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RESPONSE OF *LEUCAENA LEUCOCEPHALA* TO INOCULATION WITH RHIZOBIA FROM TROPICAL LEGUMES

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Abstract

Rhizobia isolated from root nodules of *Albizia lebbeck, Arachis hypogaea, Clitoria ternatea, Leucaena leucocephala, Medicago sativa, Pithecellobium dulce, Sesbania sesban* and *Vigna unguiculata* were tested for their ability to produce root nodules on *Leucaena leucocephala*. Amount of fixed N_2 was measured. Except *Arachis hypogaea* isolates from all leguminous plants produced nodules on *L. leucocephala*. Isolates from *V unguiculata, A. lebbeck* and *P. dulce* were most effective in nitrogen fixation and induced substantial increase in dry weight and nitrogen contents of the host plant.

Introduction

Rhizobia from *Leucaena leucocephala* have been used frequently in cross inoculation experiments (Trinick, 1965a, 1965b, 1968, 1980). Trinick (1968) reported the specificity of *Leucaena - Rhizobium* symbiosis and the fast growing nature of the microsymbiont which could effectively nodulate on *Vigna* species. The present report discusses the symbiotic performance of rhizobia obtained from root nodules of *Albizia lebbeck, Arachis hypogaea, Clitoria ternatea, Leucaena leucocephala, Medicago sativa, Pithecellobium dulce, Sesbania sesban* and Vigna unguiculata with *Leucaena leucocephala* host in terms of frequency of nodulation and their nitrogen fixing potential.

Material and Methods

Using nodules of *Albizia lebbeck, Arachis hypogaea, Clitoria ternatea, Leucaena leucocephala, Medicago sativa, Pithecellobium dulce, Sesbania sesban* and *Vigna unguiculata* cultures of Rhizobia were isolated on Yeast Mannitol Agar medium following Somasegarn & Hoben (1985) technique and their growth rate recorded.

Leucaena plants were grown in modified Leonard jar assemblies, 4 plant in a jar (Anon., 1987), Plants were kept in growth chamber at 25-28°C with 16 h illumination and watered with nitrogen free nutrient solution (Hoagland & Arnon, 1950). Plants were inoculated using a cell suspension of rhizobial strains prepared in 10% sucrose solution @ 10 ml/plant. There were 3 replicates of each treatment. Uninoculated plants were kept as control. Plants were harvested after six weeks. Nodule number, nodule size, plant dry weight and total nitrogen contents were determined by microkjeldahl method (Bergerson, 1980).

Result and Discussion

Rhizobia from *M. sativa, L. leucocephala* and *S. sesban* formed relatively large colonies of 2mm diameter as compared to Bradyrhizobia from *A. lebbeck, A. hypogaea,*

Table 1. Nodulation response of *Leucaena leucocephala* to rhizobium strains isolated from tropical legumes.

Host of Rhizobium isolate	Nodulation Status	Nodule size (mm)	Nodule Shape	Nodule No.per plant	Total dry weight per plant	N-contents per plant (mg)	N_2 contents (mg/100 mg)
Control	-	-	-	-	144.9	0.173	0.120
Nitrate control	-	-	-	-	187.1	0.224	0.120
Albizia lebbeck	+	1.4	Spherical elongated	13.87	260.5	1.224	0.470
Arachis hypogaea	-	-	-	-	63.3	0.079	0.125
Clitoria ternatea	+	1.2	Spherical elongated bilobed branched	5.83	73.1	0.109	0.150
Leucaena leucocephala	+	1.5	Elongated, beaded spherical, branched	6.14	201.2	0.342	0.170
Medicago sativa	+	1.5	Elongated, beaded branched spherical	12.90	246.6	0.468	0.190
Pithecellobium dulce	+	1.4	Elongated branched spherical	12.40	254.4	1.195	0.470
Sesbania sesban	+	1.0	Elongated, beaded spherical	5.66	130.0	0.182	0.140
Vigna unguiculata	+	1.9	Elongated, oblate beaded	29.16	262.6	2.520	0.96

- = No nodulation

+ = Nodulation present

C. ternatea P. dulce and *V. unguiculata* which produced 1mm diameter colonies after 48 h at 28-30°C.

Nodules were produced on *L. leucocephala* in response to inoculation with rhizobia isolated from nodules of *A. lebbeck, C. ternatea, L. leucocephala, M. sativa, P. dulce, S. sesban* and *V. unguiculata* except *A. hypogaea* (Table 1).

Of the 99 strains of *Rhizobium* tested representing all the 7 recognized cross inoculation groups, 94 strains failed to nodulate on *Leucaena* (Trinick, 1968, 1980). Nodules were produced only by fast growing rhizobia isolated from tropical legumes like *Acacia farnesiana, Mimosa invasa, M. pudica, Sesbania grandiflora* and *Lablab purpureus* (Trinick, 1980). *R. meliloti, R. trifolii, R. leguminosarum, R. phaseoli* and slow-growing cowpea type rhizobia which represent the typical rhizobial type found associated with tropical legumes did not produce nodules on *Leucaena* (Trinick, 1980). Majority of the strains tested belonged to cowpea group with the exception of *Medicago sativa* (Dadarwal *et al*., 1987). *Rhizobium isolates* from *Albizia stipulata, Arachis hypogaea, Clitoria ternatea* and *Vigna sinensis* did not produce nodules on *Leucaena* but formed ineffective nodules with *Sesbania grandiflora* (Trinick, 1968). In the present study however nodules were formed on *Leucaena* when isolates from *A. lebbeck, C. ternatea, L. leucocephala, M. sativa, P. dulce, S. sesban* and *V. unguiculata* were used. It would therefore suggest that *Leucaena* can be nodulated by the use of a wider range of slow growing *Bradyrhizobium* as well as fast growing *Rhizobium*. These results corroborate Tan & Broughton (1982) that *Leucaena* rhizobia possess characteristics of both fast and slow-growing rhizobia and may be regarded as representatives of the organisms intermediate between the fast and slow-growing rhizobial groups.

An increase in the nitrogen concentration was recorded in 7 out of 8 trials. Isolates from *V. unguiculata A. lebbeck* and *P. dulce* induced substantial increase in the dry weight and nitrogen contents in respective host plants as compared to *Leucaena* isolate since total dry weight of *V. unguiculata, A. lebbeck* and *P. dulce* recorded were 262.6, 260.5 and 254.4 mg and their nitrogen contents 2.52, 1.22 and 1.19 mg, respectively (Table 2). An increase in the nitrogen content of *V. unguiculata* as a response to cross infection with wild legumes has also been reported by Srivastava & Tewari (1982). Cross infection of agriculturally important legumes with isolates from wild legumes may therefore prove a useful means of increasing total nitrogen contents within these plants.

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