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 T1 (Abu Ghraib groves near the West Qurna oil field 2) and Location T5 (yarn groves near to West Qurna oil field 1), and the lowest concentration was at site T5 (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 (CH4) and hydrogen sulfide gas (H2S) in different locations and the highest concentration was recorded at site T1 and the lowest concentration recorded at site T5, 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 T5 and the lowest concentration at site T1, while estimated the highest concentration of anthocyanin pigment at site T1 and the lowest concentration at site T5. 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 T5 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 T1 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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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-Zuñdi 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 weight 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 hydrocarbons 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 μg g⁻¹ and the highest concentration of total alkanes recorded in the summer and for the same plant was 12.47 μg 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 μg g⁻¹.

Pollutants are dangerous environment on humans, animals and plants, as it causes morphological and biochemical functions to be disrupted and lead to the production of Reactive Oxygen Species (ROS) such as (O₂⁻) Superoxide, Hydrogen Peroxide (H₂O₂) 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; Chibuk and Obior, 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:

- T₁ - Al-Madinah district (Abu Ghraib) is 5 km from the West Qurna 2 oil field
- T₂ - Al-Madinah district (Al-Bawtaib) district is 10 km from the West Qurna 2 oil field
- T₃ - Ezzedine Salim area (Al-Khoyoot) is 5 km from the West Qurna 1 oil field
- T₄ - Qurna District (Basha River) 10 km from West Qurna 1 oil field
- T₅ - 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 (μg⁻¹) Hydrocarbons were measured using a fluorescence device.
2. Total alkanes (μg⁻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 Howritz, (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).
RESULTS AND DISCUSSION

**Concentration of hydrocarbons 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 T₁ significantly superiority by recording the highest concentration of hydrocarbons in the date palm trees of the Jabjab cultivar and did not differ significantly from the site T₃ compared to the lowest concentration recorded in the site T₅ 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 T₁ and did not differ significantly from site T₃ 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
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 T1 and T3 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. T1 and site No. T3 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 T5 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 Humen (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 T1 and T3 sites, while the lowest concentration in the air at the T5 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.
**CH₄ 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 T₁ and T₃, while the lowest concentration in the air at the location T₅ 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 H₂S 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 T₁ and T₃, while the lowest concentration was recorded in the air at the site T₅, 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 T₅ 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 T₁, 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 T₁ gave the highest
Fig. 6. The effect of oil pollution on the concentration of hydrogen sulphide gas (H2S) in the air (ppm)

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

<table>
<thead>
<tr>
<th>Site</th>
<th>Photosynthesis pigments growth season 2017</th>
<th>Photosynthesis pigments growth season 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chl a</td>
<td>Chl b</td>
</tr>
<tr>
<td>T1</td>
<td>2.12</td>
<td>1.09</td>
</tr>
<tr>
<td>T2</td>
<td>3.20</td>
<td>1.22</td>
</tr>
<tr>
<td>T3</td>
<td>3.24</td>
<td>1.11</td>
</tr>
<tr>
<td>T4</td>
<td>3.11</td>
<td>1.45</td>
</tr>
<tr>
<td>T5</td>
<td>4.22</td>
<td>1.89</td>
</tr>
<tr>
<td>L.S.D</td>
<td>1.02</td>
<td>0.41</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Site</th>
<th>T.S.S</th>
<th>Total Acidity</th>
<th>Total Sugars</th>
<th>T.S.S</th>
<th>Total Acidity</th>
<th>Total Sugars</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>growth season 2017</td>
<td>growth season 2018</td>
<td></td>
<td>growth season 2017</td>
<td>growth season 2018</td>
</tr>
<tr>
<td>T1</td>
<td>42.23</td>
<td>0.65</td>
<td>45.89</td>
<td>42.71</td>
<td>0.71</td>
<td>44.81</td>
</tr>
<tr>
<td>T2</td>
<td>45.22</td>
<td>0.37</td>
<td>47.90</td>
<td>45.90</td>
<td>0.39</td>
<td>49.09</td>
</tr>
<tr>
<td>T3</td>
<td>42.78</td>
<td>0.60</td>
<td>47.09</td>
<td>43.89</td>
<td>0.69</td>
<td>47.90</td>
</tr>
<tr>
<td>T4</td>
<td>47.90</td>
<td>0.53</td>
<td>50.23</td>
<td>49.20</td>
<td>0.53</td>
<td>53.23</td>
</tr>
<tr>
<td>T5</td>
<td>56.16</td>
<td>0.52</td>
<td>52.44</td>
<td>57.12</td>
<td>0.51</td>
<td>57.44</td>
</tr>
<tr>
<td>L.S.D</td>
<td>2.65</td>
<td>0.43</td>
<td>2.78</td>
<td>2.01</td>
<td>0.21</td>
<td>2.13</td>
</tr>
</tbody>
</table>

The 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 T5 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 T1 is due to the stress by pollutants, including heavy elements (Zouari 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 protochlorophyllide 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 T5 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 T1 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, 44.81 and 0.71 for the
second season. And the reason is due to the trees near in the site Ti; 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**


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