

CROSS INOCULATION OF BRADYRHIZOBIA AMONG THREE COMMON LEGUME COVER CROPS IN RUBBER PLANTATIONS OF SRI LANKA

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ABSTRACT

Mixtures of legume cover crops are common in rubber plantations of Sri Lanka during the immature phase of rubber, and changes in their composition occur with the changes in environment conditions due to the growth of canopies in rubber plants. Bradyrhizobial isolates from *Pueraria phaseoloides* and *Desmodium ovalifolium* were able to nodulate both legumes, but none of the isolates, including CB 756 (C. S. I. R. O Collection, Queensland) produced nodules on *Mimosa invisa*.

INTRODUCTION

Growth of leguminous covers is a standard practice in rubber plantations of Sri Lanka and presently *Pueraria phaseoloides* (Roxb.) Benth., *Desmodium ovalifolium* (Prain) Wall ex Ridley, and *Mimosa invisa* (Mart. ex.) are commonly used for this purpose.

P. phaseoloides is considered to be a promiscuous legume and is nodulated by *Bradyrhizobium* bacteria of the cowpea type (Skerman, 1977; Trinick 1982). This legume makes effective symbiosis with a wide range of strains of Bradyrhizobia from different leguminous genera and species within the group and hence it has been included under the group promiscuous and effective "PE" (Date, 1977).

Legumes in the genus *Desmodium* nodulate well with certain root-nodule bacteria from the *Bradyrhizobium* cowpea miscellany, but recent reports have shown varying degrees of specificity between species and varieties (Diatloff,

1968; Diatloof and Luck, 1972; Anon, 1978). The specific nature of bradyrhizobial requirements in *Desmodium* was further elaborated on by Date (1977); and this legume was included in the group promiscuous but often ineffective "PI".

Mimosa seems to be nodulated only with fast-growing root nodule bacteria and these rhizobia show a high degree of specificity (Trinick, 1968). Date (1977) also reported that rhizobia associated with *Mimosa* are highly specific and these legumes do not nodulate effectively with strains from other genera or species; hence *Mimosa* was classified under the group specific "S". Further, Trinick in 1980 showed that fast-growing *Rhizobium* culture NGR 63 (New Guinea isolate from the host *Leucaena leucocephala*) effectively nodulated *M. invisa* while NGR 8 and 99 (fast-growing rhizobia from *L. leucocephala*) produced ineffective nodulation. In the same experiment NGR 83 and NGR 135 from *M. invisa* were ineffective on *Phaseolus lathroides* and effective on *L. leucocephala* (Trinick, 1980).

In most of the Sri Lanka rubber plantations, mixtures of cover crops can be seen during the immature phase of rubber and changes in the composition of legumes occur with the changes in environmental conditions due to the growth of canopies in rubber plants. An ideal example of this is the replacement of *P. phaseoloides* which prefers direct sunlight by shade tolerant *D. ovalifolium* as the rubber trees mature.

These cover crops are expected to; (a) grow rapidly, to ensure soil stability and (b) fix and improve soil fertility. Their nitrogen fixation ability would depend primarily upon their nodulation with effective rhizobia. However very little work has been done in Sri Lanka on the root nodule associations of these cover legumes.

This study was undertaken to investigate the ability of certain root-nodule bacterial isolates from one legume host to infect the other hosts.

MATERIALS AND METHODS

I Root-nodule bacteria

Cultures of single colony isolates from *P. phaseoloides* and *D. ovalifolium* were grown on Yeast Manitol Agar and 7-day old cultures were used for inoculation purposes.

II Test plants

Host range studies were conducted on three legumes viz. *P. phaseoloides*, *M. invisa* and *D. ovalifolium*. Acid-treated seeds (Waidyanatha and Ariyaratna, 1976) of test plants were germinated on water agar and when the radicles were 1-2 cm long, seedlings were transferred aseptically into nutrient agar slants (Jensen, 1942) in 21 cm long by 4 cm wide test tubes.

III Assay on infectivity

One ml of appropriate bacterial suspension (approx. 1×10^8 bacteria ml⁻¹) was pipetted on to the agar slants just after introducing the seedlings. The tubes were maintained in the glasshouse (28 + 4° C and 70-85% RH). Twenty isolates from *P. Phaseoloides* were tested on *D. ovalifolium* and *M. invisa*, and 15 isolates from *D. ovalifolium* were tested on *P. phaseoloides* and *M. invisa*. In addition to those isolates CB 756 (C.S.I.R.O. Collection, Queensland) was tested on all three hosts.

RESULTS AND DISCUSSION

Pueraria phaseoloides was nodulated with all 15 bradyrhizobial isolates from *Desmodium ovalifolium* and 18 *P. phaseoloides* isolates were able to

produce nodules on *D. ovalifolium*. *Bradyrhizobium* culture CB 756 produced nodules on both of these hosts. None of the cultures from *Desmodium* or *Pueraria* formed nodules on *Mimosa invisa*

These results reaffirm the promiscuous nature of *P. Phaseoloides* (Skerman, 1977; Date, 1977; Trinick, 1982) and the high degree of specificity present in *Mimosa* sp. (Trinick, 1968, 1980; Date 1977.)

It is interesting to note that the majority of *P. Phaseoloides* isolates were able to produce nodules on *D. ovalifolium* although it has been stated that the genus *Desmodium* shows varying degrees of specificity for effective nitrogen fixation. (Diatloff, 1968; Diatloff and Luck, 1972; Anon, 1978; Date, 1977). However, with regard to effectiveness, the only evidence we had was the red colour of the sliced nodules and green colour of the seedlings.

Results from these experiments have shown that both *Pueraria* and *Desmodium* are nodulated by several indigenous rhizobial isolates. It is therefore necessary to isolate and screen indigenous rhizobia, for rapid growth, high nitrogen fixation, tolerance to environmental parameters, survival and competitive ability in order to select strains suitable for an inoculation programme.

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