



Response of Wheat Seedlings (*Triticum aestivum* L.) to Aqueous Fenugreek Seed Extract

Mohamad Abd Almuhsen ^{1*}, Jasim Abdullah Hayawi ²

¹⁻² Plant Production Techniques, Agricultural Technical College, Northern Technical University, Iraq

* Corresponding Author: **Mohamad Abd Almuhsen**

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Abstract

Study was conducted in laboratories of Technical Agricultural College/Mosul with aim of identifying effect of aqueous extract of ground and unground fenugreek seeds on some growth characteristics of wheat seedlings. Petri dishes with diameters of (9) cm containing filter paper were used to plant seeds at a rate of (10) seeds per dish using completely randomized design (CRD) and with three replicates after adding (10) ml of the two extracts in addition to the comparison treatment (distilled water) . After (21) days, data were recorded and statistically analyzed using the computer according to SAS program. Different averages were distinguished by different letters of the alphabet. Results were as follows:

Aqueous extract of unground fenugreek seeds was significantly superior to the rest treatments in the trait of shoot length, as the length reached (13.86, 11.03, 17.70) cm for the three treatments, respectively. Also, in the length of root system, as it reached (14.4, 7.6, 19.4) cm, in addition to significant superiority in both the wet and dry weight seedlings (11.46, 10.50, 14.54) mg and (4.06, 3.40, 3.16) mg, respectively. Aqueous extract of ground fenugreek seeds caused a significant decrease in the average number of roots wheat seedlings, as the number reached (3.83, 2.36, 3.60) roots for the three treatments, respectively.

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1. Introduction

Wheat (*Triticum aestivum* L.) is an important strategic crop as it is a basic food item in human nutrition, in addition to containing a high percentage of essential carbohydrates that provide the body with calories (Wahid *et al.*, 2017) ^[17]. It has been called the queen of cereal crops belonging to the Poaceae family (Wolde, 2019) ^[18]. McGee (2003) ^[13] noted that fenugreek (*Trigonella foenum-graecum* L.) is classified as a self-pollinating annual herbaceous winter plant, and has the ability to fix atmospheric nitrogen through bacterial nodules on its roots, as it belongs to the legume family, which is characterized by this trait. Fenugreek is cultivated in many countries, including the Mediterranean countries, India, and China, in addition to its presence in southern Europe (Shapiro and Gong 2002) ^[16]. Dwivedi *et al.*, (2006) ^[7] added that fenugreek has multiple uses. It is used as a spice in many countries, and it decorates the table as a vegetable. There are varieties of it that can be considered animal feed (Dwivedi *et al.*, 2006) ^[7]. Mehrafarin *et al.* (2011) ^[14] confirmed that fenugreek has many therapeutic and preventive properties, so it is prescribed to treat stomach ulcers, atherosclerosis, and diabetes. It is also an antibacterial and pain reliever (Al-Baldawi *et al.*, 2014) ^[2]. Recently, it has become important in the field of antibiotics and the accompanying stimulation or inhibition of plant growth (Al-Hadwani, 2004) ^[3]. Plant extracts (aqueous and alcoholic) are natural compounds that can be obtained from different plant parts such as leaves, flowers, fruits and seeds.

These compounds usually contain active ingredients that can be used in different fields (fertilizers or herbicides) , and It is described as harmless to the environment, humans and animals, in addition to being inexpensive to prepare and decomposing quickly in the soil due to microorganisms and environmental factors, but it may not be available year-round as it is a seasonal plant (Al-Omar and Al-Abdali, 2022) [4].

Aim research identify allelopathic effect of aqueous fenugreek seed extract on growth wheat seedlings.

Materials and methods

Research was conducted in the laboratories of the Agricultural Technical College using Petri dishes with a diameter of (9 cm). Research included planting wheat seeds in the aqueous extract of ground and unground fenugreek seeds, in addition to the comparison treatment (distilled water). Extract was prepared by taking (200) grams of each of ground and unground fenugreek seeds and mixing them in (1 liter) of distilled water with continuous stirring for (3) hours , Sample is then left for (24-48) hours, then filtered using filter paper (Wattman No. 2) to get rid of sediment, after which the volume is completed to (1) liter and stored in the refrigerator until use (Al-Aryani *et al.*, 2017). Wheat seeds were planted in Petri dishes containing filter papers at a rate of ten seeds per dish using a completely randomized design (CRD) and with three replicates, after adding (10 ml) of extracts and distilled water. After (21) days, data were recorded for the following characteristics: average shoot length (cm), average root length (cm), average number of

roots, average seedling wet weight (mg), average seedling dry weight (mg). Data were analyzed using a computer according to SAS program, and different averages were distinguished by different letters of alphabet according to Duncan's multiple range test at a probability level of 5%.

Results and Discussion

Coleoptile Length (cm)

Coleoptile is one of components of embryo that emerges above the soil surface after its emergence, thus forming the vegetative group whose role is represented in the process of photosynthesis (Issa, 1990) [11]. From table (1), figure (1), clear difference in length of frond of wheat seeds appears when fenugreek extract differs compared to comparison treatment, unground fenugreek extract achieved a significant increase in the average length of shoot by (21.69, 37.68) % compared to control treatments and ground fenugreek extract. Reason for this may be attributed to the unground fenugreek extract containing some substances that act as regulators, which causes an increase in cell division and elongation, which is positively reflected in length of shoot (Farooq *et al.*, 2012) [8]. Results of same figure show a significant decrease in the average length of frond of wheat seeds when using ground fenugreek seed extract compared to the two control treatments and the unground fenugreek extract. Reason for this may be that the ground fenugreek seed extract contains some substances that can act as growth-inhibiting compounds such as abscess ion (Al-Rubaie and Abis, 2017) [5].

Table 1: Effect of extract on average length of Coleoptile

Trait	Treats		
	Distilled Water	Ground Fenugreek	Uground Fenugreek
Coleoptile (cm.)	13.86 b	11.03 c	17.70 a

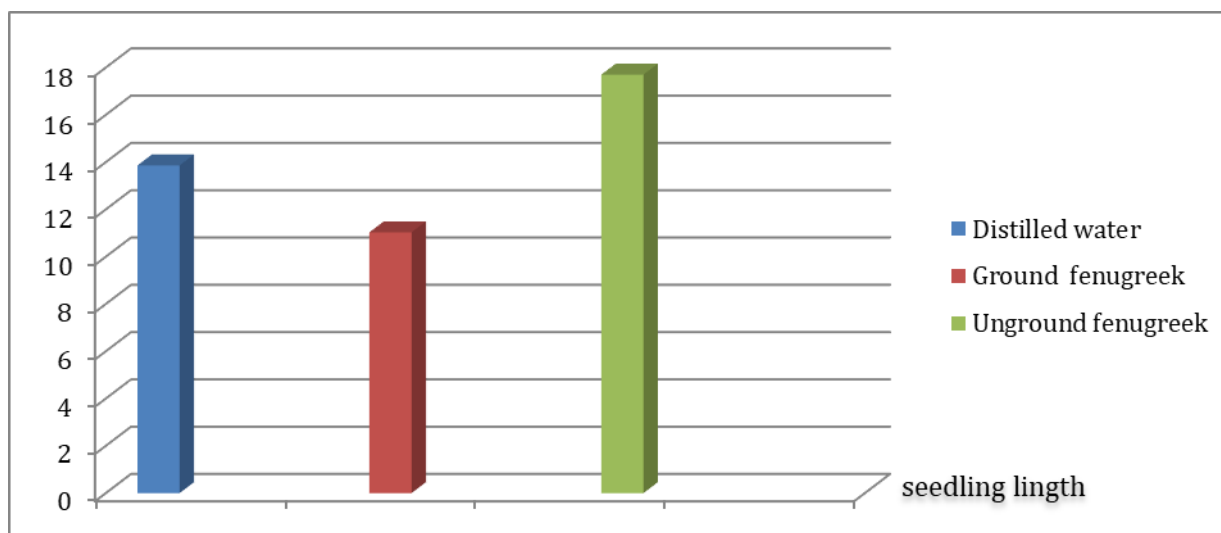


Fig 1: Length of Coleoptile (cm)

Root Length (cm)

Most plants, roots perform four important functions: absorbing water and nutrients necessary for growth and production, anchoring plant in soil, and storing materials. Although all of aforementioned functions are important, first function is the most important (Ahmed, 1984) [1]. From table (2) , figure (2), it is clear that characteristic length of root system of wheat seeds followed the same behavior as the

characteristic of length vegetative system when the treatments of ground and unground fenugreek extract differed compared to the comparison treatment, as the treatment of unground fenugreek extract significantly outperformed two treatments of comparison and the ground fenugreek extract, with an increase rate of (25.77 and 60.82)%. This may be due to fact that unground fenugreek extract may contain substances that behave like some growth regulators, which

leads to an increase in the rate of cell division and elongation, which results in an increase in length of vegetative system (Farooq *et al.*, 2012) [8]. Results also show a significant decrease in average length of root system when treated with ground fenugreek extract, as the average length for the three treatments was (14.4, 7.6, 19.4) cm., respectively. Reason for this decrease may be attributed to the fact that the ground

fenugreek seed extract contains some growth-inhibiting substances, including saponins and tannins, which negatively affects length root system (Hayawi and Sultan, 2023) [10]. This in turn will be reflected on rest plant parts above the soil surface through the deficiency that may occur in the absorption of water and nutrients (Lichtenthaler *et al.*, 1981) [12].

Table 2: Effect of extract on average root length (cm.)

Trait	Treats		
	Distilled Water	Ground Fenugreek	Uground Fenugreek
Root lngth	14.4 b	7.6 c	19.4 a

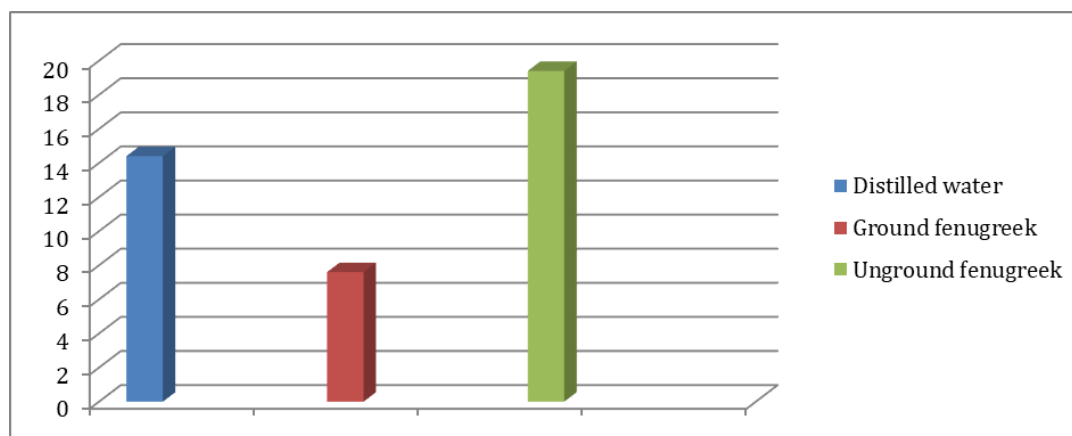


Fig 2: Root length (cm)

Roots Number

Expansion of the roots and increase in number their branches depend primarily on the availability of water and nutrients necessary for growth, in addition to being affected by surrounding environmental conditions. Plants of Poaceae family are characterized by the increase in the number of their branches (Ahmed, 1984) [1]. Table (3), Figure (3) shows that differences between comparison treatments and unground

fenugreek extract did not reach level of significance in average number of roots, as the number reached (3.8 and 3.6) for two treatments, respectively. Ground fenugreek extract treatment caused a significant decrease in average number roots, which reached (2.4). Reason for this may be attributed to fact that ground fenugreek seed extract contains some antibiotic substances, which hinders growth and branches root system (Al-Taie, 1995 and Prutenskaya, 1972) [6, 15].

Table 3: Effect of extract on root number

Trait	Treats		
	Distilled Water	Ground Fenugreek	Uground Fenugreek
Root number	3.8 a	2.4 b	3.6 a

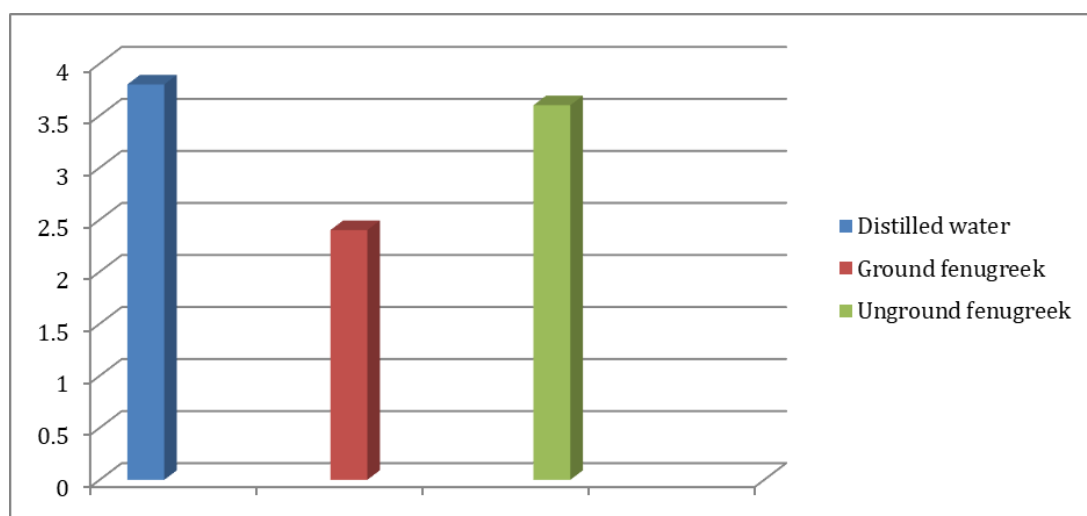


Fig 3: Roots Number

Seedling Wet Weight (mg)

Results of table (4), figure (4) indicate the significant superiority of unground fenugreek extract over the comparison treatments and ground fenugreek extract in average wet weight of wheat seedlings, as weight for three treatments reached (11.46, 10.50, 14.54) mg., respectively.

Perhaps the reason for this is association of this trait with traits of Green group length, length root system, and number roots, Figures (1, 2, 3), which achieved a significant superiority when treated with unground fenugreek extract compared to rest of treatments.

Table 4: Effect of extract on Seedlings wet weight (mg.)

Trait	Treats		
	Distilled Water	Ground Fenugreek	Uground Fenugreek
Seedling wet weight (mg.)	11.46 b	10.50 c	14.54 a

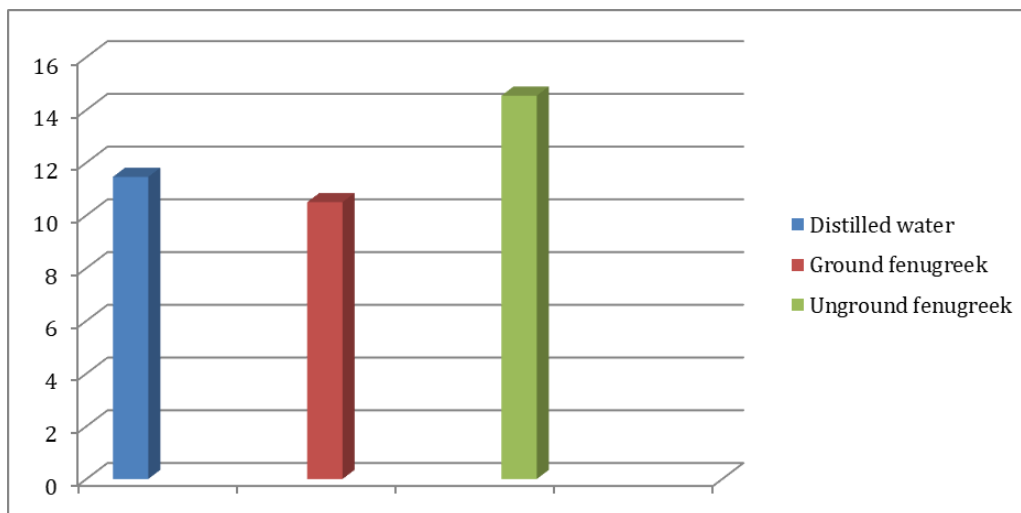


Fig 4: Seedlings wet weight (mg.)

Seedling Dry Weight (mg)

Dry weight is the final result of photosynthesis process and resulting deposition of dry matter in vegetative group (Hayawi, 2015) [9]. Results of Table (5), Figure (5) show a significant increase in average dry weight of wheat seedlings when using aqueous extract of unground fenugreek seeds treatment compared to control treatments and ground

fenugreek seed extract. There was a significant decrease in the same trait when treated with the aqueous extract of ground fenugreek seeds, as dry weight of three treatments reached (4.06, 3.40, 5.16) mg, respectively. Reason for this may be attributed to association of this trait with wet weight trait of wheat seedlings.

Table 5: Effect of extract on Seedlings dry weight (mg.)

Trait	Treats		
	Distilled Water	Ground Fenugreek	Uground Fenugreek
Seedling dry weight (mg.)	4.06 b	3.40 c	5.16 a

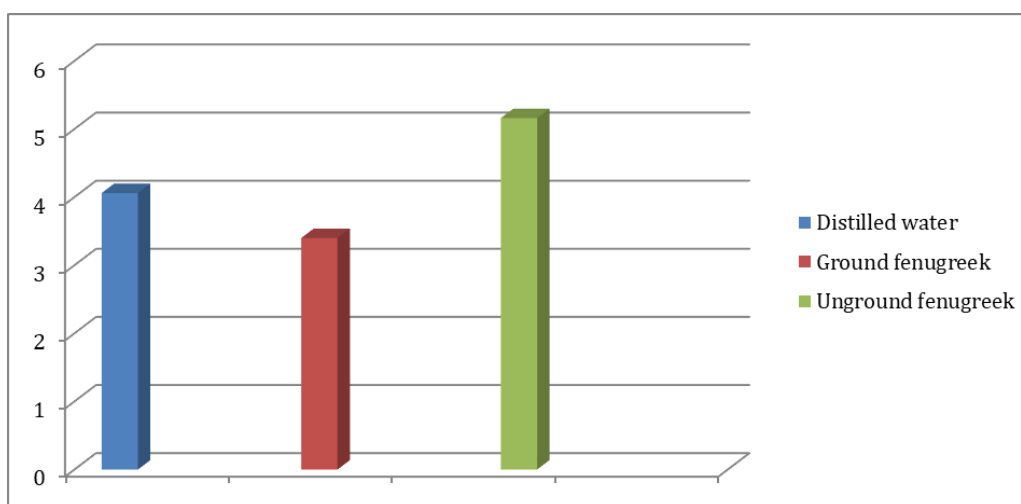


Fig 5: Seedlings dry weight (mg)

Conclusions

From the results obtained, conclude that:

1. Aqueous extract of unground fenugreek seeds behaved as growth regulators.
2. Aqueous extract of ground fenugreek seeds behaved as growth inhibitors.

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