Bio-Science Research Bulletin
http://www.bpasjournals.com

Original Research Article

Print version ISSN 0970 0889
Online version ISSN 2320 3161
DOI: 10.5958/2320-3161.2022.00013.X
Volume 38, Number 2
July-December 2022: P.95-99

A Study on the Allelopathic Impact of *Chenopodium murale* L. on Wheat Crop Plants

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Received on 20.05.2022
Revised on 25.09.2022
Accepted on 24.11.2022
Published on 15.12.2022

ABSTRACT

Allelopathy is a mutual biological occurrence in which the growth, development, and reproduction of other organisms are impacted by the biochemicals produced by one organism. Allelochemicals are a class of biochemicals that can either benefit or harm the target species. Plant allelopathy is one of the ways that receptor and donor plants interact, and it can have either beneficial or negative effects. Organic soluble plant extracts have an inhibitory impact. A dose–response relationship analysis is required in bioassay laboratory tests, since the stronger inhibitory impact of higher concentration extracts may be attributed not only to allelopathy but also to enhanced osmotic potential. The negative effect on seedling growth is often larger in bioassays than the influence on germination rate. To study the effect of Chenopodium on wheat crop was studied by applying leaf extract of Chenopodium murale on wheat plant. The weed samples of C. murale were collected from fields and road sides of the University. The different concentration of Chenopodium extract (i.e. 50%, 75%, 100%) were appliedon wheat plants. The results after three days were compared with the control. The result shows that Chenopodium has less inhibitory effect at lower concentration and strong inhibitory effect at higher concentration.

KEYWORDS: *Allelopathy, Allelochemicals, Chenopodium, Wheat, Inhibitory effect.*

How to cite this article: Mor A., Kumar M., Nara R., Singh R. (2022). A Study on the Allelopathic Impact of *Chenopodium murale* L. on Wheat Crop Plants.*Bio-Science Research Bulletin*, 38(2), 95-99.

INTRODUCTION

Weeds and agricultural plants are located near to one another. They deny agricultural plants the meagre nutrients, accessible space, light, and moisture that they need to grow. (Singh et al., 2020). Because of this when weeds are prevalent, the physiological function and growth of crops are impaired (Rajcan and Swanton, 2001).The conflict between weeds and crops reduces agricultural output. Of all the crop pests, it is known that weeds cause the biggest yield reductions in crops. Crop productivity is often reduced by 34% by weeds (Jabran et al., 2015). Allelopathy is a subfield of chemical ecology that examines how chemicals produced by plants or microorganisms affect the emergence, development, and dispersion of other plants and organisms in natural communities or agricultural systems. Since the mid-1990s, allelopathy research has advanced quickly, becoming a hot issue in recent years in the fields of horticulture, ecology, agronomy, soil science, and other scientific disciplines (Einhellig, 1995). Allelopathy research flourished in the 1970s.Root and shoot may be hampered by allele-chemicals produced by allele-pathic weeds. Weeds have a negative in direct impact

on crop plants. Crop development is impacted by allelopathy from specific emerging crop seedlings, which also results in a number of other issues. Recent research has demonstrated that the allelochemicals released by *Chenopodium murale* L. root hairs are to blame for wheat's cell cycle disruption and oxidative damage (Dmitrovic et al., 2014). By serving as a new habitat for a range of insect pests and plant diseases, weeds can lower agricultural productivity. Because it requires money to control them, weeds can make it difficult to harvest crops and drive up production expenses. Allelochemicals produced by donor plants can considerably affect and, in some situations, impede the growth of receiver (test) plants in allelopathy, a chemical interaction between higher plants (Singh et al., 2021). Allelochemicals are substances that plants release that may be allelopathic, it describes a wide range of substances created by either plants or animals. Plant secondary metabolites are known as allelochemicals (alkaloids, phenolics, flavinoids, terpenoids, and glucosinolates) that are essential for the survival of plants but do not participate in their basic metabolic process. (Duke et al., 1998, Rice, 1984; Dekker and Meggitt, 1983).Plants produce secondary metabolites which are known as allelochemicals, these allelochemicals are natural herbicides are a single plant compound or a combination of plant compounds that may naturally suppress weeds. The most harmful weed on a global scale is *Cynodon dactylon* and *Chenopodium album*, which also ranks fourth among weeds in terms of production of allelopathic chemicals. In addition to reducing germination, the allelopathic effect also delays the period of germination, which may affect plant competition (Putnam, 1988).

Worldwide, *Chenopodium album* and *Chenopodium murale* can be found. Western Asia is assumed to be the origin of *C. album*, but this isn't proven (Anonymous 2017). A perennial tall plant that may yield up to 24,000 seeds per plant, *Chenopodium murale* has a high rate of dispersal (Holm et al, 1997). An herbaceous plant called *Chenopodium murale* may grow in a variety of soil types (Mitic et al. 2012). The plant can reach a height of 0.6 m and has a stem that is 3–10 cm long, frequently branched, hairy, especially on juvenile parts, and rarely thick (Anonymous 2017). The rhombic-ovate, irregular, hairy, and toothed leaves measure 1.5–9.0 cm in length and 0.8–5.0 cm in width. Flowers grow in a small, glomerule-dense cluster that resembles a cyme. The seeds have a diameter of 1.2-1.5 mm, are horizontal, and are black and dull (Mitic et al. 2012).

Allelochemicals from the common wheat weed *Chenopodium album* L. have the ability to be released into the soil and may have an impact on the germination and growth of nearby plants, either positively or negatively. It has been demonstrated that *C. album* has allelopathic effects on wheat (*T. aestivum*), resulting in lower germination rates and shorter shoot and root lengths (Daizy et al., 2006), radish (Malik et al., 1994), wheat and jute (Roy et al., 2006), and safflower (Rezaie & Yarnia, 2009). This study therefore plan to investigate the allelopathic effect of *C. murale* species on wheat plants.

MATERIALS AND METHODS

Chenopodium murale plants species were collected from Maharishi Markendeshwer (Deemed to be University) roadside populations that were organically expanding. The appropriate quantity of *Chenopodium* was collected, brought into the lab, and cleaned. The leaf was then removed from the twigs and washed once again with running water. After washing, use a weighing machine to calculate the weight of the leaves based on the development of the concentration. With the help of a mortar and pestle, leaves are crushed after being weighed. The plant material extract was mixed with distilled water and poured over muslin cloth. There are three concentration levels decided, 100%, 75%, and 50%. For a 100% concentration, mix 100g of *Chenopodium* leaves with 100ml of distilled water. For 75% and 50% concentration 75g and 50g leaves were grinds in100ml of distilled water respectively (El-Khatib and Abd-Elaah, 1998). To keep track of the many growth parameters of the test species, these extracts were used in bioassay. *Triticumaestivum* was the variety used for the test crops. The test species' seeds were purchased in the neighbourhood Mullana market. Test species seeds were surface

sterilised for 1-3 minutes with 1% sodium hypochlorite solution before being thoroughly washed with distilled water. Seed germination and radicle growth data: In 12 pots, three replicates of each concentration and one replicate of the control were used to measure the seed germination and radicle lengthening of the test species. Then, in every replication of the control and treatment, ten seeds of each test species were maintained. 10 ml of the bioassay extract were added to pots following the germination of test species seed at a laboratory room temperature of 25° to 30°c.

RESULTS

Different concentrations of extracts of *C. murale* reduced plant height, number of tillersat higher concentrations (Table 2). However, lower concentration (50%) had stimulatory effects on all these parameters as compared to initial set (Table 1). Maximum plant height (19.5 cm) were recorded in pots treated with 50% concentration and thereafter plant height decreased with increasing concentrations. Strong inhibitory effects on these parameters were observed at 100% concentration treatment where plants attained a height of 14.1 cm lengths. As compared to control, 50% concentrated extract stimulated plant height (Figure 1).

Figure 1: Effect of *Chenopodium* extract on wheat shoot (A) Initial growth, (B) 100% concentration, (C) 75% concentration, (D) 100% concentration and (E) control

Table 1: The growth of wheat plants before applying different concentrations of *C. murale* in the starting of experiment

S. No.	Set I			Set II			Set III		
	Pot 1	Pot 2	Pot 3	Pot 4	Pot 5	Pot 6	Pot 7	Pot 8	Pot 9
1	8.4	8.7	10.8	11.1	9	12.2	12.3	12	9.9
2	9.4	7.2	7.4	12.2	11	13	14.5	11.8	12.6
3	9.7	9.8	8.1	13.1	10.9	12.9	13.8	13.2	11.3
4	7.8	12.5	11.1	14	12.4	14.3	15.1	14.1	10.7
5	7.7	7.4	12.3	9.8	10.1	15	10.2	11.9	9.8
6	8.6	12.5	9.8	12	11.4	13	9.5	12.5	12

Table 2: The growth of wheat plants after 3-days of applying different concentrations of *C. murale*

S. No.	Set I Control			Set II Growth in 50% Conc. Cm.			Set III Growth in 75% Conc. Cm.			Set IV Growth in 100% Conc. Cm.		
	Pot 1	Pot 2	Pot 3	Pot 1	Pot 2	Pot 3	Pot 4	Pot 5	Pot 6	Pot 7	Pot 8	Pot 9
1	17.5	15.1	16.4	15.5	16.9	16	13.3	13.1	14.6	11.2	12.3	13.1
2	16.7	13	15.6	19.2	17.6	17.2	14.5	13.2	16	11.3	11.7	14
3	15.5	16.4	14.2	15.7	14.9	13.8	14.8	14.4	17.1	10.9	14.1	11.3
4	16.8	14.5	13.9	17.3	16.2	15.7	15.7	12.9	16.2	9	12.1	12.1
5	14.9	13.6	17.2	16.7	15.5	16.7	15	13.2	17.3	10.2	10.9	10
6	15	16.1	16.9	16.2	14.8	19.5	14.4	11	15	10.4	9.9	11

Effact on Roots after three days

The roots get start shrink after applying concentration. Maximum shrinkage found in 100% concentration, as compared to75% and 50% concentration. The roots in control set observed healthy and longer then concentrations applied roots (Figure 2).

Figure 2: Effect of *Chenopodium* extract on wheat root from left control, 50% concentration, 75% concentration and 100% concentration

DISCUSSION

The current study demonstrates that the fresh aqueous leaf extracts of *Chenopodium murale* had effects on wheat development and yield that were both stimulatory (at lower doses) and inhibitory (at higher concentrations). *C. murale* allelopathic activity may be connected to the phenolic and alkaloid chemicals found in its leaves. According to Malik et al. (1994), aqueous air-dried *Chenopodium album* extract hindered the germination and growth of wheat and radish plants. They extracted seven phenolic compounds from the test plant's shoots, and they determined that chlorogenic acid was the main phytotoxin. Similarly, *Lactuca sativa, Lycopersicon esculentum,* and *Allium cepa* were examined for their ability to germinate and flourish after Cutillo et al., 2003, discovered 7 cinnamic acid amides from *Chenopodium album*. They noticed that all of these plants had decreased germination and development. This study sought to understand the detrimental effects of *Chenopodium* extracts on wheat (*Triticumaestivum*) germination and growth.

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