

NODULATION AND NITROGEN FIXATION IN SOME DESMODIUM SPECIES

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SUMMARY

Effective nodulation of *Desmodium uncinatum* was obtained by inoculation with *Rhizobium* isolated from *D. intortum* and *Glycine javanica*, but no nodules were formed with isolates from *Glycine tabacina*, *Stylosanthes humilis*, *Arachis hypogaea* or *Lespedeza striata*.

Three reputedly highly efficient strains of *Rhizobium* on *Desmodium* were tested for nitrogen fixation in five species of *Desmodium*. The host spectrum of effective association varied.

Introduction

The use of *Desmodium intortum* and *D. uncinatum* in grass-legume pastures in Queensland is increasing, and interest is being shown also in recent introductions of other species of *Desmodium* with diverse growth habits. Although data on the pasture potential of these legumes are rapidly accumulating, very little has been published on the symbiosis of species of *Desmodium* with *Rhizobium*.

Specificity of *D. uncinatum*

Preliminary tests with *D. uncinatum* on 14 coastal soils in Queensland showed that only eight had suitable rhizobia and of these only three gave rise to an effective association. At the same time, phasey bean (*Phaseolus lathyroides*) nodulated freely in all, with only three ineffective cases. The results indicate a specific bacterial requirement of *D. uncinatum* as compared with *P. lathyroides* and a need to inoculate seed of *Desmodium* sown in these soils. This specificity was further confirmed under aseptic conditions in bottle-jar units (Norris 1964) in comparison with five other tropical legumes. The responses to inoculation with six *Rhizobium* isolates from tropical legumes are shown in Table 1.

TABLE 1
RESPONSE OF SOME LEGUMES TO INOCULATION WITH *Rhizobium*

Strain	Host of Isolation	Test Plant					
		<i>Desmodium uncinatum</i>	<i>Centrosema pubescens</i>	<i>Dolichos lablab</i>	<i>Calopogonium mucunoides</i>	<i>Leucaena leucocephala</i>	<i>Phaseolus lathyroides</i>
QA626	<i>Glycine tabacina</i>	—	+ I	+ I	+ E	+ I	+ E
CB627	<i>Desmodium intortum</i>	+ E	+ I	+ E	+ I	—	+ E
QA827	<i>Stylosanthes humilis</i>	—	+ I	—	+ I	—	+ E
QA951	<i>Arachis hypogaea</i>	—	—	—	—	—	+ E
QA922	<i>Glycine javanica</i>	+ E	—	+ E	+ E	—	+ E
QA784	<i>Lespedeza striata</i>	—	—	+ I	—	—	+ I

+ Nodules present
— Nodules absent

I Ineffective association
E Effective association

Nitrogen Fixation in Five *Desmodium* Species with Inoculation

Three reputedly efficient *Rhizobium* strains (QA922, CB627, QA720) on *Desmodium* were compared on *D. distortum* Macbr., *D. intortum* (Mill.) Urb., *D. sandwicense* E. Mey, *D. tortuosum* (Swartz) DC. and *D. uncinatum* (Jacq.) DC. in the glasshouse, using the bottle-jar units. One-week-old seedlings were inoculated from 7-day-old agar cultures of *Rhizobium* and allowed to grow for 6 weeks. Nodulation occurred in all inoculated units. Table 2 shows the nitrogen content of inoculation and inoculated treatments.

TABLE 2
NITROGEN FIXATION IN FIVE *Desmodium* SPECIES

Rhizobium Strain	Mean N content (mg/plant)				
	<i>D. distortum</i>	<i>D. intortum</i>	<i>D. sandwicense</i>	<i>D. tortuosum</i>	<i>D. uncinatum</i>
QA720	1.96	4.95	4.55	13.60	5.72
QA922	21.90	7.26	6.01	16.71	5.16
CB627	4.32	9.02	2.25	16.82	4.50
Uninoculated control	0.26	0.24	0.21	0.25	0.36

QA922 and CB627 were highly efficient strains on a number of *Desmodium* species, although each had a different host spectrum of effective association. CB627 was ineffective on *D. distortum*. In other glasshouse tests, CB627 was also found ineffective on *D. cuneatum* Hook. & Arn. and failed to form nodules

on *D. heterophyllum* (Willd.) DC. Its effective host range includes the following additional species: *D. gyroides* DC., *D. rhytidophyllum* F. Muell. ex Benth., *D. gyrans* DC., *D. rensonii* Paynt., *D. polycarpum* (Poir.) DC., *D. discolor* Vogel and *D. triflorum* (L.) DC.

Discussion

Although many of the tropical legumes symbiose with the ubiquitous "cowpea type" *Rhizobium* (Norris 1959), some specific associations do occur. The best known is that of *Glycine max* (Leonard 1923), although the specific bacterial requirements of *Lotononis bainesii* (Norris 1958), *Leucaena leucocephala* (Trinick 1965), *Clitoria ternatea* (Allen and Allen 1939) and *Centrosema pubescens* (Bowen 1959) have been recorded. From Table 1 it would appear that *Desmodium uncinatum* would fit the moderately strain-specific group which includes *Centrosema pubescens* and *Dolichos lablab*. *D. heterophyllum* could be highly specific, as so far it has nodulated only with strains from its own species.

The specificity of *Desmodium uncinatum* has been recognized in the past (Bowen 1959) and as a result a particular inoculant for *Desmodium* was supplied in Queensland. CB627 has proved a useful strain for inoculant production. Some limitations on *D. distortum*, *D. cuneatum* and *D. heterophyllum* have recently been demonstrated with this strain but on present indications these three legumes might find only limited use in agriculture.

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(Received for publication April 7, 1967)

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