

Response of Soil Community Structure to Halal Vegetation Success Based on Pyrosequencing

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Abstract: order. reveal. relationship ~ bacterial community structure, halophytic vegetation succession, high-throughput sequencing technology. used. investigate. composition, distribution. soil bacterial community structure under bare land, four halophytic vegetation types (saline seepweed angiospermae imperata cylindrica., venetum L). Yellow River Delta. about 31976 valid sequences. obtained from 5 vegetation types, Bacteria. classified. 27 phyla 62 classes 78 orders 196 families, 569 genera. proteobacteria. dominant phyla. four types. halophytic vegetation. relative abundance. 36.4 ~ 53.2% while Bacteroidetes. dominant community. bare land. relative abundance. 46.2%. Soil quality, bacterial community diversity and abundance showed an increase trend with the positive success of halal vegetation, and the content of soil organic carbon was positively related with OTU numbers, Ace index and Shannon index of bacteria. RDA analysis showed that the community structure of soil has a great similarity. with the positive success of halal vegetation, the electrical conductivity decline, and the contents of organic carbon, active organic matter and alkali nitrite created.

Keywords: Yellow River Delta Bacteria Community Structure High Flux sequencing Salt vegetation play

1. Material and Methods

Part In material cycle Soil Structure Formation Promote Plant Growth Development And Ecological Environment Improvement play the important of Role^[8 ~ 10]Other

1.1. Soil samples collection. The With the microbial research methods of development. Found traditional research methods such. According to times of Yellow River delta of study to understand. In accordance with salt sheng zhi. Microbial plate culture. Biological MARKER METHOD, Biolog Identification and difficult to quasi-Was play for the order. Select light board. Two kind of strong salt-tolerant plant community fin. The reflect environment in bacteria of actual there status. Bacteria Community and its more. Suaeda salsa. Roe Mao and two light salt-tolerant plant community Imperata cylindrica. Apocynum venetum. So The high flux sequencing and Genome of means^[12,13] Research. Line Sampling. Which Each plant community in dispersion is set 5 A sampling area

Research saline soil environment under soil bacteria of diversity and its and salt vegetation. Each sampling area draw 2 m × 2 m Of-like In plant near 10 cm. Relationship has important of Significance. In By diagonal five sampling method collection of soil samples Mixed uniform

Again will each sample 5 A sampling area soil samples Mixing Into for sterilization pouches after Quickly placed cooler. Back to laboratory. Soil samples divided into two A respectively air-dry and -80 Frozen The former for soil physical and chemical properties Determination The latter for Molecular Biology Research.

1.2. Soil physical and chemical properties of Determination

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Application elements analyzer determination soil organic carbon (Soil in carbonate has hydrochloride take off) And total nitrogen content The alkali solution diffusion method determination Alkali Solution Nitrogen Take Olsen Method Determination of soil available phosphorus. Through low temperature the heating potassium dichromate Oxidation-Colorimetric Method (Don't multiplied by oxidation correction coefficient?) Determination of soil activity organic matter^[14]. Combined Kettler And Methods^[15] The soil particle size the analysis. The light plug-in swell determination of each sampling point Soil 10 cm The of Ground Temperature. The TDR100 Soil water detector determination of each sampling point soil in 0 ~ Natural 20 cm Of Water Content.

1.3 Soil DNA Extraction

The Soil DNA Kit (# D5625-01 American Omega The company) Extraction soil samples in total DNA Specific operation in accordance with the instructions of.

1.4 PCR Amplification

By agarose electrophoresis of extraction to the genome DNA The detection View genome DNA The concentration and its integrity. Use Qubit 2.0 DNA Detection Kit of genome DNA Accurate quantitative To determine PCR Reaction should be join DNA Of. PCR Used of primers have fusion. Roche 454 FLX Sequencing platform of general primers (Fusion Bacteria

PCR Reaction System Main have the following six part Respectively:

10 × PCR buffer 5.0 μL, DNTP (10 mmol L⁻¹) 0.5 μL, Template DNA 10.0 ng, On, Downstream Primers (50 μmol L⁻¹)

1.0 μL, Plantium Taq DNA (U μmol⁻¹) Polymerase 0.5 μL, And H₂O Bu zhi 50.0 μL. Configuration good PCR System in accordance with as follows reaction conditions PCR Amplification: 94 Pre-Degeneration 30 s (1A cycle); 94 Degeneration Natural 20 s, 45 Complex Natural 20 s, 65 Extension 1 min (5A cycle); 94 Degeneration Natural 20 s, 60 Complex Natural 20 s, 72 Extension Natural 20 s (Natural 20A cycle); 72 Extension 5 min (1A cycle), 10 Save.

1.5 High Flux sequencing and Data Analysis

"With agarose electrophoresis on PCR Product The determination after The Shanghai Sangon agarose recovery kit (Cat: SK8131) DNA The purification recovery. Recovery product" Qubit Bei 2.0 Fluorescent agent the quantitative Processing. According to experiment get DNA Concentration Will samples and proportion mixed And oscillation uniform. Finally" With Roche the company 454 Sequencer

Roch gs flx sequencer) The mixed product the sequencing.

The to unless target regional of Sequence Use Mothur Software the Pretreatment. For sequence in Chimera Available Uchime The effective removal (Quality Control). By Blast Comparison database of processing after sequence the species Classification. The similarity is greater 97% The sequence Uclust Software classified as with same operational classification unit (OTU), After the analysis of the bacterial community structure and diversity. This study in Sigmaplot 12.5 Okay Beta Diversity main Coordinate Analysis (PCoA) Results The Drawing The SPSS 16.0 The correlation analysis and single factors Variance Analysis "Canoco 4.5 The RDA Analysis.

2. Results and Analysis

2.1 Soil Physical and Chemical Properties

Light board, Fin Suaeda salsa to and ROE Mao to belong to the sea product wet normal saline soil Which light board to salinization degree than fin Suaeda salsa high a lot; Imperata cylindrica

And Apocynum venetum to belongs to the weak salt light wet prototype Soil. Soil salt content and soil conductivity was positive correlation relationship^[16] This paper the Soil Electrical Conductivity

Rate characterization soil salinization degree. By table 1 We can know that Soil of physical and chemical properties in different vegetation type under there are some difference. In all plots in Salt Content overall sort: Mild salt-tolerant

community<Severe salt-tolerant community<Light board;Light board to activity organic matter,Nitrogen,Total Nitrogen of content to far lower than have vegetation cover of Soil.Related analysis foundActivity organic matter and organic carbon,Nitrogen,Available Phosphorus was significantly positive correlation($P < 0.05$),And conductivity and C/N ratio was very significantly positive correlation($P < 0.01$).According to the above analysis can seeYellow River delta of soil quality with the salt vegetation of positive play for have gradually improve of trend.

2.2 Community Structure Diversity Analysis

High Flux sequencing results after low-quality of sequence FilterTheHave to sequence length most are in400 ~ 600 bpInterval inAverage sequence length440 bpTo further analysis of requirements.5Of soil samples of get effective sequence31976ArticleWhichLight board,Fin Suaeda salsa,

Roe Mao,Imperata cylindrica to and Apocynum venetum to the effective sequence number respectively6931,5185,10453,5184And4222.

TheMothurIn-depth analysis community structure of diversity(Figure1.),Press higher97%Similarity sharing165361Otus,The ROE grass covered in SoilOtusMaximum Number,Followed by white grass.Shannon,Chao1AndAce 3The indices show a similar trend,Plate ground

Soil bacterial diversity index lowest,And the bacterial diversity index of Roe grass landSupreme,Followed by white grass and Apocynum.Correlation analysis discoveryOtusNumber,Bacterial Diversity IndexAce,Shannon,Chao1Positively correlated with soil active organic matter and organic carbon.($P < 0.05$),The correlation coefficient with active organic matter was:0.906,0.947,0.969,0.967,The correlation coefficient with organic carbon was:0.912,0.990,0.973,0.980.As Halophytes are the main source of organic carbon in saline soil,Therefore, salt Cultivation

The succession must affect the bacterial community structure diversity and abundance in saline soil..

2.3 Community comparison

To further measure the differences in species composition among samples.,This study is based on BetaDiversity IndexUnifrac MetricValues for each samplePCoAAnalysis.As shown in Fig.2.Shown,PC1,PC2AndPC3The interpretation29.9%,13.2%And11.0%.Roe grass and white grass get together,The similarity of bacterial community was the highest.,Second,The similarity between the two lands was higher than that between the two lands.;The similarity of Suaeda heteroptera land to white grass and ROE grass land was also high.,

However, the similarity between Suaeda salsa and Apocynum venetum was relatively low..The distance between the above four salt-generating vegetation and the bare land is far,It shows that they have a lower similarity with the community structure of the land..

InQuasi-of door is light board to most important of doorRelative abundance46.2%And its in fin Suaeda salsa,Imperata cylindrica,Apocynum venetum and ROE Mao of relative abundance3.6 ~ 8.0%Significantly reduce.Different of isDeformation of the door,Actinomycetes door,Acid of door,Green bending bacteria door,Thick-walled bacteria door,Warts micro-bacteria door in light board to the relative abundance were was significantly lower than that of salt vegetation cover of plotsRespectively from30.0%,3.2%,0.2%,0.4%,0.5%,0.32%Improve36.4

Nitrogen showed a significant positive correlation($P < 0.05$).It shows that nutrients in the soil can promote the growth of most bacteria.,Salt inhibits the growth of most bacteria.

4.Soil bacterial genera and environmental explanatory variablesRDASort Graph

Fig.4 The alignment diagram of RDA with soil bacterial communities in genus and explicit Variables

3. Discussion

Generally speaking,Nitrogen in Soil,Phosphorus content is an important indicator of Soil Fertility^[17].Plant growth activates Soil Nutrients,Plant litter is also the main source of Soil Organic Carbon and Nitrogen^[18],Therefore,Carbon,

Nitrogen, especially active organic matter in vegetation-covered Soils, Alkali-hydrolyzable nitrogen, The content of organic carbon was significantly higher than that of bare land. The content of carbon and nitrogen in soil of severe salt-tolerant vegetation was significantly lower than that of mild salt-tolerant vegetation. Although it belongs to heavy salt-tolerant vegetation, The content of carbon and nitrogen in soil was significantly higher than that of Suaeda salsa. In particular, alkali-hydrolyzable nitrogen, Active organic matter and organic carbon, The former is Of the latter 3 ~ 8. Times, The change of its content may be affected by the species and Properties of plant organic matter.^[19] This indicates that organic matter from plants is the main source of soil organic carbon.^[18] And affected by vegetation types. The accumulation rate of soil carbon and nitrogen is different in different succession stages. The results of this study are in line with Cheng ruimei and Gong Xia *et al.*^[20,21] Similar results. The above results show that, Soil Quality gradually improved with positive succession.

Studies have shown that, Plants provide energy and nutrients to microbes through organic inputs, At the same time, soil microbes promote soil organic matter

Mineralization increases soil fertility, Promote Plant Growth, Thus improving plant Polarity

Adaptation of terminal conditions^[22,23]. Therefore, Study on Soil microbial community structure helps to understand plant survival strategies. In this study, the high-throughput sequencing showed that the bacterial diversity index of salt vegetation soil was significantly higher than that of the bare land. And

The diversity index was significantly correlated with soil active organic matter and organic carbon. Positive correlation ($P < 0.05$). Beta The diversity analysis also showed that the similarity between the soil and the bare land of the four salt vegetation was the lowest. However, the highest similarity was found in the four cultivated plants. This is probably because it belongs to the same department. To earth

Similar effects of soil and soil microbes. Classification results also showed that the soil bacterial composition of the two plants was the most similar. But there is a big difference between the bare land and the four salt vegetation at the gate level. Bacteroides gate is the most important gate in the plot of light Plate, However, the most important door of the salt-covered vegetation is the Proteus phyla. Conductivity of bacterioca and Soil (Salt Content) A significant positive correlation. This may indicate that the bacteria have strong salt tolerance. Pending further confirmation. Proteobacteria include many bacteria involved in the nitrogen cycle.^[24,25]

Rhizobia, such as nitrogen fixing (Rhizobium), It is not detected in the light board ground, It was detected in saline vegetation soil. The relative abundance of light salt vegetation was higher than that of heavy salt vegetation. Therefore, it can be inferred that the nitrogen work in

Bacteria play an important role in Nitrogen Fixation and Nitrogen Cycling in halophytes. Therefore, the content of nitrogen in soil of halophytes increased significantly. Likewise, The nitrifying spiral fungus contains the genus nitrifying spiral bacteria involved in the nitrification reaction. It is not detected in the light board ground, The relative abundance of heavy salt vegetation and light salt vegetation in soil showed an increasing trend.

In nature, Climate, Vegetation type, Soil Structure, Soil Physics and Chemistry

Properties can affect the quantity and composition of soil bacterial community.^[26,27] Ben Yan Soil bacteria and their physical and chemical parameters. RDA Analysis discovery, Conductivity, Carbon and nitrogen ratio has a greater influence on the composition of Genus; Soil Organic Carbon, Active organic matter, Alkali-hydrolyzable nitrogen, The effects of genera from the fields of Elymus and Apocynum were gradually enhanced; Among them Roe Mao and Imperata cylindrica plots bacteria of similar Other samples between bacteria of composition difference is big. Most bacteria of in salt vegetation soil in abundance was significantly higher than that in light board But also have some salt-tolerant bacteria of in light board ground phase the abundance is high Such Truepera, Salinarimonas, Loktanella And Cycloclasticus Of They and electric-rate was now the. Positive off ($P < 0.05$). Special don't Gracilimonas Of in light board to in relative abundance highest 30.4% In severe salt-tolerant plant community (Fin Suaeda salsa and ROE Mao) And mild salt-tolerant vegetation community (Imperata cylindrica and Apocynum venetum) The relative abundance is only 0.210%~

3.88%. Above results show soil physical and chemical properties, Salt vegetation and bacteria three between collaborative role, Each Other Influence.

4. Conclusion

1) Detection of 5A cover type soil samples of get effective sequence

1976 Article Which Quasi-of door is light board to most important of door And deformation of the door is salt vegetation soil the most main of door.

2) Have vegetation cover of mild salt-tolerant community (Imperata cylindrical community, Apocynum venetum community), Severe salt-tolerant community (Fin Suaeda salsa community, Roe Mao community) Bacteria

Rich Degree and diversity is light board high. And bacteria diversity index

ACE, Shannon, Chao1 And soil organic carbon was significantly positive correlation ($P < 0.05$).

3) Roe Mao and Imperata cylindrica soil bacteria community of the most similar Four of salt vegetation and light board to the Community structure between has a low of Similarity.

4) With the salt vegetation positive play Influence soil bacteria community composition of leading physical and chemical factors by Electrical Conductivity gradually to organic carbon, Activity organic carbon and nitrogen.

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