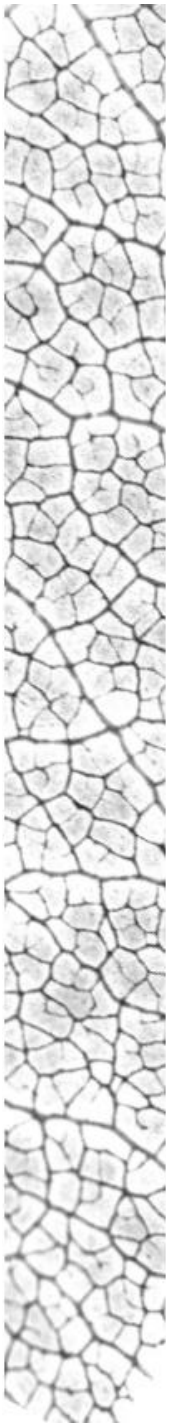

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Study the effect of seasonal variation of oil pollutants in Northern Basra Governorate on some physiological characteristics of date palm trees, *Phoenix Dactylifera* L.

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Abstract

The study was conducted during the period from the beginning of November 2016 to October 2018 in five sites, namely the Al-Madinah district (Abu Ghraib orchards and Albo Kotayb orchards) and Izz al-Din Salim area (orchards of yarns) and Qurna district (Al Basha river orchards and al-Sharash groves) north of Basra governorate with the aim of knowing The effect of oil fields on air pollution and the physiological characteristics of date palm cv. jabjab. The results showed that the oil pollution had a negative impact on the environment and the physiological characteristics of date palm, as it recorded a significant difference in the concentration of hydrocarbons and total alkanes and the lead component in the date palm leaves in different study, sites where the highest concentration was in site $\mathbf{T_1}$ (Abu Ghraib groves near the West Qurna oil field **2**) and Location $\mathbf{T_3}$ (yarn groves near to West Qurna oil field **1**), and the lowest concentration was at site $\mathbf{T_5}$ (groves of Sharash far from oil fields). The results also showed that climate variations have an impact on the concentration of hydrocarbons and total alkanes and the lead element in the leaves where The two highest concentrations were in the spring and summer and the lowest in the winter and two seasons. The study showed that there was a significant difference in the concentration of gaseous pollutants carbon monoxide (CO) and methane gas (CH_4) and hydrogen sulfide gas (H_2S) in different locations and the highest concentration was recorded at site $\mathbf{T_1}$ and the lowest concentration recorded at site $\mathbf{T_5}$, also the results showed that climate variations have an effect The concentration of gaseous pollutants was highest in the winter season compared to the lowest concentration in the summer season and for the two seasons. The results also showed that the site had a significant effect on the concentration of pigments in photosynthesis, as the highest concentration of chlorophyll A, B and the carotene pigments at site $\mathbf{T_5}$ and the lowest concentration at site $\mathbf{T_1}$, while estimated the highest concentration of anthocyanin pigment at site $\mathbf{T_1}$ and the lowest concentration at site $\mathbf{T_5}$. The results showed that the difference in sites affected the percentage of total dissolved solids, total acidity and total sugars, as the highest percentage of dissolved solids and total sugars in fruit dates of dates at site $\mathbf{T_5}$ was 56.16% and 52.44.% For the first season and 57.12, 57.44% for the second season and less The percentage of acidity reached 0.52, 0.51% for the two seasons respectively, while the site $\mathbf{T_1}$ recorded the lowest percentage of soluble solids and total sugars reached 42.23, 45.89% for the first season and 43.89, 44.81% for the second season and the highest acidity rate was 0.64 and 0.71% for the two seasons respectively.

Keywords: date palm, cultivar jabjab, oil fields

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INTRODUCTION

Oil is one of the most dangerous sources of environmental pollution because it contains organic and inorganic toxi compounds such as phenols, cyanides, sulfides, toxic metal ions, suspended and dissolved materials, hydrocarbons, and carbon oxides that lead to environmental corruption (soil, water, and air) (Saadi, 2006). Plants are among the most organisms sensitive to pollutants being immobile and static, as well as their ability to accumulate pollutants through their absorption from soil or by atmospheric sedimentation methods (Zurayk *et al*., 2001). Pollution has an effect on plant metabolic processes such as photosynthesis and carbohydrate formation by affecting its absorption of the necessary optical wavelengths and the gas exchange

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process by closing the stomata and affecting the breathing process by crashing the mitochondria membranes (Nelson-Smith, 1991). It degrades the natural activity of biological systems (Ghalachyan et al. 2014). In a study conducted by the researcher (Ibrahim, 1999) on five varieties of date palm, namely Al-Barhi, Al-Dairy, Al-Buraim, Al-Zuhdi and Al-Khadrawi along the Shatt Al-Arab, the presence of different concentrations of hydrocarbons in the cultivares, and it recorded 1.27 µ. g $^{-1}$ dry wight in Al- Dairy cultivar at the Al-Madinah station. And and the highest concentration recorded 8.49 µ. g $^{-1}$ dry weight in the Al-Barhi cultivar at Al-Hartha station. The study showed that the source of hydrocapones comes through various local oil activities. Al-Jabri (2017) found in his study that the highest concentration of lead in date palm leaves was at the Najibiya station site and for the dry season was 43.34 (mg-kg^{-1}) and did not significantly differ from the Qurna site which recorded 39.05 (mg-kg^{-1}), while The lowest lead concentration recorded in the Al-Faw site and for the rainy season was 23.56 (mg.kg^{-1}). Kadhim (2019) explained in his study that the highest concentration of total hydrocarbons was recorded in the *Suaeda vermiculata* plant in the spring season was 10.63 µ.g^{-1} and the highest concentration of total alkanes recorded in the summer and for the same plant was 12.47 µ.g^{-1}, while the lowest concentration of total hydrocarbons and alkanes The record in *Conocarpus lanciflius* plant was in winter amounted to 8.36, 7.79 µ.g^{-1}.

Pollutants are dangerous environment on humans, animals and plants, as it causes morphological, physiological and biochemical functions to be disrupted and lead to the production of Reactive Oxygen Species (ROS) such as (O^{-}_{2}) Superoxide, Hydrogen Peroxide (H_2O_2 and Hydroxyl radical (.OH^{-}). Because of the high effectiveness and toxicity of these ROS free radicals, they cause Disrupting the functions of cell components such as cellular membranes and nucleic acids (Verma and Dubey, 2003), and works in oxidation of membrane fats, and leads to a decrease in photosynthesis (Doganlar et al. 2012), and has a negative effect on the activities of microorganisms in the soil, which leads to reduced degradable Organic matter and thus affect the absorption of nutrients (Pallavi and Rama, 2005; Chibuik and Obioro, 2014), and have an effect on the leaves content of chlorophyll (Zouari et al. 2016).

The study aims to measure the environmental pollution north of Basra Governorate resulting from the oil fields and their effects on the physiological characteristics of the date palm trees of the Jabjab variety.

MATERIALS AND METHODS

This study was conducted in the palm groves located in the north of Basra Governorate for two consecutive years, 2017-2018, as five sites were selected:

T_1 - Al-Madinah district (Abu Ghraib) is 5 km from the West Qurna 2 oil field

T_2 - Al-Madinah district (Al-Bawtaib) district is 10 km from the West Qurna 2 oil field

T_3 - Ezzedine Salim area (Al-Khoyoot) is 5 km from the West Qurna 1 oil field

T_4 - Qurna District (Basha River) 10 km from West Qurna 1 oil field

T_5 - Qurna District (Al-sharash) Comparative Treatment There are no oil fields nearby

Three date palm trees selected the jabjab variety for each site (located to the southern side of the oil fields) homogeneous in length, growth strength and age as much as possible. The trees were washed before the experiment began. The samples were collected quarterly on the dates 1/15, 4/15, 7/15 and 10/15 for the two seasons 2017 and 2018 from the leaves (fronds) by taking three (pinnae)) of four leaves per palm tree distributed over the vegetative group. The fruit samples were collected at maturity randomly on 20/ 8 For the seasons 2017 and 2018, the samples were dried, grind and keep for the purpose of making measurements. Gas pollutants were recorded for the above sites in cooperation with the Environment Directorate - Basra Governorate and included the following measurements:

1-Hydrocarbons (µ. g $^{-1}$) Hydrocarbons were measured using a fluorescence device**.**

2-Total alkanes (µ.g^{-1}) The total alkanes were measured using a chromatographic device**.**

3-Estimate the lead component (mg.g^{-1}) depending on the method described by Jones, 1984.

4-The gaseous pollutants (carbon monoxide gas, methane gas hydrogen and sulfide gas) were measured using the HORIBA device in cooperation with the Basra Governorate Environmental Directorate.

5- Determine the leaves content of the chlorophyll A, B, carotenoids and anthocyanins light pigments (mg. 100. g^{-1} soft weight) according to the method described by(Arnon, 1949).

6- The qualitative characteristics of the fruits are estimated: the percentage of total dissolved solids, the total percentage and the percentage of total sugars according to Howrtiz, (1975), and estimated the total acidity as described in A.O.A.C. (1970)

Performed as a factorial experiment with Randomized Complete Block Design (R.C.B.D) with three replications. The results were analysed using the Genstat program and the averages were compared using the Least Significant Difference (L.S.D) at a probability level of 0.05 (Al-Rawi and Khalaf Allah, 2000).

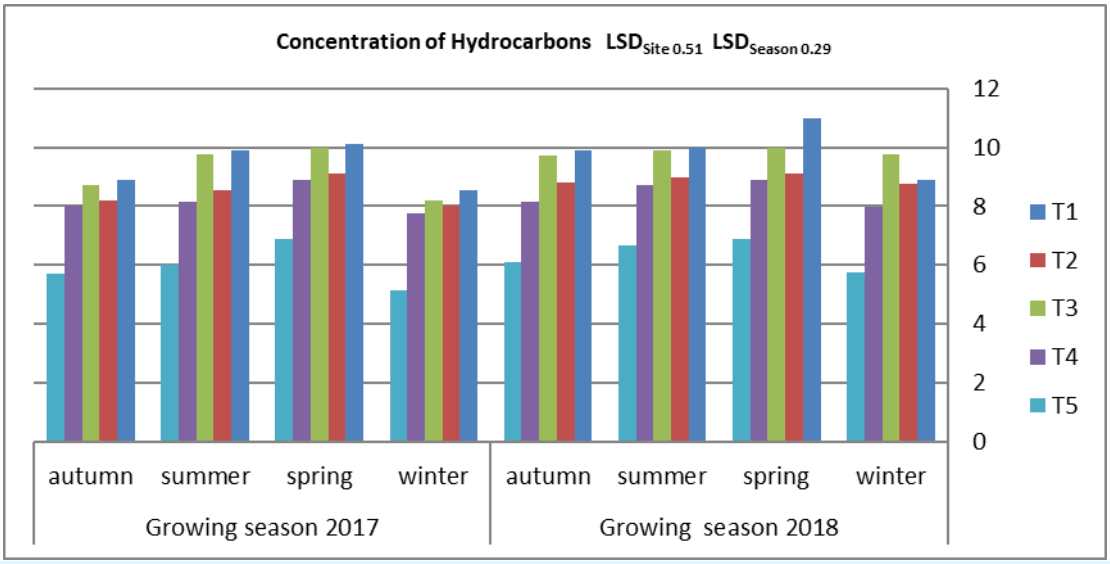

Fig. 1. Influence of oil pollution on the concentration of hydrocarbons in the leaves (µ . g $^{-1}$ dry weight)

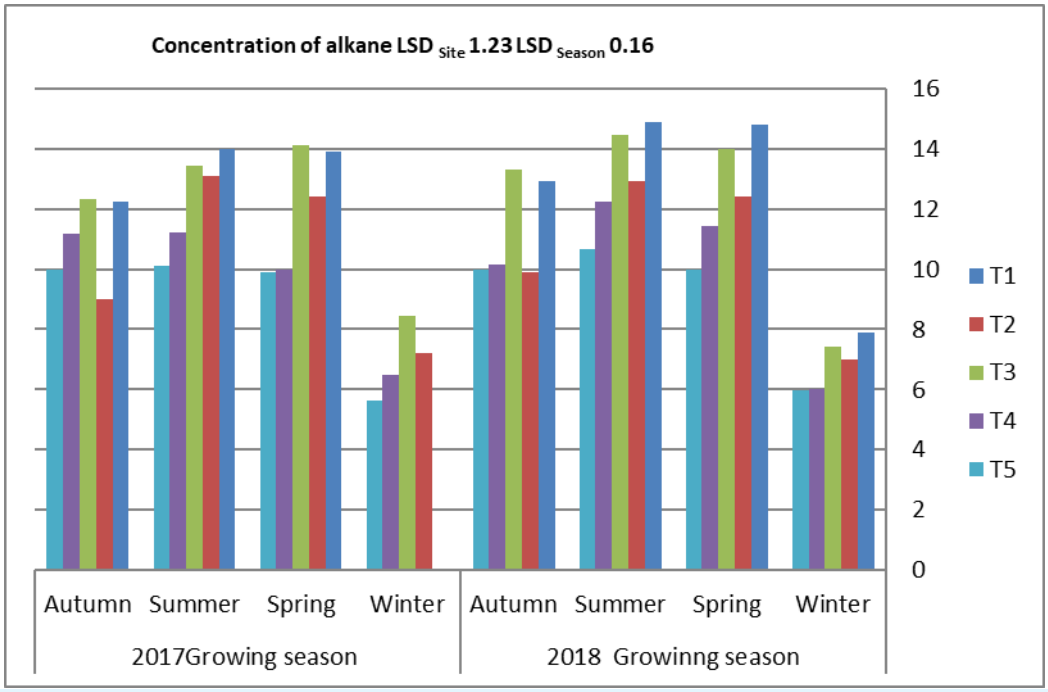

Fig. 2. The effect of oil pollution on the concentration of alkanes in the leaves (µ . g $^{-1}$ dry weight)

RESULTS AND DISCUSSION

Concentration of hydrocapones in the leaves (µ. g $^{-1}$ dry weight)

Fig. 1 illustrates the main effects of oil pollution on the accumulation of hydrocarbons in the palm leaves, where the site T_1 significantly superiorty by recording the highest concentration of hydrocarbons in the date palm trees of the Jabjab cultivar and did not differ significantly from the site T_3 compared to the lowest concentration recorded in the site T_5 and the two seasons of the study. The figure also shows that the concentration of hydrocarbons was more concentrated in the spring season and did not differ significantly from the summer season, while the lowest concentration was in the leaves in the winter growing season and for the two growing seasons.

Concentration of total alkanes in the leaves (µ.g^{-1} dry weight)

Fig. 2 shows that the site had a significant effect on the concentration of alkanes in the leaves, as it found its highest concentration in the palm leaves at site T_1 and did not differ significantly from site T_3 and a significant difference from site T5 which recorded the lowest values and the two seasons of the study. The figure also shows that the concentration of alkanes was more

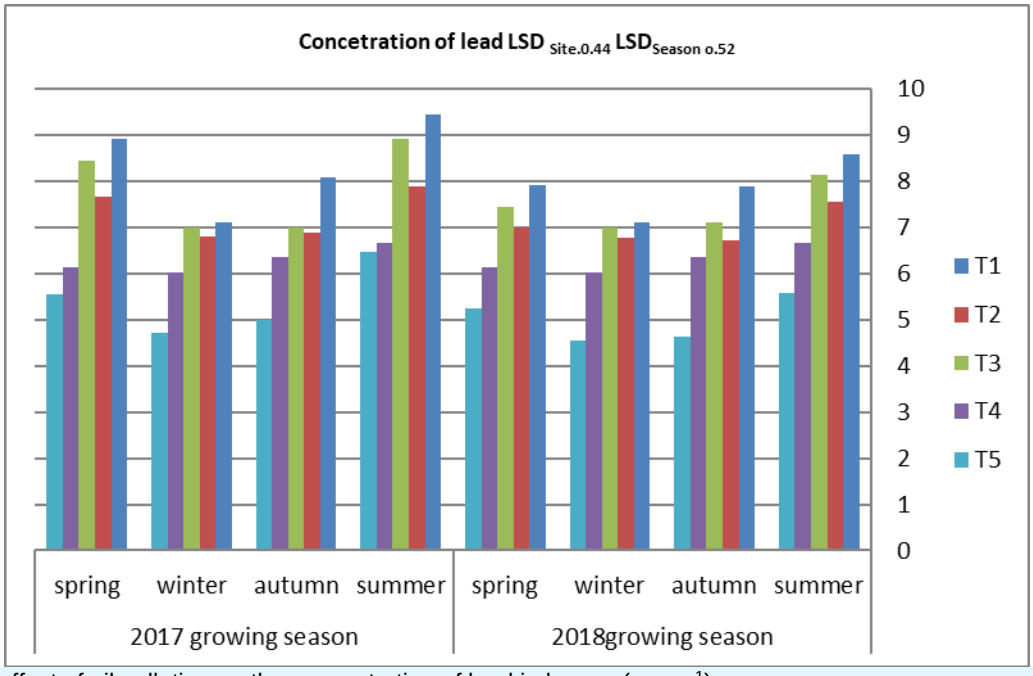

Fig. 3. The effect of oil pollution on the concentration of lead in leaves (mg. g^{-1})

concentrated in the summer and spring seasons, while the lowest concentration was in leaves in the winter growing season and in the two seasons. The increase in the concentration of hydrocarbons and alkanes in the leaves date palm trees of the Jabjab cultivar and in the two growing seasons

Figs. 1 and **2** at the T_1 and T_3 sites, is due to the proximity of these sites to the oil fields and the oil extraction operations and the accompanying burning of natural gases during the separation of raw fuel and its emission to the atmosphere feom the Flares, which are considered one of the most important sources of environmental pollution. We also note from the figures (1 and 2) that the highest concentration of hydrocarbons and alkanes in the palm leaves was in the spring and summer while the lowest concentration was in the winter, due to environmental factors such as heat, wind, and rain. This is consistent with Kadhim (2019) on plant *Suaeda vermiculata*.

Concentration of lead in leaves (mg. g^{-1}) dry weight

It is observed from **Fig. 3** that the location of palm trees from the oil fields has a significant effect on the lead concentration in their leaves, as the results showed that the highest concentration was found in the palm leaves planted at site No. T_1 and site No. T_3 due to their proximity to the oil fields west of Qurna 1 and 2 Containers of burning torches, which are considered one of the most important sources of lead contamination (Efe,2010), compared to other sites Which is far from these fields where the T_5 site has the lowest concentration. The figure also shows that climate variations in different seasons also affected significantly the lead concentration, as the highest lead concentration was found in the summer and spring seasons compared to the winter season, which recorded the lowest lead concentration and these results are consistent with Shaheen et al. (2016) on buckthorn trees. The reason is due to climatic factors such as heat, wind, and lighting. Hopkins and Humer (2008) indicated that high temperatures, lighting, and intensity of winds lead to an increase in transpiration speed and thus an increase in the absorption of water and elements, including heavy elements such as lead as a result of increased evaporation, which leads to an increase in lead concentration In the papers, as shown by Moore et al (2003) to the effect of temperature and intensity of illumination on the opening and expansion of stomata, which would allow the entry of metallic elements, including lead.

Concentration of carbon monoxide CO in the air (ppm)

It is noted from **Fig. 4** that the concentration of carbon monoxide gas in the air differs significantly according to the different recorded locations, as it recorded the highest concentration in the T_1 and T_3 sites, while the lowest concentration in the air at the T_5 site was recorded, as the same shape of the seasons showed a significant effect on the gas concentration In the air, it recorded the highest concentration in the winter season compared to the summer season, for all sites, and for the two study seasons.

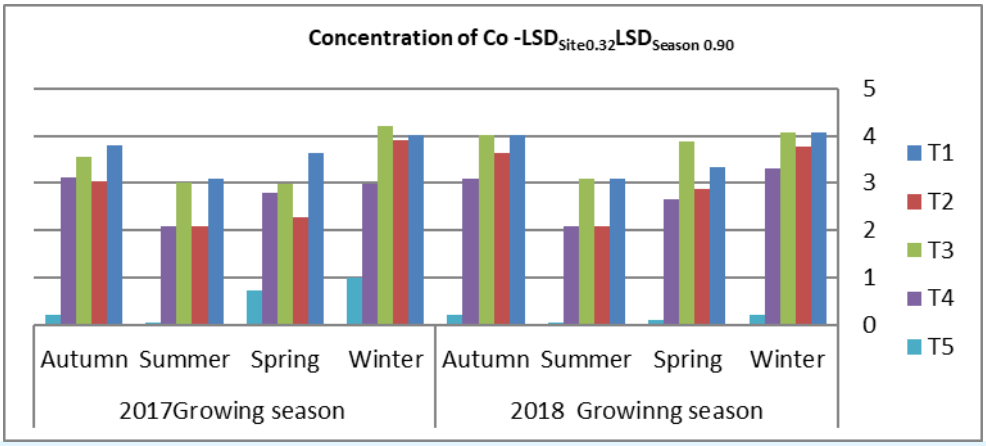

Fig. 4. Effect of oil pollution on the concentration of carbon monoxide (CO) in the air (ppm)

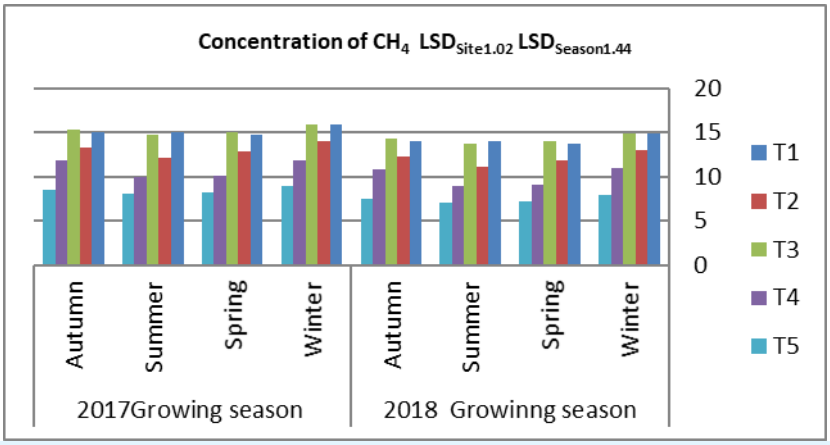

Fig. 5. Effect of oil pollution on methane concentration (CH_4) in air (ppm)

CH_4 concentration in air (ppm)

Notes from **Fig. 5**. The concentration of methane in the air differs significantly according to the different locations recorded, as it recorded the highest concentration in the location T_1 and T_3, while the lowest concentration in the air at the location T_5 was recorded, as the figure itself showed that climate changes are also having a significant effect on the gas concentration in Atmospheric air, which recorded the highest concentration in the winter season, for all sites, and for the two seasons.

Concentration of H_2S in air (ppm)

It is observed from **Fig. 6**. The concentration of hydrogen sulfide gas in the air differs significantly according to the different recorded locations, as it recorded its highest concentration in the location T_1 and T_3, while the lowest concentration was recorded in the air air at the site T_5, as shown by the same figure that climate changes are also having a significant effect. On the concentration of gas in the air, as it recorded the highest concentrations in the winter season, for all locations, and for the two seasons. The reason is due to the difference in the concentration of the polluted gases according to the locations to their proximity or their distal from the oil fields, as oil production accompanies the burning of the gases accompanying the oil, which increases the pollution of the environment near the field more than the remote environment, Also for different climatic conditions such as temperature, wind, and humidity, which vary according to the season it has an effect in the concentration of pollutants according to the seasons, and this result is consistent with (Douabul et al. 2013; Kahdam, 2019).

Concentration of photosynthesis pigments in leaves (mg. g^{-1} soft weight)

Notes from **Table 1**. The photosynthesis pigments were affected by oil pollution, as the results showed that the concentration of pigments varied according to the different sites. Site T_5 gave the highest concentration of chlorophyll A, b and carotene in palm leaves as it reached 4.22, 1.89 and 2.17 for the first season, 3.99, 1.76 and 2. 00 (mg.g^{-1} soft weight) for the second season, respectively, compared to site T_1, which gave the least pigment, as it reached 2.21, 1.09, and 1.18 for the first season, 2.12, 1.06, and 1.14 (mg.g^{-1} soft Wight) For the second season consecutive. The same table shows that the anthosanine pigment was also affected by the different sites, as site T_1 gave the highest

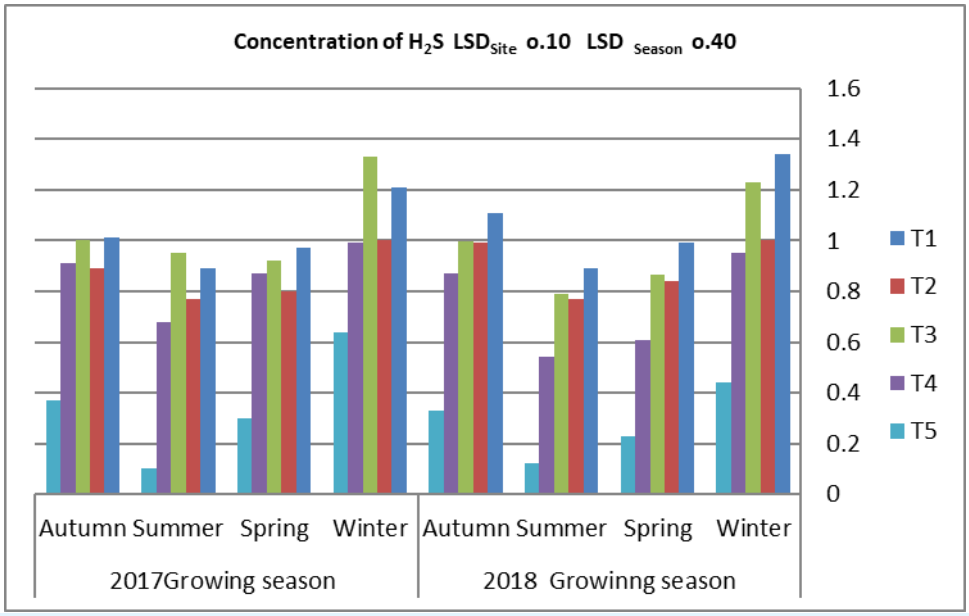

Fig. 6. The effect of oil pollution on the concentration of hydrogen sulphide gas (H_2S) in the air (ppm)

Table 1. The effect of oil pollution on the concentration of photosynthetic pigments in leaves (mg. g^{-1} soft weight)

Site	Photosynthesis pigments growth season 2017				Photosynthesis pigments growth season 2018			
	Chl a	Chl b	carotene	Anthocyanin	Chl a	Chl b	Carotene	Anthocyanin
T_1	2.21	1.09	1.18	0.138	2.12	1.06	1.14	0.140
T_2	3.20	1.22	1.40	0.100	3.09	1.12	1.34	0.120
T_3	2.34	1.11	1.22	0.113	2.22	1.10	1.17	0.130
T_4	3.11	1.45	1.76	0.099	3.07	1.34	1.64	0.099
T_5	4.22	1.89	2.17	0.068	3.99	1.76	2.00	0.076
L.S.D 0.05	**1.02**	**0.41**	**1.00**	**0.06**	**0.09**	**0.41**	**0.66**	**0.02**

Table 2. The effect of oil pollution on the percentage of some specific characteristics of fruits

Site	growth season 2017			growth season 2018		
	T.S.S	Total Acidity	Total Sugars	T.S.S	Total Acidity	Total Sugars
T_1	42.23	0.65	45.89	42.71	0.71	44.81
T_2	45.32	0.57	47.90	45.90	0.59	49.09
T_3	42.78	0.60	47.09	43.89	0.69	47.90
T_4	47.90	0.53	50.23	49.20	0.53	53.23
T_5	56.16	0.52	52.44	57.12	0.51	57.44
L.S.D. 0.05	**2.65**	**0.43**	**2.78**	**2.01**	**0.21**	**2.13**

concentration of the pigment and for both seasons, as it reached 0.138 and 0.140 mg.g^{-1} leanly weight respectively, compared to the T_5 site which scored the lowest values of 0.068, 0.076 mg.g^{-1} for the two seasons. The decrease in chlorophyll pigments A and b in the leaves of plants in site T_1 is due to the stress by pollutants, including heavy elements (Zouaried and Gomes, 2015). This decrease in pigments may be due to the effect on the biosynthesis of chlorophyll as a result of inhibition of the enzymes necessary for this process such as amino levulinic acid dehydratase and proto-chlorphllide reductase or to the effect of pollutants on the absorption of the element magnesium and zinc necessary for the synthesis of chlorophyll (Elloumi et al. 2014)), and that the pigments of chlorophyll A is more sensitive to stress than the of chlorophyll B as indicated by the study (Zouari et al. 2016; Elloumi et al. 2014). The accumulation of anthocyanins in trees near to pollutant sources compared to distant trees is attributed to the role of this pigment in protecting plants from ROS as it is from the non-enzymatic anti-oxidant system (Krupa et al. 1996; Nell and Gould, 2003).

The percentage of qualitative characteristics of fruits

The results of **Table 2** showed that oil pollution has a negative effect on the qualitative characteristics of palm fruits, and the site difference showed a significant effect on the qualitative characteristics of the fruits as the site gave T_5 the highest percentage of total solids, total sugars and the lowest acidity for the two growing seasons as it reached 56.16, 52.44 and 0.52 for the first season and 57 12, 57.44 and 0.51 for the second season respectively, compared to the site T_1 which gave the lowest percentage of soluble solids, total sugars and the highest acidity ratio as it reached 42.23, 45.89 and 0.65 for the first season and 42.71, 44.81and 0.71 for the

second season. And the reason is due to the trees near in the site T_1 from the pollution sources which are oil fields. The lower qualitative characteristics of the fruits are attributed to the effect of pollutants on photosynthesis through their effect on photosynthetic pigments, **Table 1**, where the plant content of chlorophyll is an indication of the continued process of photosynthesis (Doganlas et al. 2012).

CONCLUSION

We conclude from this study that oil pollutants have negative effects on the air and on the growth characteristics of date palm trees that vary according to the different growing seasons. Therefore, we suggest establishing palm groves in places far from the oil sites in order to avoid the negative effects resulting from them.

REFERENCES

A.O.A.C. (1970). Official method of Analysis.Association of Official method of Analytical chemists Washington, D.C.,: 910PP.

Al-Jabri K MA (2017). The effect of seasonal variation of heavy metal contamination and the effect of cadmium and lead in some biochemical, anatomical and genetic traits of date palm cultivar Barhi. PhD thesis - College of Science - University of Basra - 205 p.

Al-Khashman OA, Al-Muhtaseb AH, and Ibrahim K A(2011). Date palm *Phoenix dactylifera* L. leaves as biomonitors of atmospheric metal pollution in arid and semi-arid environments. Environ. Pollut. 159:1635-1640.

Al-Rawi KM, and Khalaf Allah A M, (2000). Design and analysis of agricultural experiments. Dar Al Kutub Printing and Publishing, Mosul / Iraq: 448 p.

Arnon D I(1949). Copper enzymes in isolated chloroplasts, polyphenoxidase in *Beta vulgaris*. Plant Physiol. 24:1-15.

Chen F, Wang S, Mou S, Azimuddin I, Zhang D, Pan X, Al- Misned F A. and Mortuza M G. (2015). Physiological responses and accumulation of heavy metals and arsenic of *Medicago sativa* L. growing on acidic copper mine tailings in arid lands. J. Geochem. Explor. 157:27–35.

Chibuike G U. and Obiora S C (2014). Heavy metal polluted soils: Effect on plants and bioremediation methods. Appl. Environ. Soil Sci. vol. 2014, Article ID 752708, pp. 12.

Doganlar Z B, Doganlar O, Erdogan S. and Onal Y. (2012). Heavy metal pollution and physiological changes in the leaves of some shrub, palm and tree species in urban areas of Adana, Turkey. Chem. Speciation Bioavailability, 24(2): 65-78.

Douabul A Z, Al-Maarofi S S, Al-Saad H T, and Al-Hassen SH (2013). Gaseous pollutants in Basra City, Iraq. Air, Soil and Water Research, (6): 15-21.

Efe S I, (2010). Spatial variation in acid and some heavy metal composition of rainwater harvesting in the oil-producing region of Nigeria. Nat. Hazards. 55: 307-319.

Elloumi N, Zouari M, Chaari C, Jomni C, Ben Rouina B, and Ben Abdallah F (2014). Ecophysiological responses of almond (*Prunus dulcis*) seedlings to cadmium stress. Biologia J. 69(5):604–609.

Forstner U. (1980). Trace metals analysis of polluted sediment. Part 1. Assessment of sources and intensities. Environ. Technol. Lett.1: 494-505.

Heath R L, and Packer L, (1968). Photoperoxidation in isolated chloroplasts. I. Kinetics and stoichiometry of fatty acid peroxidation. Arch Biochem. Biophys. 125:189–198.

Hopkins W G, and Huner N P (2008). Introduction to plant physiology. 4th Ed. John Wiley and Sons Inc. USA. 523 P.

Howrtiz W (1975). Official methods of Analysis. Association of official Analyticl chemists, Washington, D.C., U.S.A.

Ibrahim A O (1999). Hydrocarbons concentrations in leaves of some cultivarsof date palm phoenix dactylifera L. along Shatt AL- Arab River. Basrah Jscience, B,vol. 17, no. 1: 73-78.

Jackson M L, (1958).Soil chemical analysis prints Hall Inc-Englewood,Cliffs,N.J.

Jones J B (1984). Plants. In: Williams S. (ed.). Official Methods of Analysis of the Association of Official Analytical Chemists. Arlington, Virginia 22209, USA. pp 38–64.

Kahdim H A, (2019). Environmental pollution assessment of West Qurna 1 field in Basra Governorate - Iraq. PhD thesis - College of Science - Basra University - 190 p.

Krupa Z, Baranowska M. and Orzot D. (1996). Can anthocyanins be considered as heavy metal indicator in higher plants? Acta Physiol. Plant. 18:147-151.

Moore RC, Clark W D and Vodopich D S (2003). Botany. 2th Ed.McGraw Hill Company, U.S.A. 919 p.

Neill S O, and Gould K S, (2003). Anthocyanins in leaves: light attenuators or antioxidants? Funct. Plant Biol. 30:865-873.

Pallavi SH, and Rama SH D (2005). Lead toxivity in plant Brazilion Journal of plant physiology, 17(10):28-35.

Shaheen M A, El-Nakhlawy F S, Almehmadi F M, Ihsan M Z, and Al-Shareef A R, (2016). Assessment of seasonal variation for air pollutant accumulation by *Zizyphus* tree under washing treatment. Environ. Monit. Assess. 188(6): 343-354.

Vollenweider P, Cosio C, Gunthardt-Goerg M S, and Keller C (2006). Localization and effects of cadmium in leaves of a cadmium-tolerant willow (*Salix viminalis* L). Part II Microlocalization and cellular effects of cadmium. Environ. Exp. Bot. 58: 25–40.

You M, Huang Y, Lu J, and Li C (2015). Environmental implications of heavy metals in soil from Huainan, China. Anal. Lett. 48: 1802-1814.

Zouari M, Elloumi N, Ahmed C, Delmail D, Rouina B, Abdallah F, and Labrousse P (2016). Exogenous proline enhance growth, mineral uptake, antioxidant defense and reduced cadmium-induced oxidative damage in young date palm *Phoenix dactylifera* L. Ecol. Eng. 86: 202-209.

Zurayk R, Sukkariah B, and Baalbaki R. (2001). Common hydrophytes as bioindicators of Nickel, Chromium and Cadmium Pollution. Water Air Soil Pollut. 127(1): 373-388.