EVALUATION OF N_2-FIXATION ABILITY OF SOME LESSER-KNOWN TREE LEGUMES, WITH SPECIAL REFERENCE TO *PERICOPSIS MOONIANA* (THW.) THW.

by

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ABSTRACT

Plants belonging to family Leguminosae perform well in N- depleted soil by converting atmospheric N_2 into available forms of nitrogen. Preliminary research revealed that there are approximately 326 species of leguminous plants in Sri Lanka including 18 endemic species. However, hardly any information is available on their rhizobiology and dinitrogen fixation. In this work, isolation, purification, characterization and selection, of native rhizobia in the root nodules of dinitrogen fixing tree legumes were studied.

Four species of lesser known legumes, (*Humboldtia laurifolia* Vahl., *Adenanthera bicolor* Moon, *Abarema bigemina* (L.) Kosterm. and *Pericopsis mooniana* (Thw.) Thw. were sampled from two selected agro ecological zones, the low country wet zone (Sinharaja Forest Reserve) and Intermediate zone (Badagamuwa Forest Plantation, Kurunegala). Rhizobia were isolated from nodules found on three species (*Abarema*, *Humboldtia* and *Adenanthera*.). They were purified and characterized together with a few other rhizobial isolates taken from the Biological Nitrogen Fixation (BNF) culture collection. Their N_2-fixing parameters were evaluated using the test crop siratro (*Macroptilium atropurpureum*). The isolates of *P. mooniana* were tested using both the host and siratro. A reference strain was included for each evaluation test. The best-performing strains were further characterized by API kits (Bio-chemical identification test). The rhizosphere population was also estimated by the Most Probable Number (MPN) method. An in depth study was done to evaluate the contribution of BNF using marked *Bradyrhizobium* ($KULGP^{200Str}$ + $Pm3^{200Rif}$)

strains with the host species *P. mooniana* which has a high timber value. The percentage contribution of biological N_2-fixation to the plant nitrogen was calculated by the N-balance test. Furthermore, their competitiveness in infection and persistence in the soil were also evaluated.

A certain degree of host specificity was observed among the rhizobial strains isolated from *P. mooniana*. Six strains showed 100% nodulation with both crops, seven strains showed >50% nodulation with *Pericopsis* and 100% nodulation with siratro, four strains showed <50% nodulation with *Pericopsis* and 100% with siratro. *Humboldtia* strains H13, H14 and *Abarema* strains Ab1, Ab2 and Ab4 nodulated siratro 100%. Strain Hl1, Hl2, Ab3 showed 88.3%, 66.6% and 50% nodulation, respectively with siratro. Although nodule like structures were observed in *Adenanthera* plants, rhizobial isolates could not be obtained from them.

In *P. mooniana* without inoculation, 22.8% of the plant N was derived from N_2-fixation after 12 months; with 30kgN/ha and without inoculation this increased to 35.1% and with 60kgN/ha and without inoculation the amount was 36.1%. After inoculation with KULGP^{200Str} and Pm3^{200Rif}, 26.1% of the plant N was derived from BNF and it was 47.5% with inoculation and 30kgN/ha; with inoculation and 60kgN/ha, the percentage declined to 40.2%. The total biomass also reflected those differences in N_2-fixation between the treatments.

P. mooniana showed a 10.7% increase in growth due to inoculation with *Bradyrhizobium* (KULGP^{200Str} + Pm3^{200Rif}), one year after inoculation. The biomass which increased by 10.5% and 17% due to the application of 30kgN and 60kgN/ha/year of urea without inoculation, increased further to 16.5% and 18%

respectively due to inoculation. These results show that inoculation enhanced the growth as much as with the application of 30kgN/ha/year and a further increment can be achieved by combining inoculation with a low dose of nitrogen (30 kgN/ha). But 60kgN/ha did not give a proportional increase. Therefore, it appears that inoculating a nursery of *Pericopsis* seedlings is a practice that could stimulate early growth of the plants suitable for forest and timber production plantations.

This study indicated that *Bradyrhizobium* strains KULGP^{200Str} and Pm3^{200Rif} inoculated on *P. mooniana* plants were also able to persist in the soil for at least a year. The high percentage nodule occupancy by these introduced strains also indicated their competitive ability with the indigenous strains. While KULGP^{200Str} formed more nodules without fertilizer and low dose of N fertilizer (30kg), Pm3^{200Rif} produced more nodules under higher dose of N (60kg). Thus, Pm3^{200Rif} is observed to be more N fertilizer tolerant.