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# Physiological Responses of some Plant Species to Crude Oil and its Effects Residues on Seed Germination.

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# ABSTRACT

The goal of this paper was to identify potentially useful plant indicator species for ecological restoration and remediate of oil contaminated soils. The use of plant-based system to remediate contaminated soils has become an area of intense scientific study in recent years and it is apparent that plant which grow well in contaminated soils need to be identified and screened for use in phytoremediation technologies. Therefore, in this study the effect of crude oil on germination and seedling emergence of selected plant species was investigated. The objective was to determine if crude oil exerts detrimental effect to plants during early critical stages in their development. The detrimental effect growth was compared to the control. Oil pollution in whatever form is toxic to some plant species and their environment has been observed by many researcher workers that crude oil affects soil properties and this in turn affects the physiological, anatomical and development of plants grown on such soils. The germination process is a very extremely sensitive phase in plant growth and development, being indicative to any type of environmental contaminants. The effect of heavy crude oil residues were investigated for some seed parameters of Triticum aestivum. These parameters of Triticum aestivum were promoted by different dilutions of types of heavy crude oil (0.0 V/V, 0.5 V/V, 1.0 V/V, 2.0 V/V, 4.0 V/V, 6.0 V/V, 8.0 V/V, 10.0 V/V). And have also of grasses germinated successfully in different levels of petroleum hydrocarbon contamination. The obtained results showed that, low concentrations of both phenol and naphthol caused an increase of germination percentages of most seeds of tested crops. This is probably due to that, low dilutions of these compounds may act as signal for amylase production in the seeds.

**Keywords:** Physiological responses; Crude oil; Seed germination

## INTRODUCTION

Petroleum crude oil is a complex mixture of thousands of hydrocarbon and non-hydrocarbon organ metallic compounds and metallic compounds [1]. Hydrocarbon form over 90% petroleum oil is grouped according to their chemical structures such as straight, branched and cyclic alkanes. Such as paraffins of 15%-60 % and aromatics of 3%-30 %, or more complicated chemicals like asphaltenes. The hydrocarbons in crude oil are mostly alkanes, cycloalkanes and various aromatic hydrocarbons, while organic compounds contain nitrogen (0.1%-2%), oxygen (0.05%-1.5%), sulfur (0.05%-6.0%), and trace amounts of metals such as iron, nickel, copper and vanadium (<0.1%). The non-hydrocarbon components of petroleum oil include, sulfur, oxygen, nitrogen compounds, trace elements, inorganic salts, naphthenic acids and carbon dioxide [2]. All crudes contain both paraffinic the ratio of paraffinic hydrocarbons is high compared to aromatics and naphthenes. The ratios of naphthenic and aromatic hydrocarbons are relatively higher than in paraffinic crudes. Water and oil are usually considered to be immiscible that is they are insoluble. However, crude oil contains a very small soluble portion referred to as the water soluble fraction [3]. The soluble components are dissolved hydrocarbons. The components of crude oil that go into solution make up the water soluble fraction such as phenol and napthol compound. The lower the molecular weight of these soluble fractions, the higher is their solubility [4]. Crude oil containing free sulfur, hydrogen sulfide (H2S), or other sulfur containing compounds in amounts greater than 1% is called sour crude. Oil that contains little or no sulfur is called sweet crude.

## TYPES OF CRUDE OIL

Based on the density crude oil is divided in to the following groups

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## Light crude oil

Light crude oil is a complex mixture of thousands of different chemicals. It is relatively liquid that flows easily at room temperature and has a low density [5]. It has a low viscosity, low specific gravity due to the presence of a high proportion of light hydrocarbon fractions [6]. It is generally has low wax content.

#### Heavy crude oil

Heavy crude oil has been defined as any liquid petroleum with American Petroleum Institute (API) gravity less than 20°C [2]. It is that oil which cannot easily flow to production wells under normal reservoir conditions, and highly viscous it is referred to as "heavy" because its density or specific gravity is higher than that of light crude oil. Physical properties that differ between heavy crude oils and lighter ones include higher viscosity and specific gravity, as well as heavier molecular composition. There are two main types of heavy crude oil: those that have over 1% sulfur (high sulfur crude oils), with aromatics and asphaltenes and these are mostly, and that have less than 1% sulfur (low sulfur crude oils), with aromatics, naphthenes and resins [3].

#### Physiological effects of crude oil on plants

Effects on seeds germination of seeds in soil polluted with crude oil may be significantly reduced the seeds germination [3,4]. Apparently, the hydrocarbon film created on the seed surface prevents the imbibitions of water and oxygen to the developing embryo, inhibited seed germination in oil contaminated soil also can be directly or indirectly related to the presence of oil in soil [6]. Attributed poor seed germination due to the penetrating power of the volatile fractions of oil. In contact with a seed, oil would enter the seed coat and readily kill the embryo [7]. Most studies of the effects of crude oil in maize (corn) have examined the effect of crude on physiological parameters such as percentages of seed germination (Ekundayo et al., 2001). Seed germination of Okra, soybeans and Amaranths hybridus oil [6,8,9]. Generally, petroleum hydrocarbon contamination causes retarded seed germination adverse biological effects [10,11]. Some researchers consider naphthalene as a more important source of crude oil toxicity than low molecular weight aromatics. It is believed that the low boiling point unsaturated hydrocarbons such as benzene, toluene, xylene and naphthalene, can reduce the level of nutrient availability plant nutrient in contaminated soils [12] and can also increase the levels of other elements such as iron and zinc [13] are the most toxic components in crude oil [14].

## MATERIAL AND METHODS

#### Plant seed

Triticum aestivum L. (Wheat), family Poaceae (Cereals), were purchased at supermarket seven seas. All grains were collected from Hei Alsalam area and were stored at room temperature ranges from 25°C-30°C.

#### Chemicals

Formaldehyde, Distilled Water (DW), the crude oil used was (from AL-Breiga port, field Alamal) heavy crude oil, with the following concentrations of each type of oil. (0.0% v/v, 0.5% v/v, 1.0% v/v, 2.0 v/v, 4.0% v/v, 6.0% v/v, 8.0% v/v, 10.0% v/v).

#### Germination test

Seed preparation prior to germination: The seeds to be used in this work were surface sterilized by washing with 10% formaldehyde and rinsed three times with sterile water for 10 minutes [15].

Sterilized glass petri dishes (9.0 cm) lined with double layers of Watman No.1.filter paper was used. Glass petri dishes were cleaned and sterilized in an oven at 180°C for 2 hours. Seeds were placed in the petri dishes each contains ten. Six replicates were used for each treatment of different kinds of crude oil.

The filter paper was watered by adding 3 ml of distilled water or solution to be tested. All petridishes were in incubated in an incubator of (Gallerkamp) at temperature of 20°C for one week. Distilled water was or tested solution was added to the petridishes whenever it was needed to all replicates at the same time. Germinated seeds were counted daily and germination percentage was calculated at the end of the germination period for each treatment as following.

$$Germination \ percentage = \frac{Number \ of \ seeds \ that \ germinated}{Number \ of \ seeds \ sown} \times 100$$

$$Coefficient \ of \ germination \ velocity \ (CGV) = \frac{A1 + A2 + A3... + An}{A1T1 + A2T2 + ...}$$

Where A is the numbers of seeds germinating and T is the number of days taken to germinate, was calculated.

$$GR = \frac{n}{d}$$

'n' number of emerged seeds in day d, d is day after planting.

Germination index 
$$(GI) = \frac{Gs}{Gc} \times \frac{Ls}{Lc} \times 100\%$$

Where Gs and Gc are number of seeds germinated in the sample and control, respectively, whereas Ls and Lc are the radicle length in the sample and control, respectively.

Number of non-germinated seeds was calculated daily to determine daily inhibition of germination percentages by using the following formula:

Mean inhibition of final germination percentage (%) = 
$$\frac{Final mumber of non-germinated seeds}{Total number of seeds} \times 100$$
  
Mean germination time  $(MGT) = \frac{nl \times dl + n2 \times d3 + n3 \times d3 + .....}{Total number of days}$ 

Where, n=number of germinated seed, d=number of days

Daily and final germination percentages (%) were calculated for the determination of some of the following parameters.

Mean daily germination 
$$(MDG) = \frac{FGP}{D}$$

FGP is final germination percent, D is day of maximum germination (experiment period).

#### **Early Seedling Development**

For determining the effect of these compounds on the seedling growth, germinated seeds were allowed to develop in to seedling for 2 weeks for the following different parameters, measurements meants. For wheat the measurement of roots and shoots were separated. Ten seedlings of each replicated of each treatment were weighed together due to the small size of the seedling. Different parameters were measured for the determination of seedling growth.

These measurements include: Root and shoot length (cm) for wheat by using a ruler.

Fresh weight of root and shoot (g) in wheat using balance of four decimal. Roots and shoots of each seedling for every treatment were separated wholes wheat was placed in an oven at 85°C for 48 hours in order to determine their dry weight (g).

-Root/shoot ratio (R/S) was calculated for each treatment used for wheat as following:

R/S=Dry weight of root (g)/Dry weight of shoot (g).

Relative water contents% = 
$$\frac{Fresh \text{ weight} - Dry \text{ weight}}{Number of seeds sown} \times 100$$

Inhibition percentage of fresh and dry parameters of seedlings in relation to control treatment was calculated by a given formula:

Inhibition seedling percentages(%) = 
$$\frac{T-C}{T} \times 100$$

'C' number of fresh and dry parameters in control, T is number of fresh and dry parameters in treatment.

Seedling Vigor Index (SVI) is calculated using the following modified formula:

SVI = Seedling length (cm) × germination percentage

Tolerance index (TI) is calculated using the following modified formula:

 $II = \frac{Length \ of \ seedling \ in \ treatment}{Length \ of \ seedling \ in \ control}$ Grade of Growth Inhibition Index (GG1) =  $\frac{DWc - DWs}{DWs} \times 100\%$ 

Where DWc and DWs are dry mass of the control and sample, respectively.

Mean of daily seed germination percentages of Triticum Aestivum were calculated under different dilutions of heavy crude oil Table 3.1. Although there were not significant differences within different treatments upon the germination percentages of wheat seeds, during from 1-5 days, were promoted with increasing the concentrations of heavy crude oil. Were significant differences found during 6.7 days, (F=2.29, P<0.05, F=2.29, P<0.05) respectively within treatments. By using Tukey's pairwise comparisons test showed significant differences were found only between concentration 1.0% v/v and higher concentration 8.0 % v/v of heavy crude oil of fourth and seventh days in shown Figure.3.1. Parameters of Germination Rate (GR) of Triticum Aestivum. Were measured under different dilutions of heavy crude oil the results in Table 3.2, showed that (GR) was significantly (F=2.29, P<0.05) within treatments, was decreased in concentration 1.0% v/v and were increased in different concentrations of heavy crude oil. Tukey's pairwise comparisons test showed significant differences between concentration 1.0% v/v and 8.0% v/v of heavy crude oil. Inhibition of Final Germination Percentages (IFG%) of same plant, in Figure. 3.2. Were significantly (F =2.29, P<0.05), within treatments, were increased in dilution 1.0% v/v and were decreased in different dilutions of same oil. Tukey's pairwise comparisons test showed significant differences between concentrations 1.0% v/v and 8.0 % v/v of heavy crude oil. Mean daily germination.

#### Seed germination

Mean of daily seed germination percentages of Triticum aestivum were calculated under different dilutions of heavy crude oil Table 3.1. Although there were not significant differences within different treatments upon the germination percentages of wheat seeds, during from 1 day, 2 day, 3 day, 4 day and 5 day) were promoted with increasing the concentrations of heavy crude oil. Were significant differences found during 6.7 days, (F=2.29, P<0.05, F=2.29, P<0.05) respectively within treatments. By using Tukey's pairwise comparisons test showed significant differences were found only between concentration 1.0% v/v) and higher concentration 8.0% v/v of heavy crude oil of fourth and seventh days in shown Figure 3. 1. Parameters of Germination Rate (GR) of Triticum Aestivum. Were measured under different dilutions of heavy crude oil the results in (Table 3.2), showed that (GR) was significantly (F=2.29, P<0.05) within treatments, was decreased in concentration 1.0% v/v and were increased in different concentrations of heavy crude oil. Tukey's pairwise comparisons test showed significant differences between concentration 1.0% v/v and 8.0% v/v) of heavy crude oil. Inhibition of Final Germination% (IFG%) of same plant, in Figure. 3.2. Were significantly (F=2.29, P<0.05), within treatments, were increased in dilution 1.0% v/v and were decreased in different dilutions of same oil. Tukey's pairwise comparisons test showed significant differences between concentrations 1.0% v/v and 8.0 %v/v of heavy crude oil. Mean daily germination.

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Treat ment (%)	Germ inatio n						
	perce ntage s (%)						
	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
0	+43.3 ± 13.0	+56.7 ± 12.0	+60.0 ± 11.5	+66.7 ± 8.4	+66.7 ± 8.4	*66.7 a ± 8.4	*66.7 a ± 8.4
0.5	40.0 ± 8.90	46.7 ± 9.90	66.7 ± 13.3	73.3 ± 9.9	73.3 ± 9.9	73.3a ± 9.9	73.3a ± 9.9
1	40.0 ± 13.7	50.0 ± 10.0	50.0 ± 10.0	53.3 ± 9.9	53.3 ± 9.9	53.3a b ± 9.9	53.3a b ± 9.9
2	40.0 ± 5.20	56.7 ± 3.30	63.3 ± 8.03	73.3 ± 8.4	73.3 ± 8.4	76.7a ± 6.2	76.7a ± 6.2
4	43.3 ± 9.60	80.0 ± 5.20	83.3 ± 3.30	86.7 ± 4.2	86.7 ± 4.2	86.7a ± 4.2	86.7a ± 4.2
6	36.7 ± 9.60	63.3 ± 9.60	70.0 ± 8.60	70.0 ± 8.6	70.0 ± 8.6	73.3a ± 6.7	73.3a ± 6.7

**Table 1:** Effect of different dilutions of heavy crude oil on daily germination (%) of Triticum aestivum L. (Wheat) seeds.



**Figure 1:** Effect of different dilutions of heavy crude oil on daily germination percentage (%) during the fourth day (A) andtheseventh day (B) of Triticum aestivum L. (Wheat) seeds.

Were increased with increasing concentrations 0.5% v/v and 2.0% v/v up to 10.0% v/v and decreased in concentration 1.0% v/v. Tukey's pairwise comparisons test showed significant differences between concentrations 1.0% v/v and 8.0% v/v of same oil. Mean Germination Time (MGT), Germination Index (GI) Table 3.2 and coefficient of germination velocity Figure 3.3 of wheat, were not affected by different dilutions of same oil, and were not significant differences in treatments.



**Figure 2:** effect of different dilutions of heavy crude oil on inhibition of final germination percentages (%) of Triticum aestivum L.(Wheat) seeds.

#### Seedling growth

The influence of different dilutions of heavy crude oil upon the length shoot of wheat was result showed that no significant differences in treatments. The effect of different concentrations of heavy crude oil on length root of Triticum aestivum seedlings was significantly (F=2.32, P<0.05) within treatments, reduced as the control and increased in different concentrations of heavy crude oil. Tukey's pairwise comparisons test showed significant differences between controls and concentration 4.0% v/v). The influence of different dilutions of heavy crude oil upon the fresh weight shoots of Triticum aestivum. Was tested Table 3.3. Result showed not affect by different dilutions of same oil. Whereas fresh weight root of same plant was found significantly (F = 2.38, P<0.05) within treatment reduced as the Control and increased in different concentrations of heavy crude oil Table 3.3. Tukey's pairwise comparisons test showed significant differences between control and concentration 4.0% v/v. Represents the influence of different concentrations on dry weight of shoots and roots of Triticum aestivum, were not affected by different dilutions of same oil on dry shoots and were not significant differences in treatments Table 3.4. Whereas dry weight of roots was significantly (F=2.25, P<0.05) within treatments the result showed reduced in control, and increased with concentrations of heavy crude oil. Tukey's pairwise comparisons test showed significant differences between control and concentration 4.0% v/v Table 3.4. Root/shoot ratio and Relative Water Content (RWC %) of wheat plant were measured under different dilutions of heavy crude oil Table 3.4 were not significant differences in treatments, relative water content in showed Figure 3.5 and Figure 3.6. respectively). Table 3.5 inhibition percentages of length, fresh and dry weight (g) seedling and Grade of Growth Inhibition Index (GGI) of Triticum aestivum were not significant differences in all parameters. Figure 3.7 shown that inhibition dry weight and grade of growth inhibition index of wheat seedling. Analyses of data of seedling emergence percentages (%), Seedling Vigor (SVI) and Tolerance Indexes (TI) of same species plant Table 3.6. The results shown that not affected by different.

## DISCUSSION AND CONCLUSIONS

Oil pollution in whatever form is toxic to some plant species and their environment has been observed by many researcher workers [16-20] that crude oil affects soil properties and this in turn affects the physiological, anatomical and development of plants grown on such soils. The germination process is a very extremely sensitive phase in plant growth and development, being indicative to any type of environmental contaminants. The effects of heavy crude oil residues were investigated.

Treatment (%)	GR	MDG	MGT	GI
0	*0.5a ± 0.06	*9.5a ± 1.2	+12.9 ± 1.8	+50 ± 9.3
0.5	0.5a ± 0.07	10.5a ± 1.4	13.9 ± 2.0	61.4 ± 17.5
1	0.40ab ± 0.07	7.60ab ± 1.4	10.5 ± 1.97	41.4 ± 12.8
2	0.6a ± 0.04	10.95a ± 0.9	14.3 ± 1.3	67.7 ± 15.5

4	0.6a ± 0.03	12.4a ± 0.6	16.9 ± 0.8	77.8 ± 17.5
6	0.5a ± 0.05	10.5a ± 0.95	13.98 ± 1.5	55.5 ± 16.2
8	0.6ac ± 0.03	12.9ac ± 0.6	17.5 ± 0.9	69.9 ± 17.2
10	0.5a ± 0.06	10.0a ± 1.2	13.6 ± 1.7	51.3 ± 13.0

**Table 2:** Effect different dilutions of heavy crude oil on themeans of Germination Rate (GR), Mean Daily Germination(MDG), Mean Germination Time (MGT) and Germination Index(GI) of Triticum aestivum L.



**Figure 3:** Effect of different dilutions of heavy crude oil on Coefficient of Germination Velocity (CGV) of Triticum aestivum L. (Wheat) seeds.

Treatment (%)	Mean values			
	Shoot length (cm)	Root length (cm)	Shoot fresh weight (g)	Root fresh weight (g)
0	+8.4 ± 1.8	*6.6a ± 1.4	+0.05 ± 0.01	*0.03a ± 0.007
0.5	8.4 ± 1.7	8.2ab ± 1.6	0.05 ± 0.01	0.06ab ± 0.01
1	10.3 ± 1.96	8.2ab ± 1.6	0.06 ± 0.01	0.05ab ± 0.009
2	11.3 ± 1.7	9.9ab ± 1.4	0.09 ± 0.01	0.07ab ± 0.01
4	12.2 ± 1.4	13.5b ± 1.5	0.08 ± 0.009	0.08b ± 0.009
6	10.9 ± 1.9	9.6ab ± 1.6	0.06 ± 0.01	0.05ab ± 0.009
8	12.8 ± 1.6	12.5ab ± 1.5	0.09 ± 0.01	0.07ab ± 0.009
10	10.6 ± 1.7	9.10ab ± 1.4	0.08 ± 0.02	0.05ab ± 0.01

Table 3: Effect of different dilutions of heavy crude oil on length shoots, roots (cm) and fresh weight (g) shoots, roots of Triticum aestivum L. (Wheat) seedlings.



Treatment	Mean values					
(70)	Shoot dry weight (g)	Root dry weight (g)	Root / shoot	Relative water content (%)		
0	0.009 ± 0.004	0.003a ± 0.001	0.60 ± 0.20	43.9 ± 8.3		
0.5	0.004 ± 0.001	0.004ab ± 0.001	0.60 ± 0.10	49.1 ± 8.5		
1	0.006 ± 0.001	0.004ab ± 0.001	0.30 ± 0.07	45.5 ± 8.5		
2	0.007 ± 0.001	0.005ab ± 0.001	0.70 ± 0.10	64.6 ± 7.9		
4	0.007 ± 0.001	0.007b ± 0.001	0.80 ± 0.097	70.0 ± 7.2		
6	0.006 ± 0.001	0.004ab ± 0.001	0.50 ± 0.097	53.9 ± 8.2		
8	0.007 ± 0.001	0.005ab ± 0.001	0.70± 0.10	70.1 ± 7.2		
10	0.005 ± 0.001	0.004ab ± 0.001	0.50 ± 0.09	61.2 ± 8.0		

**Table 4:** Effect of different dilutions of heavy crude oil on the means of dry weight (g) of shoots and roots, root/shoot ratio and Relative Water Content (RWC%) of Triticum aestivum L. (Wheat) seedlings.



**Figure 5:** Effect of different dilutions of heavy crude oil on means of root / shoot ratio of Triticum aestivum L. (Wheat) seedlings.



**Figure 6:** Effect of different dilutions of heavy crude oil on relative water contents percentages (%) of Triticum aestivum L. (Wheat) seedlings.

Treatment	Mean values				
(78)	Length (cm)	Fresh weight (g)	Dry weight (g)	Grade growth	of

**Figure 4:** Effect of different dilutions of heavy crude oil on means of dry weight (g) shoots (A) and roots (B) of Triticum aestivum L. (Wheat) seedlings.

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				inhibition index
0	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
0.5	15.6 ± 7.60	19.8 ± 8.10	-18.0 ± 29.0	18.0 ± 29.0
1	18.04 ± 8.20	17.5 ± 8.80	-4.5 ± 23.9	4.5 ± 23.9
2	22.7 ± 8.60	32.6 ± 7.60	1.0 ± 23.0	-1.0 ± 23.0
4.0	32.6 ± 8.50	31.96 ± 9.30	6.5 ± 25.2	-6.5 ± 25.2
6.0	17.96 ± 9.70	4.80 ± 17.6	-9.4 ± 37.8	9.4 ± 37.8
8	31.03 ± 9.50	33.0 ± 9.80	10.2 ± 19.6	-10.2 ± 19.6
10.0	19.8 ± 10.5	11.8 ± 17.2	-21.5 ± 50.0	21.5 ± 50.0

Table 5: Effect of different dilutions of heavy crude oil on the mean values of seedling growth inhibition percentages (%) and Grade of Growth Inhibition Index (GGI) of Triticum aestivum L. (Wheat) seedlings.



Figure 7: Effect of different dilutions of heavy crude oil on inhibition percentages (%) of dry weight (g) (A) and Grade of Growth Inhibition Index (GGI) (B) of Triticum aestivum L. (Wheat) seedlings.

Treatment (%)	Mean values				
	SE %	SVI	ті		
0	+	+	+		
	10.0 ± 1.9	299 ± 61.0	0.50 ± 0.09		
0.5	10.7 ± 1.9	332.1 ± 64.0	0.50 ± 0.10		
1	10.0 ± 1.9	370.5 ± 71.0	0.40 ± 0.10		
2	14.0 ± 1.7	423.3 ± 59.5	0.60 ± 0.10		
4	15.3 ± 1.6	515 ± 54.4	0.70 ± 0.10		
6	12.0 ± 1.8	410 ± 68.0	0.50 ± 0.10		
8	15.3 ± 1.6	505.7 ± 61.2	0.60 ± 0.10		
10	13.3 ± 1.8	367.7 ± 61.0	0.50 ± 0.10		

 Table 6: Effect of different dilutions of heavy crude oil on

 Seedling Emergence (SE%), Seedling Vigor (SVI) and Tolerance

 Indices (TI) of Triticum aestivum L. (Wheat) seedlings.

For some seed parameters of some weeds which include Solanum nigrum, and some cultivated plants such as Triticum aestivum seeds. These parameters of Solanum nigrum and Triticum aestivum were promoted by different dilutions of types of crude oil. These results are agreed with the findings reported [22] who found that germination index of Indian mustard was not affect with diesel oil contaminated soil. Grasses germinated successfully in different levels of petroleum hydrocarbon contamination. The effect of phenol and naphthol compounds, as water soluble fractions of crude oil, on the germination and seedling development was investigated for seeds of some crops cultivated in Libya [23,24]. The obtained results showed that, low concentrations of both phenol and naphthol caused an increase of germination percentages of most seeds of tested crops. This is probably due to that, low dilutions of these compounds may act as signal for  $\alpha$ - amylase production in the seeds [24]. These results agreed with those obtained [25] who found that low dilutions of naphtol had a promoting effect on rate and final germination of oat seeds. This was probably caused by strong resistant qualities of the black nightshade and wheat seeds. This high quality of resistance marks the foregoing species to be considered as promising candidates for the phytoremediation of sites crude polluted with petroleum oil. The study underscores the need for the use of cheap and available, and environmental friendly technology as a remedy for the harmful effects of petroleum contaminants in the environment. In general, seed germination of all target species used in this work was enhanced under the stimulation of heavy crude oil. This is might be due to the hydrophopicity of heavy oil which possesses less solubility in water and therefore causes phytotoxicity. Most studies of the effects of crude oil have examined the effect of petroleum residues on physiological parameters such as percentages of seed germination of corn, okra, soybeans and Amaranths hybridus where their germination was delayed in the soil polluted by crude oil [3,13]. Generally, contamination by petroleum hydrocarbon causes retardation of seed germination [26] that led to adverse biological effects of some plant species. Some researchers have considered naphthalene as a more important source of crude oil toxicity than low molecular weight aromatics [23,25]. Shoot growth retardation in plants due to petroleum pollution as observed in this work had been reported by different workers on related studies [26-32]. During their study with three vascular plants (fluted pumpkin, maize and okra) reported retardation in their shoot growth as a result of crude oil contamination. Seedling performance of plants used in this study was measured under different dilutions of different type of oil compound. Generally, the highest performance in terms of percentage emergence and seedling development was recorded in black nightshade and wheat. It seems to the present study that the adverse effect noticed on the treated never-fading flower and corn plants may be due to unfavorable germination conditions created by toxic substances contained in the crude oil. Growth reduction in crude oil polluted media as observed in this study for some plant species may also be attributed to a disruption in aeration. This observation is in line with the findings reported delayed germination and reduction in grain yield of maize in crude oil polluted soil [3,33-40]. This study indicates that wheat have more potential for resistance of crude oil concentrations and that can be used as promising tools for phytoremediation technology. It is apparent from the discussions that the following conclusions can be made. The influence of heavy crude oil upon different target plant species used in this research was not clearly pronounced (different) i.e., all plant species were not affected by the applications of heavy crude oil residues. This

might be due to that heavy oil is more viscous and less soluble in water.

## **SUMMARY**

The effected of heavy crude oil was examined for seed germination and seedling performance in the case of seed measures of Triticum aestivum L. (Wheat) were enhanced under. Whereas, they were promoted heavy crude oil. Furthermore, seedling performance was noticed to be good of Triticum aestivum under type of oil. Based on the obtained results the following conclusions can be summarized. This study indicates is wheat having more potential for resistance of crude oil concentrations and they can be used as promising tools for phytoremediation technology

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