Symbiosis, 9 (1990) 321–323
Balaban Publishers, Philadelphia/Rehovot

The Response of Different Species of *Lupinus* to VAM Endophytes*

L. AVIO, CRISTIANA SBRANA and MANUELA GIOVANNETTI

Istituto di Microbiologia Agraria, Via del Borghetto 80, 56124 Pisa, Italy.

Introduction

Lupinus, a non-host genus in a typically mycorrhizal family, Leguminosae, has been investigated for mycorrhizal infection. In this paper we report the response of different species and races of *Lupinus* to inoculation with different *Glomus* species. We studied the effects of lupin plants on spore germination and growth of germinative hyphae of *G. mosseae* and tried to induce mycorrhizal infection in lupin plants grown under low phosphorus conditions.

Materials and Methods

Four races of *Lupinus albus* L., three of *L. atlanticus* Gladst., three of *L. angustifolius* L., two of *L. mutabilis* Sweet (kindly provided by Istituto del Germoplasma, C.N.R., Bari) were tested in the first experiment. In the other experiments a local variety of *L. albus* L. was utilized.

Experiment 1. Seeds of lupin were sown in pots containing 400 g of a 1:2 soil-sand sterile mixture. Inoculum (20 g of soil from pot-cultures, containing spores, infected roots and extra-radical mycelium) was placed under each seed at sowing. The different combinations of lupin races and fungi tested are shown in Table 1. The infectivity of inoculum was checked by inoculation of 5 plants of *Trifolium repens* L. with the same quantity of inoculum for each fungal species. Mycorrhizal infection was assessed after three months using the method of Phillips and Hayman (1970). The aim of this experiment was to test the ability of some VAM fungi to infect different lupin species and races.

*Reviewed

Table 1. Combinations of lupin plants and fungi tested for mycorrhizal infection.

Plant species	accessions	Fungal species		
		Glomus mosseae	*G. micro-carpum*	*Glomus* sp.
L. albus	110424	x	x	x
L. albus	110426	x	x	
L. albus	110427	x	x	x
L. albus	110428	x	x	x
L. atlanticus	113879	x	x	x
L. atlanticus	113880	x	x	
L. atlanticus	113881	x	x	
L. angustifolius	112000	x	x	x
L. angustifolius	112244	x	x	x
L. mutabilis	113875	x	x	
L. mutabilis	113877	x	x	
L. mutabilis	113878	x	x	

Experiment 2. Seeds of *L. albus* were germinated on sand. Seven-day-old seedlings were transferred into pots containing gravel and inoculated with *G. mosseae*. Each plant received 50 ml/week of Hoagland solution minus P. Plants were harvested after four months and roots observed for mycorrhizal infection.

Experiment 3. Seeds of *L. albus* were deprived of their cotyledons, germinated and transplanted in pots as in exp. 2. Inoculum consisted of sporocarps of *G. mosseae* placed on two millipore membranes around the roots of lupin plants. Seedlings of clover were prepared and inoculated in the same way as a form of control. After four weeks the plants were harvested and the sporocarps recovered and checked for germination.

Results and Discussion

In exp. 1 no mycorrhizal infection was observed in any lupin plant, whichever the endophyte inoculated. Neither appressoria nor entry points – even abortive – nor hyphal growth around roots was observed, while 40% mycorrhizal infection was observed in clover plants. The strong resistance of the genus *Lupinus* to VAM infection is here confirmed.

In exp. 2 none of the plants grown without P was infected by *G. mosseae*, except one which showed some appressoria resembling those described by Morley and Mosse (1976). These appressoria failed to penetrate root cells and no growth of fungal mycelium around roots was observed. These results show that even in a medium lacking P, no mycorrhizal infection occur in lupins.

In exp. 3 sporocarps of *G. mosseae* germinated (80%) as the control (84%) so that lupin roots had no detectable effect on their germination. Root or seed coat exudates of lupins have been suggested as the cause of the absence of infection in the lupins

themselves (Morley and Mosse, 1976). Our results show that lupin roots do not inhibit the germination of spores or the extension of germinative hyphae. This agrees with reports that non mycorrhizal plants do not adversely affect germination of VAM fungal spores (Glenn et al., 1985) or hyphal extension, though they could influence their rates (Tommerup, 1984).

REFERENCES

Glenn, M.G., Chew, F.S., and Williams, P.H. 1985. Hyphal penetration of *Brassica* (Cruciferae) roots by a vesicular-arbuscular mycorrhizal fungus. *New Phytol.* **99:** 463–472.

Morley, C.D. and Mosse, B. 1976. Abnormal vesicular-arbuscular mycorrhizal infections in white clover induced by lupin. *Trans. Br. mycol. Soc.* **67:** 510–513.

Phillips, J.M. and Hayman, D.S. 1970. Improved procedures for clearing roots and staining parasitic and vesicular-arbuscular mycorrhizal fungi for rapid assessment of infection. *Trans. Br. mycol. Soc.* **55:** 158–161.

Tommerup, I.C. 1984. Development of infection by a vesicular-arbuscular fungus in *Brassica napus* and *Trifolium subterraneum*. *New Phytol.* **98:** 497–502.