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Investigating the Relationship between Soil and Plant Organic Carbon, *Camphorosma Monspeliaca L.*, and Some Chemical Parameters in Arid and Semi-Arid Rangelands of Ghahavand Plain

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Extended Abstract

Introduction: Plant and soil conservation play a vital role in effective rangeland management, especially in dealing with the threats caused by climate change. On the other hand, there exists a complex interaction between soil and vegetation in rangeland ecosystems, neither of which is solely dependent on the other. Moreover, various natural factors, including climate change, aridity, desertification, and drought, may accelerate the degradation of rangelands, making the identification of such a relationship a necessity for evaluating the potential for carbon sequestration in arid and semi-arid landscapes. In this regard, as rangeland ecosystems in Qahavand plain, Hamadan, have been influenced by drought and desertification, this study sought to examine the relationship between soil parameters and the key species of the Qahavand rangeland, that is, Camphorosma Monspeliaca L. , concentrating on the storage of organic carbon.

Materials and Methods: to collect soil and plant samples from the study area during the mid-growing season, three transects and eleven plots were selected using a systematic randomized sampling method. The positions of the transects were chosen based on the overall slopes of the area, and the plots were selected randomly along each transect using Google Earth software and GPS. Moreover, soil samples were taken from depths of 0-15 and 15-50 cm, which were then transferred to the laboratory for analysis. In this regard, a total of twenty-two soil samples and eleven aerial biomass samples were collected for further chemical analysis so that changes in soil and plant properties can be studied. Finally, various parameters such as soil and plant organic carbon, soil texture, pH, EC, bulk density, total nitrogen, nitrate, and ammonium were measured, followed by the performance of statistical analysis and linear correlation using SAS v.9.4 software.

Results and Discussion: Changes in the organic carbon content and their relationship with other parameters were investigated in the areas covered by Camphorosma Monspeliaca L. The results revealed no significant changes in organic carbon, acidity, total nitrogen content, nitrate, and ammonium at depths of 0-15 cm and 15-50 cm ($P>0.05$). Therefore, it can be argued that the presence of Camphorosma Monspeliaca L. species does not exert a significant influence on those parameters in surface and subsurface soils. On the other hand, notable changes were found in clay percentage and specific bulk density at both soil depths mentioned above. Moreover, Pearson's linear correlation analysis between soil parameters and organic carbon content indicated that except for silt percentage ($p>0.05$), there was no strong and significant relationship between the two. Generally, changes in soil organic carbon content, acidity, clay percentage, sand percentage, total nitrogen percentage, nitrate, and ammonium were found to have been aligned in the same direction. However, the organic carbon content showed an inverse relationship with other parameters. Therefore, it could be argued that except for silt percentage ($r=-0.41$, $p \leq 0.05$), there was no significant correlation between soil organic carbon and the other parameters.

While variations in soil organic carbon were generally expected to be found within the 0-50 cm depth, no

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significant changes were reported within the study area in this regard. In other words, the analysis of changes in soil organic carbon and linear correlations did not show any substantial difference in the organic carbon content between the surface and subsurface layers of the soil covered by *Camphorosma Monspeliaca* L, indicating that no significant alteration has occurred in soil organic carbon storage within the 0-50 cm depth of Qahavand rangelands which is dominantly covered by *Camphorosma Mmonspeliaca* L. The phenomenon could be attributed to the plant's morphology and root growth patterns, considering the fact that *Camphorosma Monspeliaca* L. is characterized by a deep robust root system that can extend up to a depth of six meters and cover an area of 60-70 cm, contingent upon the groundwater depth. Furthermore, the absence of noticeable changes in other key properties of both surface and subsurface soil may also be related to such a phenomenon.

Additionally, no significant correlation was found between the organic carbon storage in surface and subsurface layers of the soil and the plant's organic carbon. It should be noted that interactions among numerous factors play a crucial role in predicting soil carbon reservoirs and that inorganic carbon could potentially constitute a significant reservoir in Qahavand rangeland soils. Accordingly, it is recommended that a broader range of physical and chemical properties of both the soil and *Camphorosma Monspeliaca* L. be monitored to gain a comprehensive understanding of soil carbon sequestration within the region. Based on the average soil organic carbon content and soil bulk density, estimations suggest that the potential for soil organic carbon sequestration within the 0-50 cm depth of Qahavand rangelands approaches 90.9 tons per hectare.

Keywords: Carbon Sequestration, Qahavand Plain, *Camphorosma Monspeliaca* L., Soil Organic Carbon.