Allelopathy effect of aqueous extracts of *Arum cyreniacum* on germination of seeds of some leguminous crops

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Abstract: *Arum cyreniacum* herbs are distributed close to agricultural crops, especially in AlJabal Al-Akhdar region. therefore, This study aimed of testing an allelopathic effect of aqueous extracts of (leaves and tubers) of *Arum cyreniacum* at a concentration (10, 20 and 40%) on germination of seeds of some leguminous crops plants (*Lens culinaris*, *Cicer arietinum*, and *Lupinus albus*). The results showed that there were highly significant differences in germination percentage reduction between aqueous extracts and concentrations compared with control. Where extracts of leaves were superior in recording the largest inhibition ratios compared to tubers extract, as all tested concentrations significantly decreased germination percentage except for a concentration of 10% for *Lens culinaris* and *Cicer arietinum* plants with germination percentage (100%),with a delay an average time of germination, and was a concentration of 40% is the most toxic in inhibiting the growth of all seeds tested. The results also noted that all extracts with their concentration led to a reduction in radical and plumule length of all seeds tested.*Lens culinaris*, *Cicer arietinum* were the most leguminous types resistant of aqueous extracts, while *Lupinus albus* were the most sensitive.

Introduction

Legumes (Fabaceae) are the third largest family of angiosperms (Lewis *et al*., 2005). Take a vital put within the conventional diets all through the World (Malaguti *et al*., 2014). They provide a range of essential nutrients including protein, carbohydrates, dietary fibre, minerals and vitamins. (Kouris-Blazos and Belski, 2016), contribute to diminishing the emanation of greenhouse gases(Stagnari *et al*., 2017), their capacity to advantageously fix nitrogen and progress soil richness(Smýkal *et al*., 2020). The Legumes crops are exposed to competition from many weeds and wild plants that show an inhibitory effect that limits their productivity (Ebid, 2016). For example, showed the study (Khan and Khan, 2015) the aqueous extract of *Datura alba* caused a significant decrease in the germination percentage, the plumule length and the radical for three *Cicer arietinum* cultivars. In addition, it was observed the number of seedlings developing of *Ceratonia siliqua* decreased in the regions where *Satureja thymbra* L. grows (Masoud and Abugarsa, 2018), Moreover, It was observed that *Vicia faba* and *Phaseolus vulgaris* were affected by *Solanum nigrum* extracts (Ismaiel and Salama, 2021). this inhibitory effect is due to the effect of chemical compounds secreted from the plant (Allelochemical), this phenomenon is known as Allelopathy, it is considered as a competitive

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means to weaken, prevent or stimulate growth of neighbouring plants (Salih and Abdulrraziq, 2020).

Arum cyreniacum, is a tuberous annual herb belonging to the (Araceae) family, used for food and medicinal purposes, endemic to Cyrenaica region near agricultural lands, especially, Al-Jabal Al-Akhdar region - Libya (Abdulrraziq and Salih, 2020).

This study aimed of testing an allelopathic effect of aqueous extracts of leaves and tubers of *Arum cyreniacum* at a concentration (10, 20 and 40%) on germination of seeds of some leguminous crops.

Materials and Methods

Samples of *Arum cyreniacum* (leaves- tubers) were collected from of Al-Bayda city, washed with distilled water, and then dry under natural conditions, grind with an electric grinder, and finally preserving for use.

Seed selection:

The seeds of the homogeneous leguminous(*Lens culinaris*,*Cicer arietinum*and *Lupinus albus*) were selected, cleaned of impurities, and viability was tested by soaking in distilled water to get rid of empty seeds floating on the surface, were soaked in 1% sodium hypochloride solution for 3 minutes, washed withdistilled water (Dafaallah *et al*., 2019).

Aqueous Extraction:

The aqueous extract (leaves- Tubers)was prepared separately by adding 100 g of air-driedpowder to 500 ml of distilled water for 24 h, after thatthe extract was filtered through filter paper and placedon a Shaker for 24 hours. Then it was centrifuged at thespeed of 2000 rounds per minute for 15 minutes. Theextract was passed through Whatman filter paper No.1.The obtained extract concentration was considered as thestock solution (100%) (Masoud and Abugarsa, 2018). Then it wasappropriately diluted with distilled water to give finalconcentrations of 10, 20 and, 40%.

Test for Extracts:

Normally, 10 seeds per each Petri dish, were lined with two Whatman No.1 filter papers, incubated at room temperature, each treatment was repeated three times, dishes were subjected to daily observation for 10 days and follow-up of germination in terms of addition of extracts to the treated dishes. add distilled water to Control as needed for each dish (Othman *et al*., 2018),

Germination was calculated by recording a number of germinated seeds in all treatments starting from second day, which the first germination occurred, germination criterion is appearance of radical outside seed cover (Ganatsas *et al*., 2008), at end of the experiment took final results of following qualities :

Germination percentage (PG %) = number ofgerminated seeds / total number of seeds × 100 (Yousif*et al*., 2020).

Mean germination time (MGT) = the total numberof germinated seeds per day / total number of germinatedseeds at end of the experiment (Das *et al*., 2017).

radical and plumule lengths : The root and feather lengths were taken using a graduated ruler, and the averages were calculated by taking 5 seedlings from each plate.

Statistical Analysis:

The study experiences were designed according tothe completely randomized (CRD). Statistical analysiswas performed using Minitab 17 program and ANOVAvariance analysis tables. The averages were comparedusing Tukey's test at P <0.05

Results:

The results of this study showed to aqueous extracts of *Arum cyreniacum*, have high inhibitory activity in reducing germination percentage, radical and plumule Length, with increasing the average germination time of *Lens culinaris*, *Cicer arietinum*, and *Lupinus albus* seeds, after 10 days from the start of the experiment, compared to control.

The data recorded in the table (1, 2 and 3) that the concentration of 10% of leaves and tubers extract had no inhibitory effect on a germination percentage of *Lens culinaris*, *Cicer arietinum*, but caused a clear delay in the average germination time, While this percentage decreased from (100%) for control to (10, 43%) for *Lupinus albus*, respectively. while decreasing germination percentage with increasing the concentrations, where a concentration of 20 % of leaves and tubers extract recorded germination percentage (70, 90%) of *Lens culinaris*, and (76, 80%) of *Cicer arietinum*, respectively. No germination of *Lupinus albus* appeared at a previous concentration of leaves extract while giving a germination percentage (30%) of tubers extract. The concentration of 40 % of leaves and tubers extract recorded germination percentage (16, 40%) of *Lens culinaris*, and (50, 63%) of *Cicer arietinum*, respectively, No growth of *Lupinus albus* appeared at a previous concentration. The results also showed that all concentrations caused a clear delay in the average germination time on all leguminous seeds, The corresponding allelopathy effects on radical and plumule length were recorded. Data demonstrated that the radical and plumule length decreased significantly upon applying different concentrations of the extracts, especially, at 20, 40% which did not show any germination of plumule.

Table(1): Effect of *Arum cyreniacum* extracts on germination of *Lens culinaris* seeds.

extract	cont	germination	mean	Radical	shoot
Leaves	10	100 a	4.5 c	1.5 d	4.7 b
	20	70 b	6.3 b	0.5 e	0.6 d
	40	16 d	7.3 a	0.3 e	0.0 d
Tubers	10	100 a	3.9 c	4.1 b	5.3 b
	20	90 a	5.8 b	2.5 c	3.4 c
	40	40 c	7.4 a	0.5 e	0.0 d
Control		100 a	1.3 d	12.6 a	11.3 a

Table(2): Effect of *Arum cyreniacum* extracts on germination of *Cicer arietinum*seeds:

extract	cont	germination	mean	Radical	shoot
Leaves	10	100 a	6.2 c	1.8 c	2.7 c
	20	76 b	7.0 bc	0.8 cd	0.0 d
	40	50 d	8.5 a	0.5 d	0.0 d
Tubers	10	100 a	6.0 c	3.0 b	4.5 b
	20	80 b	7.0 bc	2.1 bc	0.0 d
	40	63 c	7.6 b	0.9 cd	0.0 d
Control		100 a	1.7 d	9.0 a	7.5 a

Table(3): Effect of *Arum cyreniacum* extracts on germination of *Lupinus albus*seeds.

extract	cont	germination	mean	Radical	shoot
Leaves	10	10 d	8.5 a	2.0 c	0.0
	20	0 e	0.0 d	0.0 d	0.0
	40	0 e	0.0 d	0.0 d	0.0
Tubers	10	43 b	7.0 b	5.0 b	0.0
	20	30 c	8.0 a	1.7 c	0.0
	40	0 e	0.0 d	0.0 d	0.0
Control		100 a	2.8 c	10.0 a	0.0

Discussion:

Weeds and wild present around the fields exert their allelopathic influence on agricultural crops, allelopathic chemicals may be distributed broadly among organs such as seeds, flowers, pollen, leaves, stems, and roots, or sometimes found in just one or two of such organs (Hayyat *et al*., 2020; Zeng *et al*., 2008).

due to the lack of research about the allelopathic activity of *Arum cyreniacum*, this study was conducted, which showed that the aqueous extracts of leaves and tubers of *Arum cyreniacum* have an allelopathic effect against germination of *Lens culinaris*, *Cicer arietinum*, and *Lupinus albus*, where all different concentrations significantly reduced the germination percentage, except for the concentration 10% to *Lens culinaris*, *Cicer arietinum*, although caused a clear delay in an average germination time. The results also showed that all extracts (tubers - leaves) in all concentrations led to a clear significant reduction in radical and plumule lengths. This may be due to *Arum cyreniacum* extracts contain: Cyanogenic glycosides Sterols, Alkaloids, Calcium oxalate, p-coumaric acid, Terpenes, Caffeic acid, Flavonoid (Ben-Ramadan *et al*., 2012; Abdel-karim *et al*., 2018), which inhibit the germination of seeds and seedlings, by preventing seed water impregnation, disrupting hydrolysis of nutrients to an embryo (Ullah *et al*., 2015), or disrupting gibberellic hormone, stop stimulates amylase production (Aghajanzadeh *et al*., 2007), or inhibiting DNA synthesis, cell division (Haroun and Abualghaith, 2015). The results also indicated that the largest inhibitory rates were for leaves extract compared to tuber extract, *Lens culinaris*, *Cicer arietinum* was the most resistant to aqueous extracts, while *Lupinus albus* was the most sensitive.

Conclusion

This study concludes that aqueous extracts of *Arum cyreniacum* have an inhibitory effect of weakens or suppressing the growth of some agricultural crops. Leaves extract was the most toxic comparison to tubers extracts. *Lens culinaris*, *Cicer arietinum* was the most resistant to all extracts. Therefore, this study recommends excluding *Arum cyreniacum* from agricultural lands, because their residues cause clear inhibitory effects to prevent germination, reduce crop productivity.

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