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ASPECTS OF THE RHIZOSPHERE EFFECT IN A *ZEA MAYS* L. GENOTYPE

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Abstract: Plant roots excrete various substances into the rhizosphere, and these substances provide a rich source of nutrients for the microbial community. The present paper is focused on the evaluation of number of microorganisms in the rhizosphere. The number of colony-forming units calculated for 1 g rhizospheric soil was 252 x 10^6, while for 1 g free soil was 84 x 10^6. Based on the morphological characters 15 bacterial strains were isolated from the sample of rhizosphere soil.

THE AIM OF INVESTIGATIONS

Evaluation of the rhizosphere effect and morphological characterization of the bacteria present in the rhizosphere of the maize plants (*Zea mays*).

MATERIAL AND METHODS

In order to determine the impact of the rhizosphere effect two samples of soil were used: one of free soil and the other of rhizospheric soil, adherent to the surface of maize plant roots. The rhizosphere soil was collected after a preliminary removal of the free soil and a gentle shake of the roots.

The samples were collected from the roots of maize plants in a local community from Gugesti (Vaslui county), generation 2001-2002.

In order to determine the density of the microorganisms on the rhizoplane, a soil sample was used, collected by washing, energetic shaking and powdering of five radicular fragments about 1cm in diameter and approximately 4 cm in length.

The three samples of soil were used to prepare dilutions (suspensions) which were inoculated on medium Bunt-Rovira (gelosis with soil extract). The Petri dishes were incubated at 28^0 C for 7 days. The incubation period was followed by isolation as pure cultures, using the same culture medium and under the similar conditions. The isolated strains were stored at 4^0 C with a view to microscopical examination.

The strains were morphologically characterized, both macroscopically by using a binocular eyeglass and microscopically by using colored smears (Gram method) and an optical microscope.

The number of CFU (colony-forming units) was determined by counting the colonies grown on the Petri dishes by the formula:

CFU/g of soil = A x 10^n / V, where A – number of colonies; 10^n – level of dilution at which the counting was carried out; V – volume of inoculum.

In order to evaluate the rhizosphere effect the R/S ratio (ratio of the number of microorganisms in the rhizosphere to the number of microorganisms in the free soil) was determined.

For the isolated strains the following conventional notations were used: R51, R52, …..R515.

RESULTS AND DISCUSSIONS

Dilution 10^{-5} was used in counting the colonies grown after the incubation period. The number of colony-forming units calculated for 1 g rhizospheric soil was 252 x 10^6, while for 1 g free soil was 84 x 10^6. The R/S ratio was calculated to 3, which supports the evidence that the number of microorganisms in the rhizosphere of adult plants is higher as compared to that found in the free soil. This difference between the two microorganisms communities may be explained by the positive impact of the plant roots on the microorganisms present in the rhizosphere.

The number of colony-forming units estimated for 1cm^2 of radicular surface was 9.08 x 10^6.

Based on the morphological characters 15 bacterial strains were isolated from the sample of rhizosphere soil.

The morphological macroscopical characters of the isolated strains are presented in Table 1.

Table 1 – Macro-morphological description of the isolated strains

CRT. NO.	STRAIN	DESCRIPTION OF COLONIES
1	R_{51}	type s, viscous appearance, creamy, slightly adherent to the substratum
2	R_{52}	type s, regular margins, creamy, freely adherent to the substratum
3	R_{53}	type s, mucous appearance, reddish creamy, slightly adherent to the substratum
4	R_{54}	type s, viscous appearance, creamy, slightly adherent to the substratum
5	R_{55}	type s, viscous appearance, creamy, slightly adherent to the substratum
6	R_{56}	type s, regular margins, creamy, freely adherent to the substratum
7	R_{57}	type s, mucous appearance, reddish creamy, slightly adherent to the substratum
8	R_{58}	type s, regular margins, creamy, freely adherent to the substratum
9	R_{59}	type s, viscous appearance, creamy, slightly adherent to the substratum
10	R_{510}	type s, mucous appearance, reddish creamy, slightly adherent to the substratum
11	R_{511}	type s, regular margins, creamy, freely adherent to the substratum
12	R_{512}	type s, viscous appearance, creamy, slightly adherent to the substratum
13	R_{513}	type r, regular margins, white, strongly adherent to the substratum, punctiform
14	R_{514}	type s, mucous appearance, reddish creamy, slightly adherent to the substratum
15	R_{515}	type s, regular margins, creamy, freely adherent to the substratum

The results of the examination of the smears obtained from the pure cultures of the analyzed strains are presented in Table 2.

Of the 15 strains, 6 were morphologically represented by Gram-negative, non sporulated, small bacilli, 2 were represented by Gram-positive, non sporulated coccobacilli, 3 by Gram-positive, sporulated bacilli with undistorted central spore, 3 by Gram-positive, non sporulated, small bacilli, and 1 by Gram-positive cocci

The bacterial strains subjected to microscopic examination may be grouped into the following categories established by Taylor and Lochhead (Figure no.1):

Table 2 – Micro-morphological description of the isolated strains

CRT. NO.	STRAIN	MORPHOLOGICAL DESCRIPTION
1	R_{51}	gram negative, isolated, non-sporulated, small bacilli with pointed ends

2	R_{52}	gram positive, isolated, non-sporulated bacilli
3	R_{53}	gram positive, non-sporulated, small coccobacilli, arranged in irregular clusters
4	R_{54}	gram negative, clustered, non-sporulated, small bacilli
5	R_{55}	gram positive, isolated, sporulated bacilli with undistorted central spore
6	R_{56}	gram positive, isolated, non-sporulated bacilli
7	R_{57}	gram negative, isolated, non-sporulated, small bacilli with pointed ends
8	R_{58}	gram positive, isolated, non-sporulated bacilli
9	R_{59}	gram positive cocci arranged in diplo
10	R_{510}	gram positive, isolated, sporulated bacilli with undistorted central spore
11	R_{511}	gram negative, clustered, non-sporulated, small bacilli
12	R_{512}	gram positive, non-sporulated coccobacilli, arranged in irregular clusters
13	R_{513}	gram negative, clustered, non-sporulated, small bacilli
14	R_{514}	gram positive, isolated, sporulated bacilli with undistorted central spore
15	R_{515}	gram negative, isolated, non-sporulated, small bacilli

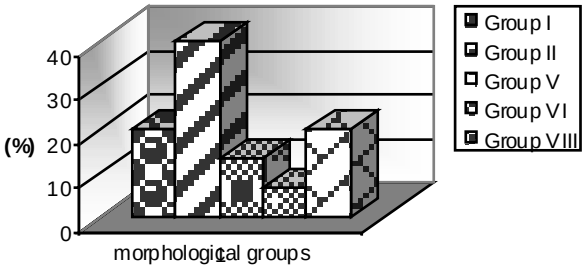

Fig. 1 - Percentage representation of the principal morphological groups of bacteria present in the rhizosphere of maize plants

- Group I – short rods, Gram positive – 20%;
- Group II – short rods, Gram negative – 40%;
- Group III – short rods, Gram variable – 0%;
- Group IV – rods evolving to cocci – 0%;
- Group V – coccoid rods – 13.4%;
- Group VI – Gram positive of Gram negative cocci – 6.6%;
- Group VII – long, non-sporulated rods – 0%;
- Group VIII – sporulated rods – 20%.

The results of the study and especially the percentage of each morphological type in the rhizospheric communities revealed comply with the specialized literature data.

CONCLUSIONS

A number of 252 x 10^6 colony-forming units were counted per gram rhizospheric soil and of 84 x 10^6 colony-forming units were counted per gram free soil.

The number of microorganisms on the rhizoplane was 9.08 x $10^6/cm^2$.

The value of the ratio r/s was 3.

A number of 15 bacterial strains (morphologically represented by bacilli, coccobacilli and cocci) were isolated from the rhizosphere soil sample.

Based on the microscopical characteristics examined, the bacterial strains were grouped into five morphological groups.

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