

## ***Interactive comment on “Microbial communities and their predictive functional profiles in arid soil of Saudi Arabia” by Munawwar A. Khan and Shams T. Khan***

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The authors thank the reviewer for the critical assessment of the manuscript and expert comments. We agree with the reviewer on many points, and corrections according to referee expert comments will be made in the revised manuscript. A native speaker can correct English and grammatical mistakes. “Inappropriate writing” can also be improved by including the comments made by the learned reviewer or any other correction proposed by reviewers and editor. Please find below point wise reply to the posted comments. Reviewer comments: Although the author wants to explore the arable potential in this region through the presented experiment, the improper experimental de-

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sign, unclear sampling process, inappropriate writing, and numerous grammar errors made the text should be reconsidered to publication. Response: As discussed above, the experimental design and sampling process can be explained to address the referee's concerns. Writing part can be improved, taking into consideration technical flaws, editing, and grammar issues. Reviewer comments: The content of the text only involved the changes in the microbial community structure, and did not involve the functions related to microbes, such as enzyme activities related to C mineralization and changes in NO<sub>x</sub> or soil N levels related to N mineralization, therefore it cannot reflect the meaning of "predictive functional profiles" in the title. Response: The data presented in the manuscript is 16S rRNA gene sequencing and functional prediction using PICRUSt analysis, which has already been used in multiple studies as a powerful tool for predicting function. Based on the results presented in the study, we chose the title, but if the reviewer disagrees, we can remove "predictive functional profiles" from the title. Discussion can be elaborated to include changes in genes responsible for the mineralization and nitrogen cycle etc. in different samples. Reviewers comments: The sampling points in each site were not enough to contrast the differences in soil community from semi-arid to arid regions and the sampling method is incorrect according to the current description. Response: We can add further details of the sampling site. We agree with the reviewer that more exhaustive sampling could have been included in the study. But in our preliminary study we used fewer samples as has also been reported in various previously published studies also to characterize the microbial community. Reviewers comments: The author should set the sampling plots for collecting soils because it is impossible to set true repetitions at each site. Furthermore, the author did not detail describe the sampling method. What is the basis of sampling? How about the aboveground vegetation? What is the size of each sampling plots at each site? What points were collected in each sampling plot? How far apart between the sampling plots? Response: The authors will add these details in the revised manuscript. At all the sites top 1-2 cm sand was removed before sample collection to avoid any debris and sand. Reviewers comments: In the Lines 49-51, why did soil samples

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distinguish between rhizosphere and non-rhizosphere soils only at Muzahmiyah? Response: If the reviewer wants, we can remove the data of the rhizospheric soil sample from Muzahmiyah. It was included to compare the Rhizosphere soil microbial community with that of relatively fertile soil from the Abha region. Furthermore, Hafralbatin is a highly arid region. Reviewers comments: Line 49, why soil samples only collected from the upper soil of 0-5cm. Due to the contrasting rainfall and temperature among these sites, soil community in the deeper soil that greatly influenced by soil moisture should include in this study. Response: We checked in some preliminary experiments (not included in the manuscript) that higher plate count was observed in the 0-5 cm region after removing the top layer, which we considered as debris or surface sand (~1-2 cm). The CFU counts decreased to an order of 10 in samples collected from a depth of 15 cm. These details will be included in the revised manuscript. Reviewers comments: The last and most important drawback of this experiment is why the chemical or physical properties of the soil, such as soil temperature, humidity, soil total carbon and nitrogen, are not measured when collecting soil samples. These parameters are more useful than the currently used parameters (annual average) to explain changes in the soil communities. Response: We agree with the reviewer, but we have included some climatic conditions, average soil temperature, soil texture, CFU counts, and average rainfall in table 1. As correctly pointed out by reviewers, these parameters also influence the microbial community. Some discussions could have been added to the manuscript, which can be included in the revised manuscript. The temperature on the day of sampling, a typical range of carbon and nitrogen content of the soil in the region can be searched in the literature at this point. It can also be included in the discussion if available. Reviewers comments: Writing skills: Data analysis should write in another subtitle different from the others in the part of 2 Materials and Methods. Response: This correction will be incorporated in the revised manuscript. Reviewers comments: Many abbreviations, such as Line 17-18 DMF and PICRUS<sub>t</sub>, should give their full name when they first present in the text. Many descriptions, such as Line 85-87. Response: The revised manuscript will include this suggested correction. Reviewers comments:

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Many descriptions, such as Line 85-87, in the part of 3 Results and discussions should move into the part 2 acted as the background of sampling sites. Response: This part will be moved to the part 2. Reviewers comments: Line 138-141, the results should be described in the order of the figures, first in Figure 4A and then in Figure 4B. Table 1, no note for the indication of M5 and M15. Response: The results will be rearranged as suggested and a note to denote M5 and M15 will be added.

Reviewers comment: English grammar errors: grammatical errors existed throughout the whole text, need to rewrite. For example, in the Abstract, Line 11, 'Microbial community composition varied remarkably from other deserts and from one place to another. ' do you want to express 'the composition of microbial community varied greatly from site to site'? Response: This sentence should come in the later in the abstract as by other deserts, we mean Antarctic, Namib" and place to place means Abha, Muzahmiya, and Hafr Al-batin. Reviewers comment: Line 13, 'Unlike other deserts', what do you mean? Response: Here also it means deserts in other parts of the world. But as suggested by the reviewer, the abstract will be restructured. Reviewers comment: 'Soils from the agricultural region of Abha were significantly different from other samples in containing only 1% Firmicutes and three to six times higher population of Actinobacteria and Bacteroidetes, respectively do you want to express that 'Soil microbial community in the region of Abha contained only 1% Firmicutes, but the populations of Actinobacteria and Bacteroidetes were three to six times higher than the other desert regions. Response: Yes, the sentence will be modified to enhance clarity.

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