The following parameter was studied during the experiment.

1. Germination (%)
2. Shoot length (cm)
3. Root length (cm)
4. Fresh weight (gm)
5. Dry weight (gm)
6. Moisture content (%)

## 3. RESULTS

### 3.1. Maize.

In the highest germination percentage (80%) was recorded at 6g/100 ml of dry powder that was on par with 9g/100 ml (65.5%) followed by control (53.3%) and 3g/100ml (51.1%). The data regarding germination %age of Maize given in [Table 1]. The highest mean value of germination was recorded in treatment 6g/24h which is 90%. This germination %age was markedly increased as compared to a control which is 30%. This showed that weed powder with low concentration affected positively and might contain some kind of promoters the [24] also found corresponding effects on Escherichia, and the incorporation of sienna leaves into the soil had an increasing effect on weed germination, reaching 15% of the control.

While in the highest root length (2.5cm) was recorded at 9g/100 ml of dry powder that was on par with 3g/100 ml (2.8cm) and 6g/100ml (2.3cm) followed by control (1.8cm). The data regarding root length is given in [Table 1]. The highest mean value for root length was recorded in 3g/36h for Maize which is 3.32cm which is higher as compare to control 1.86cm. This enhancing in root length indicates positive effect of extract on maize. The [25] Studied that all concentrations of decomposed garlic stalk markedly enhanced the root length of lettuce plants. The data regarding shoot length in [Table 1] the highest mean value for shoot length was recorded in 3g/36h for Maize which is 2.61cm as compare to control 0.91cm.

This report shows positive effect of extract on maize shoot length. This is maybe the presence of some growth promoters in extract. Similar results were obtained by [24, 26]. This result can be suggested because the root first absorbed allochemicals from the environment [27]. Data on the length of the kidneys and the roots of the lettuce indicate that garlic straw can release allelochemicals into the environment during decomposition. Therefore, it can play an important allelopathic response to test plants. However, it will be further investigated whether higher concentrations of decomposed garlic stems have enhancing effects. Gu 2009 [28] shows that allelopathic rice varieties have a positive effect on the urease activity of rice soil due to the release of allelochemicals, but this effect applies only to the early stage of growth. This indicates that the time of exposure of allelochemicals of different plants to the studied plants may be different.

The data regarding fresh weight is given in [Table 1]. The mean value for fresh weight was recorded in 6g/36h for Maize 3.3g which is high as compared to control which is 2.49g. This results show increasing in fresh weight in treatments. The Rice [2] reported that these inductions can be caused by growth-promoting chemicals in the tissue itself or by increased activity of microorganisms and the use of nutrients. Therefore, it seems that the decomposition of this weed contributes to the growth in a small amount, but is toxic to a large amount of corn growth. The highest dry weight (1.9g) was recorded at 6g/100 ml of dry powder that was on par with 9g/100 ml (1.7g) followed by 3g/100ml (53.3g) and control (1.1g). The data regarding dry weight in [Table 1] the highest mean value was recorded in 6/24h for maize 2.17g the dry weight is high in treatment as compare to control 1.19g. The seedling length (4.5cm) was recorded at 3g/100 ml of dry powder. Followed by 9g/100ml (3.3cm) and the rest of all concentrations [Table 1].

While the highest seedling weight index (157.6) was recorded [Table 1].at 6g/100 ml of dry powder that was on par with 9g/100 ml (118.1) followed by control (78) and 3g/100ml (71.3).

**3.2. Wheat.**

In the highest germination percentage (60%) was observed at 12 Hrs. followed by 36 Hrs. (49.1%) and 24 Hrs. (44.1%) while in concentration level means, the highest value was recorded at control (100%), followed by 3g/100 ml (55.5%), 6g/100ml (34.4%) and 9g/100 ml (14.4%). However among the interactions, the highest germination percentage (100%) was reported at control, followed by 3g/100ml at 36 hrs soaking (100%) that was on par with 12 hrs (100%) for the same concentration. No germination was observed for 36 hrs soaking time at 9g/100 ml. The data regarding germination %age is given in [Table 2]. *Carthamusoxyacantha*had great allelopathic impact on the Germination of wheat. The highest mean value of germination was recorded in control which was 100% and the minimum value was recorded in 9g/36h which is 0%. A decrease in seed germination is the extreme evidence allelopathic effect detected in bioassays. The [29] also found similar results, saying that weeds with a high percentage of frequency and density can have a competitive and allelopathic effect, thereby reducing the growth and yield of the respective crops. While In the highest root length (4.3cm) was observed at 12 Hrs. followed by 24 Hrs. (3.2cm) and 36 Hrs. (3.2cm) while in concentration level means, the highest value was recorded at control (7.1cm), followed by 3g/100 ml (3.8cm), 6g/100ml (2.1cm) and 9g/100 ml (1.2cm).

The data regarding root length of wheat given in [Table 2]. The highest mean value for root length was recorded in control 7.13cm which is reduce with increasing concentration the lowest value was reported in 9g/36h which is 0cm. This report indicates that's *Carthamusoxyacantha*shows highly allelopathic effect on wheat. In [30] the allelopathic effect of WITA-12 rice varieties reportedly reduced spinach root length by about 60%. In another study [31] found that Manik and Makmuer rice varieties reduced intestinal bulbs by 80% and 75%, respectively, due to their strong allelopathic effect.

Also, the highest shoot length was recorded at control (5cm) that was on par with 3g/100ml (3.7cm). Followed by 6g/100 ml (2.1cm), 9g/100ml (1.1cm). The data regarding shoot length of wheat in [Table 2] the highest value for shoot length was marked in control which is 5.04cm which is reduced with increasing concentration. The lowest value was obtained 0cm in 9g/36h. This report indicates negative effect of extract on wheat shoot length [32] or changes in the mitosis index of cells [33] or a combination thereof. Al-Wakel [34] reported that a slowdown in seedling growth may be the result of direct interference between allelochemicals and the process of cell division, which changes the balance of various growth hormones.

The difference in the activity of different extracts in suppressing the growth of seedlings of test species of weeds may be associated with different types and concentrations of allelopathic substances present in these extracts [35].

While the highest fresh weight was recorded at control (0.48cm).Followed by 3g/100 ml (0.28cm), 6g/100ml (0.10cm) and 9g/100ml (0.05cm).

The data regarding fresh weight of wheat given [Table 2] this value of control 0.48g which is high in control and show inhibitory effect in treatments. The Leather [36] considered dry weight of crop to be a better indicator of injury due to the presence of weed and the highest dry weight (0.13g) was observed at 12 Hrs. that wa on par with 36g/100ml (0.11g).

Followed by 24 Hrs. (0.07g). While in concentration level means, the highest value was recorded at control (.17). That was on par with 3g/100ml (0.15g). Followed by 6g/100 ml (0.06g), 9g/100ml (0.03g). However among the interactions, the highest dry weight (0.22g) was reported for 36 Hrs at 3g/100ml. that was on par with all Hrs of control, 3g/100ml at 12 Hrs and 9g/100ml at 12 Hrs.

No germination was observed for 36 hrs soaking time at 9g/100 ml. The data regarding dry weight of wheat in [Table 2] the highest mean value was recorded in control 0.176g and the lowest value was recorded in 9g/36h which is 0g. This reduction in dry weight shows positive allelopathic effect on wheat.

According to [37]they recorded in their experiment that dry weight of *Chenopodiumalbum*was importantly influenced by sorghum plant parts WE treatments (Table II). The combination of leaf + stem and root + leaf WE treatments importantly reduced fresh and dry weight of this weed species but the notable effect was of stem + root WE treatment that caused reducing of 37.83 and 49% in fresh weight and 33.33 and 52.06 % in dry weight over control recorded at 80 and 105 DAS, respectively.

Among the highest SDL in [Table 2] was recorded at control (12.1). Followed by 3g/100ml (7.5), 6g/100 ml (4.3) and 9g/100ml (2.4). Analysis of Variance (ANOVA) for SDLVI and SWI at different Powder Soaking time means and the interaction between

Time and concentration indicated non-significant. However, the Concentration Levels Means was significant. Among the concentration level means, the highest SDLVI was recorded at control (1217). Followed by 3g/100ml (407.6), 6g/100 ml (156.7) and 9g/100ml (63.3) shown in [Table 2].While the highest SWI was recorded at control (17) in [Table 2].Followed by 3g/100ml (9.3), 6g/100 ml (2.6) and 9g/100ml (1.3).

**3.3. Statistical Analysis.**

Means represent by the identical English letter are not significantly different using analysis of Variance (ANOVA) at LSD at 0.05 Analysis of Variance (ANOVA) at different Powder Soaking time means and the interactions between Time and concentrations were non-significant. However, Concentration Levels Means indicated significant data.

**Table 1.**The different Allelopathic effects of *Carthamusoxyacantha* at various concentrations on **Maize**.

| Germination %age | Root length (cm) | Shoot length (cm) | Fresh weight (gm) | Dry weight (gm) | Moisture content %age | Seedling length (cm) | Seedling L Vigor Index | Seedling W Index |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| 53.3$^{b}$ | 1.8$^{b}$ | .9$^{ab}$ | 2.4$^{b}$ | 1.1$^{b}$ | 75$^{a}$ | 2.7$^{b}$ | 139.4$^{b}$ | 78$^{b}$ |
| 51.1$^{b}$ | 2.8$^{a}$ | 1.6$^{a}$ | 2.4$^{b}$ | 1.2$^{b}$ | 106.1$^{a}$ | 4.5$^{a}$ | 139.4$^{b}$ | 71.3$^{b}$ |
| 80$^{a}$ | 2.3$^{ab}$ | .6$^{b}$ | 3.3$^{a}$ | 1.9$^{a}$ | 81$^{a}$ | 3$^{b}$ | 241.4$^{a}$ | 157.6$^{a}$ |
| 65.5$^{ab}$ | 2.5$^{a}$ | .8$^{b}$ | 2.9$^{ab}$ | 1.9$^{a}$ | 96.5$^{a}$ | 3.3$^{b}$ | 217.3$^{ab}$ | 118.1$^{ab}$ |

Means represent by the identical English letter are not significantly different using analysis of Variance (ANOVA) at LSD at 0.05 level of significance = 34, 0.97, 1.2, 1.4, 0.7, 115, 1.7, 175.7, 98.3.

**Table 2.** The different Allelopathic effects of *Carthamusoxyacantha* at various concentrations on **Wheat**.

| Concentration levels (gm/100ml) | Germination %age | Root length (cm) | Shoot length (cm) | Fresh weight (gm) | Dry weight (gm) | Moisture content %age | Seedling length (cm) | Seedling L Vigor Index | Seedling W Index |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 0 | 100$^{a}$ | 7.1$^{a}$ | 5$^{a}$ | .48$^{a}$ | .17$^{a}$ | 209.4$^{a}$ | 12.1$^{a}$ | 1217$^{a}$ | 17$^{a}$ |
| 3 | 55.5$^{b}$ | 3.8$^{b}$ | 3.7$^{a}$ | .28$^{b}$ | .15$^{a}$ | 128.7$^{ab}$ | 7.5$^{b}$ | 407.6$^{b}$ | 9.3$^{b}$ |
| 6 | 34.4$^{c}$ | 2.1$^{c}$ | 2.1$^{b}$ | .10$^{bc}$ | .06$^{b}$ | 82.7$^{ab}$ | 4.3$^{c}$ | 156.7$^{c}$ | 2.6$^{c}$ |
| 9 | 14.4$^{d}$ | 1.2$^{c}$ | 2.1$^{b}$ | .05$^{c}$ | .03$^{b}$ | 36$^{b}$ | 2.4$^{c}$ | 63.3$^{c}$ | 1.3$^{c}$ |

Means represent by the identical English letter are not significantly different using analysis of Variance (ANOVA) at LSD at 0.05 level of significance = 15.1, 1.9, 2.8, 0.3, 0.08, 225.3, 4.4, 247.6, 6.9.

## 4. CONCLUSIONS

The present study showed that in general, the aqueous extract of Carthamusoxyacantha plant powder in the case of maize showed no significant inhibition as compared to control while in some cases enhanced growth but in the case of wheat it showed significance inhibition and decreased wheat growth. However, in a higher amount of its allelopathic effects reduced or completely ceased the plant growth. Therefore, it was suggested that at the time of seed sowing, the amount of this weed should be controlled properly. In addition, the presence investigation has suggested that this weed specie produced allelochemicals which reduced germination as well as the subsequent growth of wheat plant.

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