Phytotoxicity of Ecbalium elaterium(L.) A. Rich on seed germination and root elongation of radish

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Abstract

Phytotoxicity of aqueous extracts of *Ecbalium elaterium* (L.)A.Rich. was evaluated on seed germination , root length , fresh and dry weight of t *Raphanus sativus* L. Target species were grown on Petri dishes supplemented with 5ml of aqueous extract prepared at concentration of 1 , 5 and 10 g/100ml extracted from leaves , stems , Roots and fruits of the plant .The results show that aqueous extract of plant parts of Ecbalium inhibited seed germination in radish at all concentration , while they increased it at 1% of aqueous extract of fruits. The results also show inhibition of root length in radish at all concentration , while they stimulated at 1% of aqueous extract of fruits .In radish the result shows that both concentration 5% and 10% of Ecbalium parts decreased total fresh weight but 1% concentration increase total fresh weight of the same plant. In radish total dry weight decreased at both concentration 5% and 10% of fruits, stems and leaves extracts while increased at 1% in all plant parts and 1% and 10% of roots extract . Finally the obtained results reported in this thesis suggests that Ecbalium can cause grate losses in crop yield through it is release of allelochemicals that can inhibit seed germination and seedling development . On the other hand allelochemicals produced by that plant may be used as natural pre-emergence herbicides to control many weeds in crop fields.

Key words: Aqeous extract - Ecbalium elaterium .

1.introduction

Ecbalium elaterium also called squirting cucumber or exploding cucumber belongs to the cucurbitaceae family . The plant is typical in the Mediterranean countries. The plants grows on uncultivated lands . *E.elaterium* is a perennial herbaceous , crawling plant . It is in flower from June to August The plant is self-fertile. The ripening fruits becomes pumped full of liquid, leading to an increase in pressure. Grows best in a rich soil and can grow in nutritionally poor soil. It cannot grow in the shade.(PEAF, 2015) . the plant is cultivated for it is uses as a medicinal plant.(PEAF, 2015) The squirting cucumber has been used as a medicinal plant for over 2,000 years, though it has a very violent effect upon the body and has little use in modern herbalism . All plant parts are extremely poisonous and the active compounds include cucurbitacins types (B, D, E, I, L and R) and other cucurbitacin types as well as several phenolics and glcosylated compounds (Jaradat *et al* ., 2012) ,adding to glycosyl cucurbitacin and 3,8 exanor cucurbitacin.

Information on the phytotoxic properties of the plant are limited and to explore phytotoxic potential of *Ecbalium elaterium* we will examine its effect on different aerial part aqueous extract on seeds germination and seedling growth of radish . several recent activities suggested that Phytotoxicity test with seed germination and root elongation of higher terrestrial plants were a valuable part of ecotoxicology (Wang, 1991) . Germination rate and root elongation , as a rapid phytotoxicity test method, possess several advantages, such as sensitivity, simplicity, low cost and suitability for unstable chemicals or samples . These advantages made them suitable for developing a large-scale database and especially applicable for developing quantitative structure -activity relationship QSAR to study mechanisms of phytotoxicity. (Wang *et al*., 2001)

2. Materials and methods

The experiments were conducted either under controlled conditions (growth chamber conditions", GALLENKAMP, designed and produced by Howard johns limited , Derby , England) at the department of botany, faculty of science , university of Benghazi , as stated for individual experiments. Seeds were obtained from local market , and used through the experiment, this table shows the English names, scientific names family names.

English names	Scientific names	Family names
Cucumber	(L.) *Cucumis sativus*	Cucurbitaceae
Radish	(L.) *Raphanus sativus*	Brasicaceae

Stock solution of used plant were prepared from each individual from plant part fruit, stem , leaves and roots and made up to desired volume with distilled water to give the final concentrations 1,5, 10 g /ml .

Seeds were treated by sowing them in 9-cm Petri dishes contain fitter paper moistened with an aqueous extract of plant part in a known volume of parts of plant extract as stated for individual experiments .

Growth chamber condition

The plant grown in Growth chamber condition for germination at 25 c dark and relative humidity 65 %.

Measurement of development

A variety of parameters were used in this study to assess the effects of E.elaterium exacts on seed germination and root length of tests species. these parameters included

Germination percentage

%Germination = no. of germinated seeds/total number of seeds*100

Length of roots

Length of roots were measured in mm using a ruler .

Fresh weight:

The fresh weight of the whole plant or it's shoot or root were recorded by weighing small tins.

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Dry weight :
Samples were dried for 24 hours in an oven at 65c ,the tin were removed from the oven closed allowed to cool and weighed .
Text processing and graphics the thesis was prepared on the computer

Statistical treatment of data (Statistical methods used in the study):
This study is based on descriptive statistics in data analysis , inferential statistics, and then dump the data, and processing for statistical analysis using the SPSS program and called statistical package for social sciences which is an abbreviation for the word Statistical Package For Sociality science Statistical methods were used following:
• The use of descriptive statistics, and extract the arithmetic mean.
•inferential statistics were used to test the moral differences.
Using analysis of variance(ANOVA)and posttest (LSD)to deviate in favor of the differences.


3 Results

3.1 Effect of different concentrations of plant parts on seed germination of radish:
The results revealed that the germination of radish was the most sensitive at10% , followed by 5% and1% of roots extract. The germination of radish was the most sensitive at 10%(no germination) followed by 5% and 1% of leaves extract. The germination of radish was the most sensitive at5% and 10%(no germination) followed by 1% of stems extract. The germination of radish was the most sensitive at 5% and 10%(no germination) but increase germination at1% of fruits extract.(fig .1) When data subjected to statistical analysis showed that there were significant differences in seed germination of radish between control and concentrations of *E.elaterium* parts .

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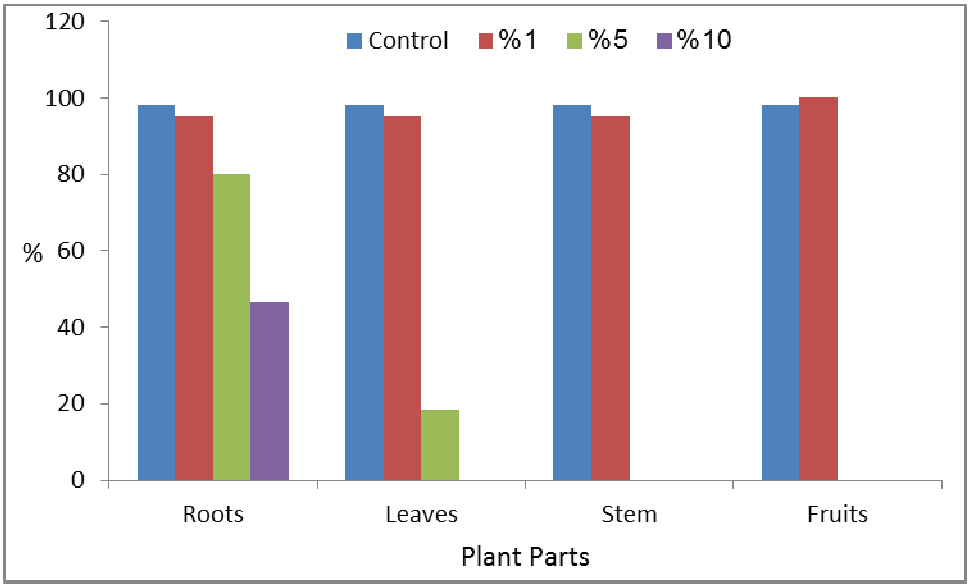


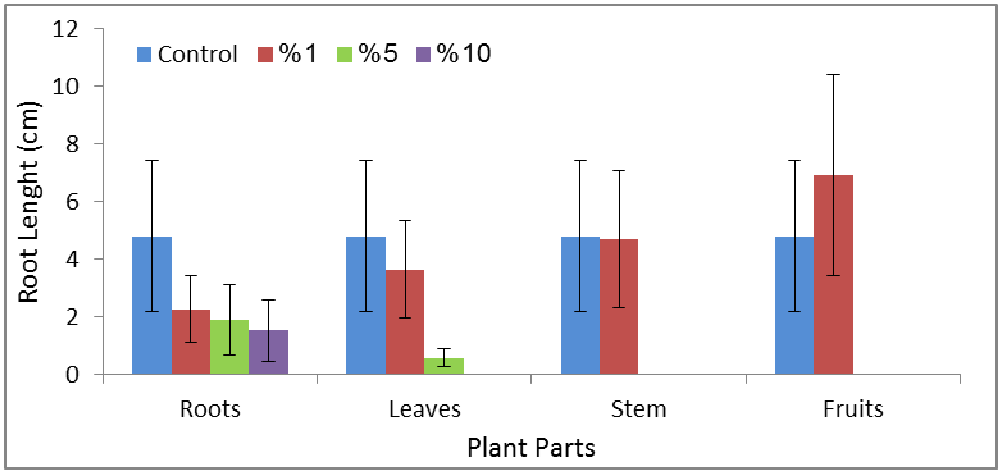
Fig. (1). Effect of different concentrations of *E.elaterium* parts on seed germination of *Rhaphanus sativus* L.

Table (1). Effect of different concentrations of *E.elaterium* parts on seed germination of *Rhaphanus* sativus L.

Treatment	Germination percentage %			
	Control	1%	5%	10%
Roots	98.0	95.00	80.00	46.66
Leaves	98.0	95.00	18.33	-
Stem	98.0	95.00	-	-
Fruits	98.0	100.0	-	-

3.2 Effect of different concentration of plant parts on root length of radish :

It can be noted from (fig. 2) that the roots extract had more effect on root length of radish at10% ,compared to5% while 1% had the least effect on root length of radish . The leaves extract on the other hand had more effect at 10% (no roots) compared to 5% and1% wich had the least effect on root length of radish. The stems extract had more effect on root length of radish at5% and 10% (no roots) compared to 1%. The fruits extracts had more effect on root length of radish at 5% and 10% (no roots length) in comparison with1% extract which increased the root length of radish . when data subjected to statistical analysis showed that there were significant differences in root length of radish as a result of *E.elaterium* parts treatments between control and the concentration we used 1%,5%,10% of all plant parts of *E.elaterium*.



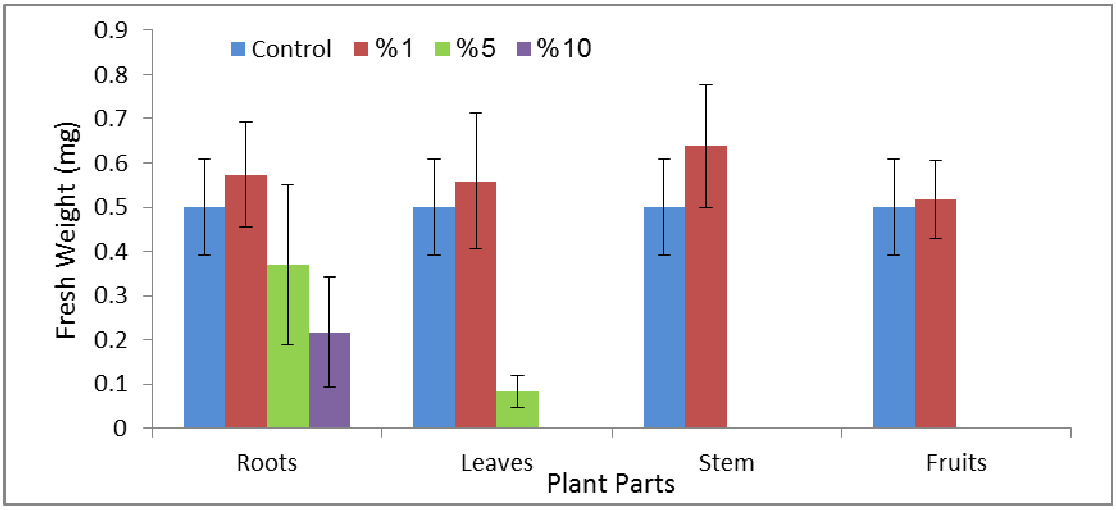
Fi g (2). Effect of different concentrations of *E.elaterium* parts on root length of *Rhaphanus* sativus L.

Table (2). Effect of different concentrations of *E.elaterium* parts on root length of *Rhaphanus* sativus L.

Descriptives									ANOVA	
Treatment	Mean				Std. Deviation					
	Control	1%	5%	10%	Control	1%	5%	10%	p-vales	L.S.D
Roots	4.78	2.251	1.871	1.517	2.62	1.16	1.22	1.07	0.000	A>B* A>C* A>D* B>D*
Leaves	4.78	3.635	0.563	-	2.62	1.68	0.313	-	0.000	A>B* A>C* B>C*
Stem	4.78	4.701	-	-	2.62	2.380	-	-	0.041	A>B*
Fruits	4.78	6.930	-	-	2.62	3.49	-	-	0.001	B>A*

3.3 Effect of different concentrations of plant parts E.elaterium on fresh weight of radish:

The effect of E.elaterium parts at different concentrations 1%,5%,10% on fresh weight of radish are shown in (fig .3) . Statistical analysis shows that there were significant differences in fresh weight of radish which treated with different concentrations of *Ecbalium elaterium* parts except fruits there were no significant differences at all used concentrations compared to control.

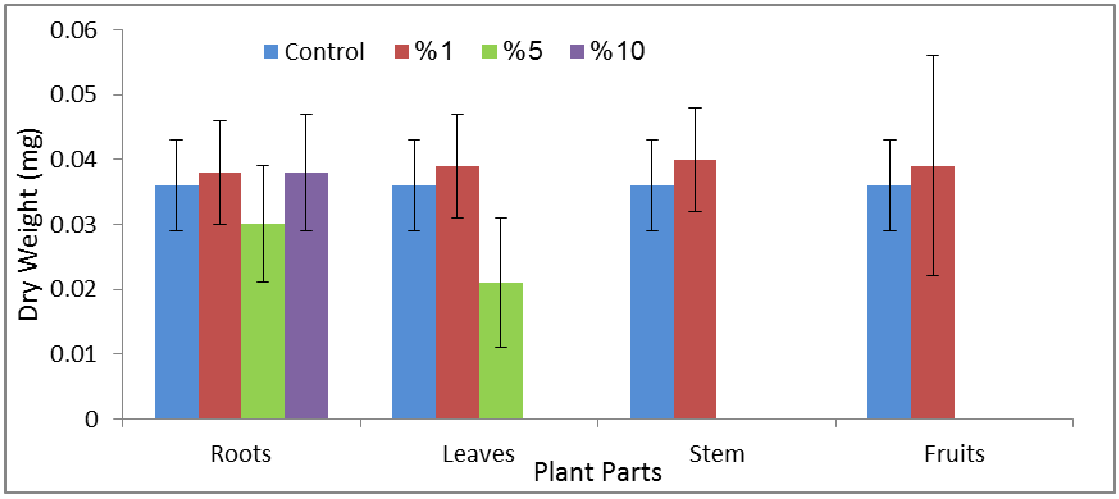


Fi g (3). Effect of different concentrations of *E.elaterium* parts on fresh weight of *Rhaphanus sativus* L.

Table (3). Effect of different concentrations of *E.elaterium* parts on fresh weight of *Rhaphanus* sativus L.

Descriptives									ANOVA	
Treatment	Mean				Std. Deviation					
	Control	1%	5%	10%	Control	1%	5%	10%	p- vales	L.S.D
Roots	0.500	0.573	0.371	0.217	0.108	0.119	0.181	0.124	0.000	A>D* B>C* B>D* C>D*
Leaves	0.500	0.559	0.083	-	0.108	0.154	0.037	-	0.000	A>C* B>C*
Stem	0.500	0.638	-	-	0.108	0.139	-	-	0.006	B>A*
Fruits	0.500	0.518	-	-	0.108	0.088	-	-	0.093	-

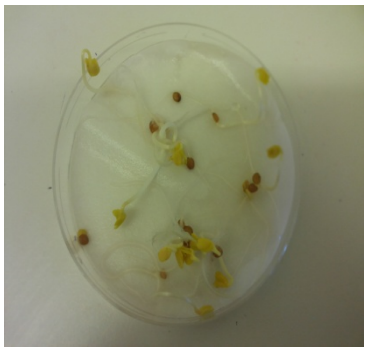
3.4 Effect of different concentrations of plant parts E.elaterium on dry weight of radish:-
The effect of E.elaterium parts at different concentration (1 %, 5%,10 %) on dry weight of radish are shown on (fig .4) . Statistical analysis shows that there were no significant difference in dry weight of radish which treated with different concentration s of E.elaterium parts except leaves it was decreasing significantly at all used concentrations compared to control .



Fi g (4). Effect of different concentrations of *E.elaterium* parts on dry weight of *Rhaphanus* sativus L.

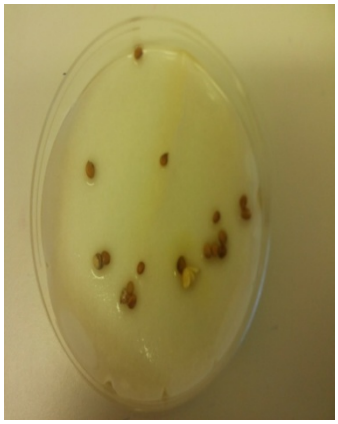
Table (4). Effects of different concentrations of *E.elaterium* parts on dry weight of *Rhaphanus sativus*

Descriptives									ANOVA	
Treatment	Mean				Std. Deviation					
	Control	1%	5%	10%	Control	1%	5%	10%	p- vales	L.S.D
Roots	0.036	0.038	0.030	0.038	0.007	0.008	0.009	0.009	0.081	-
Leaves	0.036	0.039	0.021	-	0.007	0.008	0.010	-	0.009	A>C* B>C*
Stem	0.036	0.040	-	-	0.007	0.008	-	-	1.000	-
Fruits	0.036	0.039	-	-	0.007	0.017	-	-	0.251	-

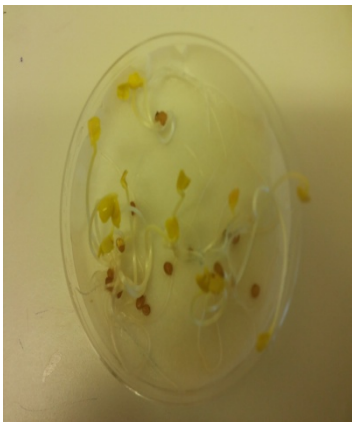


control

Roots 10%



Roots 5%

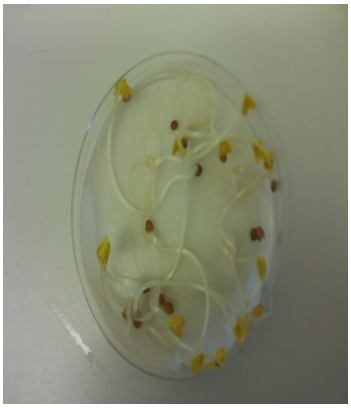


Roots 1%

Leaves 10%

Leaves 5%

Leaves 1%


stems %10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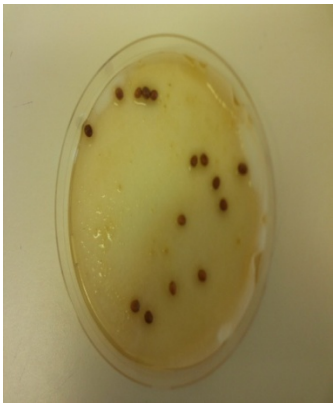
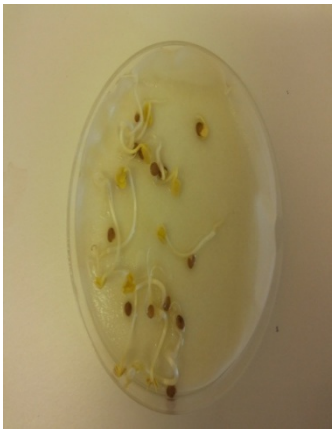
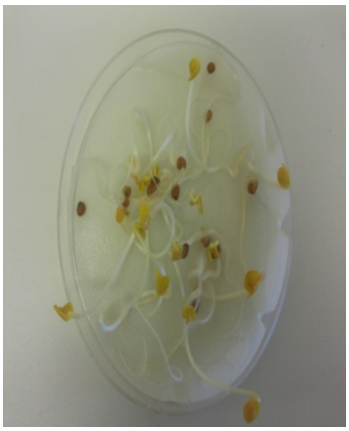
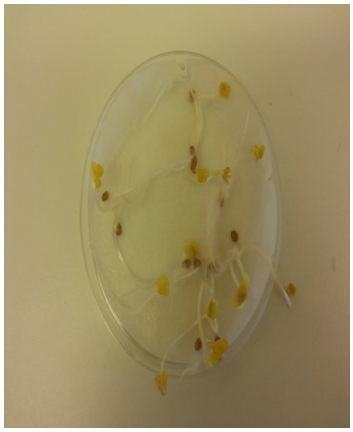

stems%1


Fruits 10%


Fruits 5%


Fruits 1%

Effects of different concentration of different plant part on seedling growth of radish

4. Discussion

Investigations were carried out with an aim to study phytotoxic potential of *E.elaterium* L. on seed germination and root elongation of radish (*Raphanus sativus* L.) as test plant .
Investigations were carried out under laboratory conditions . The result obtained were discussed here in this chapter.

4.1 Phytotoxic effects of E.elaterium L. aqueous extracts on seed germination and seedling development of radish:

The results showed that seed germination ,root elongation ,fresh and dry weight of seedlings were significantly reduced compared to control , especially by extracts at 10% and 5% concentrations from all plant parts . Dellapenna *et al.* (2009) ; Al-jbory *et al.* (2012) also found that *S.oleraceus* root extracts inhibit germination and decrease dry weight of wheat. These results suggest that Phytotoxicity of *E.elaterium* depend on extract concentration.

The inhibition on most traits increase with the increase extract concentration Islam and Noguchi (2013) also indicated that the growth restriction of cress and Italian ryegrass were more clearly observed with increasing concentration of allelopathic compounds . Hossain and Alam (2010) were found greatly inhibited of root lengths of some crops with the increase of the extract concentration of *Lantana camara* leaf extract.
On other hands our results showed stimulatory effects at lower concentration (1%) of fruits extracts on radish seeds on all parameters that is agree with Ismail and Chong (2002) who believe that allopathic materials in low concentration may be have positive or negative effect on plant growth while ; in higher concentration have only inhibitory (negative) effect . The results are in accordance with other studies which reported that the potential allelopathic may vary among plant parts (Economou et al., 2002 ; Ashrafi et al., 2008). In general extract of *E.elaterium* L. stem recorded highest inhibitory effect at all concentrations , while the lowest inhibitory effect recorded on root extract compared to control and to other extract , because roots always showed very low initial phytotoxic level (Bonanomi et al.,2005).

Conclusion

The present study was conducted to investigate the phytotoxic effect of squirting cucumber (*Ecbalium elaterium* L.) growing in Benghazi agricultural fields on seed germination and seedling growth of radish (*Raphanus sativus* L.) leaves, stems, fruits and roots aqueous extracts of *Ecbalium* at 1%, 5% and 10% concentrations were applied to determine their effect on seed germination , root elongation , seedling fresh weight , seedling dry weight. Of tested plant under conditions. The aqueous extracts of *E, elaterium* parts under study caused inhibitory effect on all measurement which increased progressively on in increasing the concentration of *E, elaterium* plant parts extracts. On the other hand at low concentration (1%) stimulation of some traits of different plant parts of E, elaterium was recorded . these result could be explained in the flight of the facts that a higher plants release diversity of allele chemicals into the environment , which include phenolics, alkaloids. Long chain fatty acid , terpenoids and flavanoids (Rice ,1984) the compounds exhibit a wide range of mechanisms of an action , effect on DNA (alkaloids) phytosynthic and mitochondrial function (quinines), phytohormone activity ion uptake and water balance (phenolics) (Inderjit, 2002).

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الخلاصة

السمية النباتية للمستخلصات المائية لنبات *Ecbalium elaterium* L. المعروف في ليبيا بفقوس الحمير أو بلحة بن جحا تم تحديدها من خلال إنبات البذور , تطاول الجذر , الوزن الرطب والجاف لنوع من النباتات تحت الدراسة هو الفجل *Raphanus* L. زرعت البذور الهدف في أطباق بتري وتم إضافة 5 مل من المستخلص النباتي الذي تم تحضيره بتراكيز 1 % ، 5% و 10 % لكل من الأوراق السيقان و الجذور و الثمار للنبات. أظهرت النتائج أن المستخلصات المائية للأجزاء النباتية للنبات ثبطت من إنبات بذور الفجل عند كل التركيزات بينما ازداد إنبات البذور عند تركيز 1 % من المستخلص المائي . كما أظهرت النتائج تثبيط لطول الجذر في الفجل عند كل التركيزات بينما أظهرت تحفيز عند تركيز 1% من المستخلص المائي للثمار . في الفجل أظهرت النتائج ان كل من تركيز 5% و 10% لأجزاء النبات خفضت من الوزن الرطب الكلي بينما تركيز 1 % زاد من الوزن الرطب الكلي لنفس النبات. في الفجل الوزن الجاف الكلي انخفض عند تركيز 5% و 10% من مستخلصات الثمار , السيقان و الأوراق بينما زاد عند تركيز 1% لكل الأجزاء النباتية وعند 1% و 10% من مستخلص الجذور. أخيرا فإن النتائج المتحصل عليها و المسجلة في هذه الرسالة بينت أن النبات الذي تم اختباره يمكن ان يسبب في خسائر كبيرة في إنتاج المحاصيل من خلال إطلاقه لكيمياويات مثبطة للنمو و التي يمكن أن تثبط إنبات البذور وتطور البادرات. من ناحية أخرى فإن المواد الكمياوية المنتجة بواسطة هذا النبات يمكن استخدامها كمبيدات حشائش لمقاومة العديد من الأنواع الأخرى في الحقول الزراعية .