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A SURVEY ON ALGAL INFESTATION IN RICE FIELDS IN PUERTO RICO

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SUMMARY

During 1982 and 1983, more than 100 algal samples were collected from several sites of infestation. All samples were examined under the microscope with the exception of Chara species. The identification work was limited to the genera. The predominant genera identified were Hydrodictyon, Spirogyra, Rhizoclonium and Oedogonium. Other less abundant genera were Anabaena, Aphanizomenon, Bacillaria, Chara, Chlorosarcina, Cladophora, Closterium, Cosmarium, Diatoma, Eremosphaera, Fragilaria, Gyrosigma, Hormidium, Nannochloris, Navicula, Oscillatoria, Pithophora, Phacus, Protococcus, Pyrobotrys, Roya, Scenedesmus, Spirulina, Synedra, Symploca and Ulothrix. The relative abundance of these genera of algae on different rice farms in Puerto Rico is also reported.

INTRODUCTION

Algal blooms formed in rice fields were found to create a physical barrier that prevented rice seedlings from penetrating the floodwater surface (Dunigan, Hutchinson and Hill 1979). The occurrence of a thick mat of algae during the delicate rice seedlings stage caused damages to the plants by entangling (Singh 1978) and chocking them (Robert 1955). The algae also interfered with tiller formation of rice plants (Banerji 1939). Dunigan et al. (1979) identified Spirogyra and Hydrodictyon as the two worst algae encountered in Louisiana rice fields. In Puerto Rico, incidences of heavy algal infestation were encountered in 1982 in the Miguel Such rice farms in Manatí. The use of algae contamined water from the Manatí river for irrigating rice fields is believed to be the cause of this infestation. As the water in the upstream portion of the Manatí river is eutrophied by waste discharge from dairy

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farms, rice farmers have no alternative but to use the contamined water to grow their crops. Similar situations exist in the Vega Baja rice growing area where rice fields depend heavily on water from the Cibuco river. Even though algal infestation in said area has not yet reached epidemic proportions, the algal problem is here to stay. Thus, it is appropriate that research be directed toward algal control in rice. As an initial step exploring algal control, we have initiated since 1982 an algal collection and identification program. The present paper reports our findings on the relative abundance of different genera of algae identified from numerous samples collected from different rice farms in Puerto Rico.

MATERIALS AND METHODS

The algal collection and identification work were initiated in 1982 and continued into mid 1983. Randomized samplings of algae were made at several sites of infestation on rice farms. The algal samples were collected from the Gurabo Substation and the following farms: Víctor González, Lidy López, Brian Santiago, Paul McConnie, Alejandro Muñoz, Miguel Such. We stored the collected algae in small glass vials with enough water, leaving sufficient space for air, and stoppered the samples. Immediately upon returning to the laboratory from the field, we opened the vials and poured the contents into larger glass receptables. Most of the collected samples with the exception of Chara were examined under the microscope within one or two days. The samples not examined on time were stored in a refrigerator. The keys described by Prescott (1970) and Smith (1950) were used as a criterion for identification. The fresh water biology book by Ward (1965) was adopted as a supplementary guide. A total of 130 algal samples were examined in duplicate during this investigation. The identification work was limited to genera only.

The relative abundance of each genus in the sample was determined by a scale from 1 to 5 (1 = rare, 2 = scarce, 3 = moderate, 4 = abundant, 5 = very abundant). Different species belonging to the same genus were grouped and reported together. In some instances, more than 10 species of a single genus were noted. Consequently, the index of relative abundance of algae represents either an average of a composite of different species of a genus or an average of one species of a genus.

RESULTS AND DISCUSSION

Table 1 shows the relative abundance of different genera of algae identified in this investigation. Hydrodictyon is most abundant on Miguel Such's farm; however, its presence ranges from rare to moderate on the Brian Santiago and Lidy López farms, respectively. This genus of algae is widely distributed in Louisiana and other rice-growing countries (Dunigan et al. 1979, Prescott 1970). The genus Spirogyra is the second most abundant in the collected samples. It infested paddies moderately on the Víctor González, Lidy López, Paul McConnie and Alejandro Muñoz farms. This genus was also reported to be one of the worst algae in Louisiana rice fields (Duningan et al. 1979). Rhizoclonium ranks third in abundance, affecting the Lidy López, Paul McConnie and Alejandro Muñoz farms. Oedogonium is the fourth; it was encountered moderately on the Lidy López and Alejandro Muñoz farms. The occurrence of Cladophora and Phitophora was limited only to the Gurabo Substation.

Other prevalent genera encountered frequently in irrigation channels belong to the genus Chara. These algae enter rice fields in irrigation water. Its prevalence in shallow rice field water is somewhat arrested as it thrives in deep water only. Consequently, this genus is particularly prevalent in irrigation channels as well as in drainage ditches. There are several genera of the Diatoms family such as Bacillaria, Fragilaria, Gyrosigma, Navicula and Synedra encountered on different rice farms. However they are not abundantly present. Blue green algae such as Anabaena, Aphanizomenon, Oscillatoria and Spirulina were also encountered in local rice fields. Among them, Anabaena and Oscillatoria are the most abundant and widespread genera. As they are capable of fixing atmospheric nitrogen (Roger and Kulasooriya 1980), we should explore the possibility of increasing rice yield through inoculation of the above-mentioned algae of the rice fiels to achieve algalization. This nitrogen fixing represents the only beneficial aspect of algal symbiosis with rice.

On the basis of this survey, we found that the algae that posed immediate problems to rice farms were Hydrodictyon, Spirogyra, Rhizoclonium and Oedogonium. Among them, Hydrodictyon is considered to be the worst in Puerto Rico. Even though there are no statistics on the yield loss sustained on Miguel Such's farm attributable to Hydrodictyon, we conservatively estimate a yield reduction of 30%. Precautions should be taken to prevent algal problems from reaching epidemic proportions in the Vega Baja area. Other minor genera of algae such as Chlorosarcina, Closterium, Cosmarium, Eremosphaera, Hormidium, Nannochloris, Phacus, Protococcus, Pyrobotrys, Roya, Scenedesmus, Synedra, Simploca and Ulothrix do not seem likely to cause serious problems to rice farmers since they are scarce and not so widespread as the four previously mentioned predominant genera.

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Table 1 - Relative Abundance of different genera of algae identified from rice fields in Puerto Rico 1/

Genus	Farm						
	Víctor González	Gurabo Sub-station	Lidy López	Brian Santiago	Paul McConnie	Alejandro Muñoz	Miguel Such
Anabaena	-	-	2.5	1.8	2.5	2.5	1.5
Aphanizomenon	-	-	2.0	-	-	1.3	-
Bacillaria	2.0	-	-	-	-	-	-
Chara	-	-	2.0	3.8	2.0	-	3.5
Chlorosarcina	2.0	-	2.0	-	2.0	2.0	-
Cladosphora	-	3.0	-	-	-	-	-
Closterium	1.8	-	1.5	-	1.5	2.0	-
Cosmarium	-	-	-	-	-	2.0	-
Diatoma	2.0	2.0	2.0	2.0	1.5	2.0	1.5
Eremosphaera	-	-	2.0	-	-	-	-
Fragilaria	-	-	2.0	-	-	-	-
Gyrosigma	1.0	-	-	-	-	-	-
Hormidium	-	-	1.5	1.5	-	2.0	-
Hydrodictyon	-	-	3.0	2.0	2.5	2.5	5.0
Nannochloris	-	-	2.0	-	-	2.5	-
Navicula	-	-	2.0	-	-	-	-
Oedogonium	-	2.5	3.3	-	2.5	3.0	-

Table 1 - Relative abundance of different genera of algae identified from rice fields in Puerto Rico 1/
Continued

Genus	Farm						
	Víctor González	Gurabo Substation	Lidy López	Brian Santiago	Paul McConnie	Alejandro Muñoz	Miguel Such
Oscillatoria	2.0	2.0	2.5	2.0	1.5	2.5	-
Pithophora	-	2.0	-	-	-	-	-
Phacus	-	-	-	-	-	-	1.0
Protococcus	1.0	-	1.0	-	1.0	-	-
Pyrobotrys	-	-	2.0	-	-	-	-
Rhizoclonium	-	-	2.8	-	3.0	3.5	-
Roya	-	-	-	-	-	1.0	-
Scenedesmus	-	-	1.0	-	-	1.0	-
Simploca	-	-	1.0	-	-	2.3	-
Spirogyra	3.5	-	3.3	-	2.5	3.0	2.0
Spirulina	-	-	-	-	-	2.0	2.0
Synedra	-	-	1.5	-	-	1.5	-
Ulothrix	-	-	1.5	3.0	-	2.0	-

1/ 1 = Rare 2 = Scarce 3 = Moderate 4 = Abundant 5 = Very abundant