Effect of Simulated Dust Storm on some Bio-chemical features of Persian Oak (*Quercus brantii* Lindl.)

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Extended abstract

1- Introduction

Dust storm is a hazardous natural event affecting all creatures. (1). Due to the global warming drought, reduction in precipitation, and mismanagement in the water by humankind, the negative effects of this calamity were more observed (2). With increasing the wind speed, and based on the size of dust particles, land topography, soil humidity, vegetation coverage and some more parameters, the storm is generated (Ataei and Heidari, 2017). Most parts of Iran in South and West are attacked by dust storm coming from some neighboring countries (Liu et al, 2003). About 90% of forests in Ilam, are covered by a valuable tree species, Persian oak (*Quercus brantii*). The dust storm has become as a big challenge in this area for two last decades (Sayehmiri et al, 2018). The dust reduces the potential water storage (Rasooli et al, 2010), photosynthesis rate, the amount of chlorophyll pigments, carbohydrates reserves and finally leads to tree mortality (Salehi et al, 2018). Therefore, because of the significant effect of dust on the trees and also having no fundamental information on the effects of this event on endemic trees in the national forest, we aimed to evaluate the effects of dust in a controllable condition on the Persian oak.

2- Methodology

This study was done in forest laboratory, Ilam University. About 40 two-year seedlings of Q. brantii were provided from governmental nursery in Eyvan. To adapt with the new conditions, the seedlings were put in the open area for two months. The dust for the study was collected from the closest desert of Iraqi desert, Dehloran, which is very similar to the dust originated from natural sources. In the laboratory, the dust was ground to reach the size of about 40 µm. To treat the seedlings with the dust, a chamber with dimensions of 2*2*2 m was made and three barbeque fans were placed to suspend the dust. The process of dusting was done in three periods: 1) 220 g of dust at six 1.5 hrs from 9 am up to 6 pm that at each series about 36 g of dust was re-added to the chamber. Likewise, a similar condition was prepared for control seedlings. 2) The 2nd and 3rd periods of dusting was also the similar to the first one, but with some changes in the concentrations and the time. The time interval between periods was 12 days and dust induced at the second and third periods was 330 and 440 g. One week after the last period, some leaves specimens were collected from seedlings. The leaves were stored in the freezer -80 °C for further analyses. The measured biochemical features were chlorophyll pigments, carbohydrates, and proline. The data was analyzed by ANOVA to determine the effect of dust, periods, and their interactions.

3- Results

According to the results, the effect of dust on chlorophyll a, b, total, carotenoid and carbohydrates were significant, but had no significant effect on proline. The interaction effect of dusting on proline was significant, with no significant effect on the other factors. The results of t-test at first the period showed insignificant differences between treated and control seedlings for all features. At second and third periods, significant differences were observed between all features except proline. The highest increase was seen in carbohydrates. The results of mean comparison showed significant differences between chlorophyll a, b, total, carotenoid and carbohydrates. The highest variation was observed in highest concentration in dust at the third period. At the third period compared to the first one, the chlorophyll a, b, total, and carotenoid showed a reduction of 31%,

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31%, 31%, and 30%. The carbohydrate in third period was 40% higher than the first period. The proline showed no significant difference.

4- Discussion & Conclusions

Chlorophyll pigments are of most important biological factors for the plants that usually are reduced by environmental stresses (Saravana Kumar and Sarala Thambavani, 2012). Linear correlation between photosynthesis rate and stomatal conductance shows the significant of stomata for net photosynthesis productivity (Ashenden and Williams, 1980). Therefore, the dust stress reduces the Co2 in the stomata (Sayyahi et al, 2015). The high activity of chlorophylase enzyme leads to breaking up the chlorophyll that decreases the chlorophyll pigments (Loggini et al, 1999). Furthermore, the shade from dust on the leaves clog the stomata and also increases the leaf temperature resulting into producing that enzyme (Moradi et al, 2017). The leaf alkaline condition makes a reduction in chlorophyll pigments. The reduction in light intensity and also nutritive ions decrease the photosynthesis rate in the pigments (Brandt and Rhoades, 1972). Due to the shading from the dust, the amount of carotenoid is reduced. The first role of this pigment is to conserve the chlorophyll (Allen et al, 1998). Concerning to the carbohydrates, the increasing amount of this feature is due to increasing starch decomposition and other polysaccharides. On the other hand, the increase in carbohydrates could be a reason for reduction of tree growth no consuming of the nutriatives (Ehdaie et al, 2006). Related to the proline, it is a significant osmolite for moderation of osmotic pressure in the cells affecting from stresses (Mohammadkhani and Heidari, 2008). No significant variation in this study might be due to short time of dusting.

In general, dust had significant effects on the most physiological features of the Persian oak seedlings as high amount of dust and less amount of chlorophyll pigments. To sum up, in spite of the continuum drought and out-break of pests and diseases, the dust with the origination of neighboring countries are another influencing factor for oak decline in Iran.

Key Words: Dust storm, Leaf physiological features, Photosynthetic pigments, Persian oak, Zagros forest.