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EFFECT OF AQUEOUS EXTRACT OF *Parathenium hysterophorus* (L.) AND *CYANODON DACTYLON* (L.) ON THE SEED GERMINATION AND SEEDLING GROWTH OF CHICKPEA SEEDS

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ABSTRACT

In the present experimental study the effect of aqueous leaf extracts of two most common weeds *viz.*, *Cynodon dactylon* (L.) and *Parthenium hysterophorus* (L.) was observed on the rate of seed germination (%) and seedling growth (cm) in *Cicer arietinum* (L.). The experiment was conducted in the laboratory of department of Botany, MJM, Arts Commerce and Science College Karanjali during the month of December 2019 to January 2020. The different concentrations (25%,50%,75% and 100%) of aqueous extract of *Cynodon* and *Parthenium* were employed to investigate their influence on the seedling physiology of Chikpea. All aqueous leaf concentrations of *Cynodon* and *Parthenium* exhibited a significantly inhibitory effect on germination percentage, seedling growth and seedling vigour index of *C. arientium* over control. As per experimental observations, the all leaf extracts of both tested weeds caused an effect on chickpea seeds and the intensity of inhibition increased when the extract concentrations were increased. The highest growth of seed germination *C. arietium* seedling was recorded in 25% concentrations of *Cynodon* leaf extract with 89% germination and the lowest growth of seed germination. *C.arietium* seedling was recorded in 100% of concentrations *Parthenium* leaf extract with 69% germination as compared to control. In chickpea, the highest shoot and root length was noted at 50% concentration in leaf extract of *Cynodon* with 7.55 cm and 12.65 cm, respectively and lowest shoot and root length was observed in 100% concentrations in leaf extract of *Parthenium* with 3.67cm and 6.28 cm, respectively. The aqueous extracts of *Parthenium* showed more inhibition on chickpea seedlings than *Cynodon*. All the experimental results were observed under laboratory environmental conditions. Therefore, further studies under field conditions will investigate the inhibitive effects of these weeds against chickpea and also to study the management of weeds by using bio-herbicides.

(Key words : *Parthenium*, *Cyadoan*, chickpea and inhibition)

INTRODUCTION

In the agriculture field, weeds have direct effects on growth of yield and quality of crops. Weeds are unwanted and undesirable plants, which cause great losses in crop yields as compared to other agricultural pests. Weeds are known to exhibit allelopathy by releasing water- soluble allelochemicals from leaves, stems, roots, rhizomes, flowers, fruits and seeds (Batish *et al*., 2007). Fischer and Quijano, (1985) are reported that several weed species have allelochemicals that affect germination and growth of crops due to toxicity. The phytotoxic effects can be attributed either to allelochemicals present in the plant or weed residues or microbial toxins produced during decomposition (Rice, 1984).

Therefore, many of the toxic effects of decomposition products on plants are inhibition of seed germination, stunted growth, inhibition of the primary root system and increase in secondary roots, inadequate nutrient absorption, chlorosis, slow maturation, and delay of failure or reproduction (Patrick *et al*., 1964).Mohammadi *et al*. (2005) reported that, chickpeas yield losses of 48% to 97% when weeds are not controlled because of their slow growth and limited canopy development. In India, observed a reduction of 80% in chickpea yield due to weeds being allowed to compete for a full (Tiwari *et al*.,2001).

P. hysterophorus and *C. dactylon* are the two main common weeds in India and it is found in every part of India. Both of these are a predominant weed of leguminous crop fields and have been reported to reduce the yield of legumes.*Parthenium* is considered to be one of the ten worst weeds of the world (Oudhia, 2002). *P.hysterophorus* is one of the most toxic weeds in the world and it creates a lot of problems in growing short structure crops (Jeschke *et al*.,2012). But, *Parthenium* is a more poisonous and aggressive weed as compared with *Cynodon* weed. The allelopathic potential of *Parthenium* weed results from the release of phytotoxic substances such as, ferulic, caffeic,

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vanillic, chlorogenic, p-coumaric and p hydroxybenzoic acids, parthenin, ambrosin and coronopilin, which inhibits germination and growth of several crop plants and multi-purpose trees (Swaminathan *et al*., 1990). *Cynodon dactylon* (L.) is widely dispersed most dangerous weed throughout the world and is considered having fourth most allelopathic compounds. *C. dactylon* produces phenolic acids and cyanogenic compounds and thus has allelopathic potential (Mahmoodzadeh, 2010).

Vasilakoglou *et al*.(2005) reported that *C.dactylon* extract also stopped seed germination of cotton and corn and growth of cotton decreased 50%.Similarly, Golparvar *et al*.,(2015) also mentioned that *C. dactylon* extract had strong allelopathic and inhibitory effects on different traits of basil and common purslane. The allelopathic effects of different parts of *P. hysterophorus* on seed germination and seedling growth have been evaluated in *Brassica* sp. (Singh *et al*., 2005) and rice, wheat, chickpea, soybean and mustard (Biswas, 2010).

Chickpea (*Cicer arietinum* L.) is an important pulse crop and provides nutritious food for an expanding world population, which belongs to the leguminous family. Chickpea ranked third in global production after bean and pea and most of the production centred in India. *Cicer arietinum* is usually grown in the drought-tolerant than other cool season legumes. Therefore, more weeds will occur and they directly affect crops. In that particular period the *Parthenium*, *Cynodon*, *Tridax* and *Alternanthera* like weeds will grow. These weeds release allelochemicals which affect the plant growth, seed germination thereby influencing the production. Keeping the above in view the present work was made on the allelopathic potential of *Parthenium* and *Cynodon* weed species on the germination and growth of seeds of the economically important crop plants and to compare the allelopathic potential of these two weeds plants of *Cicer arietinum*.

MATERIALS AND METHODS

The experimental works were conducted during December 2019 to January 2020 under laboratory conditions at BotanyDepartment, MJM Arts Commerce and Science College, Karanjali, Tal-Peth,Dist. Nashik, Maharashtra, India.

Collection and screening of plant material

The fresh healthy leaves of *Cynodon dactylon* (L.) and *Parthenium hysterophorus* (L.) were collected from near the chickpea fields around the MJM Arts Commerce and Science College Karanjali. In the germination experiment, the chickpea seeds were collected from commercial agriculture suppliers of Karanjali. Before the germination test the seeds of chickpea were washed through distilled water several times.

Preparation of plant extracts

10 g of fresh leaves of these two weeds were homogenized in 10 ml distilled water individually. Then, aqueous extract was filtered through Whatman No. 1 filter paper and volume was made to 100 ml with distilled water. This solution was treated as a stock solution. 25, 50, 75 and 100% concentration of stock solutionswere prepared for treatment.

Seed germination

Healthy and uniform sizes of Chickpea seeds were selected and were kept in petriplates containing 25,50, 75 and 100% concentrations of two weed extracts for 12 hours. Simultaneously, control was treated as distilled water. For 12 hours, 10 Chickpea seeds were kept in sterile petriplates over filter paper at room temperature. The filter paper was moistened with 10 ml distilled water and distilled water was supplied to the seedlings uniformly, as and when required. The whole experiment was repeated three times and the average values were expressed. The Petri dishes were maintained under laboratory conditions for one week. Equal volume of distilled water was added in the experimental Petri-dishes when moisture content of the blotting paper declined. The germination of seeds was observed for up to four days (96h). The seeds with visible radicles were considered as germinated. (Turkey, 1969).

Fresh and dry weight of seedlings

The germination of root and shoot length of the seedlings was analyzed after two weeks with the help of scale. Then, to measure the fresh weight, the root and shoot portions of seedlings were weighed. After, they dried in a hot air oven at70^{o}C for 24 h and the dry weight was taken by using adigital balance. The Seed Vigour Index (SVI) was calculated by using the following formula:

SVI = (Length of root + Length of shoot) × Seed germination %

The percentage inhibition of germination was also calculated by using the following equation:

I=100-(E2×100/ E1); where, I represents Percentage inhibition, E1 represents response of control plant and E2 represents response of treated plant (Surendra and Pota, 1978).

Statistical analysis

The results were calculated for three independent determinations with their means and standard deviations. The data was analyzed with one way ANOVA. The difference was considered to be significant if p value was less or the same to 0.05 (p = 0.05) (Mungikar, 2003).

RESULTS AND DISCUSSION

In the present experimental study was conducted to investigate the effect of aqueous extract of two different weed species of *Cynodon dactylon* (L.) and *Parthenium hysterophorus* (L.) on seed germination and seedling growth of *Cicer arietinum* (L.).

Seed germination rate (%)

The aqueous extracts of *C.dactylon* and *P.hysterophorus* caused a significant inhibition of the germination of the *C.arietinum* over control (Table- 1 and 3).

From the results, it is much clear that the treatment of aqueous extracts caused a greater stimulatory effect on seed germination than that of control. Among both weeds, chickpea showed the maximum reduction in seed germination (69%) and (82%) when treated with 100% aqueous extract of *P.hysterophorus* and *C.dactylon*, respectively. The maximum per cent seed germination was observed in chickpea seeds (89%) and (82%) at 25% concentration of *Cynodon* and *Parthenium* leaf extract, respectively. When increasing concentration of aqueous leaf extracts (25%, 50%, 75% and 100%) of *Parthenium* and *Cynodon* was observed that a gradual decrease in germination percentage (Figure 1). The results showed that all concentration of aqueous extracts of *P.hysterophorus* was more inhibitory effect as compared to *C.dactylon* extracts. Similar results were also obtained by (Maharjan *et al*.,2007), who observed that the increasing concentration of *Parthenium* water extract exhibited inhibitory impacts on seed germination of cereal crops. These results showed that leaf aqueous extract of *Parthenium* exhibited significant inhibitory effect on seed germination and had adverse effect than the stem as reported by Tefera (2002). The present study revealed that increase in the concentration of *Parthenium* and *Cynodon* plant extracts inhibited the germination of Chickpeas. Similar findings have been reported by Golparvar *et al*. (2015). They reported that aqueous extracts of *C.dactylon* had strong allelopathic and inhibitory effects on different traits of Basil and common Purslane.

Seedling length

Root and shoot length of chickpea were also significantly (P = 0.05) suppressed by the all concentration of aqueous extracts of *C.dactylon* and *P.hysterophorus* as compared with control (Table 2 and 3). In chickpea seeds minimum root length was found 100% concentration of *Cynodon* and *Parthenium* leaves extract i.e 8.25 cm and 6.28 cm respectively, whereas in control it was found to be 12.05 cm. Similarly, the lowest value of shoot length was also observed in 100% concentration of *Cynodon* and *Parthenium* leaf extracts i.e 5.33 cm and 3.67 cm, respectively. The maximum value of root length 12.65 cm and 12.19 cm was recorded for 50% *Cynodon* and 25% *Parthenium* concentrations, respectively. Similarly, the highest value of shoot length 7.55 cm and 4.36 cm was found in 50% *C.dactylon* and 25% *P.hysterophorus* concentrations, respectively. Therefore, the root and shoot length of chickpea seeds maximum inhibition was observed in 100% concentration of tested both weed plants. Interestingly, minimum concentration of 50% *Cynodon* and 25% *Parthenium* promoted root growth and 25% *Cynodon* and 50% *Parthenium* promoted shoot growth. These observations recorded in the present investigation are in conformity with the findings of Wakjira (2009), who reported that the inhibition of shoot elongation caused by allelochemical lead to reduced plumule length. Patil (1994) reported that the leaf extracts of *Glyricidia maculate* inhibited the seedling growth of rice, sorghum, green gram.

Fresh and dry weight of seedling

The results of variance analysis showed that the suppression by all concentration of leaves extract of *C. dactylon* and *P. hysterophorus* on fresh and dry weights of seedlings in *Cicer arietinum* was significant (P = 0.05) as compared with control (Table 2 and 3). The values for fresh weight of seedling together ranged from 1.6 to 2.7 g and 1.3 to 2.7g in different concentrations of *C.dactylon* and *P.hysterophorus*, respectively as compared to 2.7g in the control. Similarly, the dry weight of seedling in control was 0.27g, while it was recorded ranged from 0.26 to 0.14 g and 0.23 to 0.15 g in various concentrations of *C.dactylon* and *P. hysterophorus*, respectively. The minimum fresh and dry value was observed in 100% concentration of both tested weed plants and maximum fresh and dry value was recorded in lower concentration (25%) leaf extract of both tested weed plants. Similar to these results Rn Mack *et al*. (2000) was recorded fresh weight of shoot and root, which varied from 0.83 to 1.08 g in *P. sativum* compared to control condition (1.46 g) and 0.71 to 0.96 g in *C. aeritinum* compared to control condition (0.8 g). These results are in conformity with the findings of Shikha, and Jha (2016), who observed that higher concentrations of leaf extract of *P.hysterophorus* reduced seed germination and seedling growth and weight in *C.aeritinum*, *P. sativum* and *C. cajan*.

Seed vigour index and R:S ratio

The seed vigour index values of *C.aeritinum* in leaf extracts of *Cynodon* and *Parthenium* varied from 1113 to 1633 and 686 to 1357 in different concentrations, respectively in comparison with control (1827) (Table2). The seed vigour index values decreased with increasing concentrations of leaf extract of both tested weeds plants as compared to control. Similarly, the values for r:s ratio of *C.aeritinum* in leaf extracts of *Cynodon* and *Parthenium* varied from 1.53 to 1.54 and 1.71 to 2.79 in different concentrations, respectively.These observations are in agreement with the findings of earlier workers Shikha and Jha (2018), who reported that SVI value decreased from 25.53 to 100%, 3.33 to 26.21% and 32.44 to 100%, respectively, in leaf, stem and root extracts of *Parthenium* compared to control treatment and also Shikha and Jha (2016) found that the different concentration of leaf extract of *Parthenium* the SVI values ranged from 1.20 to 548.11 with control conditions (802.41). According to Narwal, (1994) was reported that the harmful allelopathic effects of these weeds on germination and seedling vigour of many agricultural crops. Hence, present situation where timely weeding is not feasible due to paucity and high cost of labour as well as unfavourable weather and soil condition, integrated weed management though herbicidal various treatments in combination with mechanical weed control were found comparable to weed free treatment in soybean crop (Deshkari *et al*., 2019). Similar results were reported by Yenpreddiwar *et al*. (2017), who observed that, the treatment of weed free check showed their significance and superiority over rest of the treatments with significantly highest yield and yield attributing characters in cotton plants.

Table 1. Effect of aqueous leaf extract of *Cynodon dactylon* (L.) and *Parthenium hysterophorus* (L.) on seed germination of Chickpea,

Time [After Germination]	Plant Species	Germination percentage				
		Plant Extracts Treatments				
		Control	25%	50%	75%	100%
24h	C	40	32	30	20	18
	P	40	27	24	14	10
48h	C	65	55	48	43	36
	P	65	42	45	27	24
72h	C	82	68	53	54	49
	P	82	62	55	48	43
96h	C	100	89	85	84	82
	P	100	82	80	79	69

* Symbol (C)-*Cynodon dactylon* (L.) and (P)-*Parthenium hysterophorus* (L.).

Table 2. Effect of aqueous leaf extract of *Cynodon dactylon* (L.) and *Parthenium hysterophorus* (L.) on seedling length (cm), fresh weight of seedling (g), dry weight of seedling (g), R:S ratio and SVI values on seed of Chickpea.

Treatments	Plant species	Root length (cm)	Shoot length (cm)	Fresh wt. of seedling (g)	Dry wt. of seedling (g)	R:S ratio	SVI values
Control		12.05±0.11a	6.22±1.02a	2.7a	0.27a	1.93a	1827a
25%	C	11.11±0.86b	7.24±0.56b	2.7a	0.26a	1.53a	1633b
	P	12.19±1.65b	4.36±0.78b	2.7a	0.23b	2.79a	1357b
50%	C	12.65±1.32a	7.55±2.00c	2.6b	0.21b	1.67a	1717c
	P	10.44±0.74c	4.23±0.87c	2.2a	0.21c	2.46a	1173c
75%	C	12.16±0.45a	5.56±0.56d	2.3c	0.19c	2.18b	1488d
	P	8.27±0.78d	3.57±0.87d	1.8b	0.20d	2.31a	935d
100%	C	8.25±0.48c	5.33±0.82ab	1.6d	0.14d	1.54a	1113ab
	P	6.28±0.23ab	3.67±0.38ab	1.3c	0.15ab	1.71b	686ab

*Means within same column followed by the same letter(s) are not significantly different at the 0.05% level of probability and Symbol (C)- *Cynodon dactylon* (L.) and (P)- *Parthenium hysterophorus* (L.).

Table 3: Inhibition effect in seed germination rate and growth parameters in Chickpea in different concentrations of leaf extract of *Cynodon dactylon* (L.) and *Parthenium hysterophorus* (L.).

Treatments	Plant species	Seed germination(%)	Root length (cm)	Shoot length (cm)	SVI
25%	C	-11	-0.94	1.02	-194
	P	-18	0.14	-1.86	-470
50%	C	-15	0.60	1.33	-110
	P	-20	-1.61	-1.99	-654
75%	C	-16	0.11	-0.66	-339
	P	-21	-3.78	-2.65	-892
100%	C	-18	-3.8	-0.89	-714
	P	-31	-5.77	-2.55	-1141

From the present investigation it can be concluded that, the aqueous leaf extract of *Parthenium* and *Cynodon* at different concentrations was observed to have a significant inhibitory effect on the seed germination percentage, root and shoot length and fresh and dry weight of seedling of chickpea. The allelopathic effect of *Parthenium* leaf extracts was observed to have a more inhibitory effect on seed germination,root and shoot length, fresh and dry weight of chickpea as compared to leaf extract of *Cynodon*. Present study also observed that the inhibition depends on the concentration of two tested weed extracts, if increasing concentration the inhibitation is strong and decreasing the concentration is less inhibition of seed germination and seedling growth.

For overall conclusion, *Parthenium* and *Cynodon* leaf was identified as harmful leaf as these leaves resulted in lower germination and seedling vigour due to the presence of many lethal allelochemicals. Therefore, in the presence of *P.hysterophorus* and *C.dactylon* in chickpea fields should be from early stage to removal of these weeds, to avoid the losses of poor germination and seedling vigour. All the experimental results were observed under laboratory environmental conditions. Therefore future studies under field conditions will investigate the inhibitive effects of these weeds against the chickpea and also to study the management of weeds by using bio-herbicides.

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