SHORT COMMUNICATIONS

PHOTOSYNTHESIS AND COMPETITION FOR PHOTOSYNTHATE IN VA MYCORRHIZA, *RHIZOBIUM* AND *CAJANUS CAJAN* SYMBIOSIS

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TRIPARTITE symbiosis of legume, *Rhizobium* and vesicular arbuscular mycorrhizal fungus (VAM) enhances nodulation[1,2]. However, growth depression has also been reported due to mycorrhizal association[3,4]. Host photosynthate is the source of energy for the microsymbionts[5]. Hence, the photosynthesis and translocation of photosynthate to the root system may have a decisive role in the effectiveness of the symbiosis. Further, since both the microsymbionts are associated with the root system, the possibility for a competition between *Rhizobium* and VA-mycorrhiza in sharing the photosynthate translocated to the root system cannot be ruled out. This hypothesis was tested in unsterilized phosphorus deficient alfisol using redgram (*Cajanus cajan* (L) Millsp), VAM fungus *Glomus fasciculatum* and *Rhizobium* sp strain IHP 100. There were four treatments, no inoculation (M_0R_0), *Rhizobium* alone (M_0R), mycorrhiza alone (MR_0) and dual inoculation (MR). $^{14}CO_2$ fixation in leaves (immediately after feeding $^{14}CO_2$) and radio-activity present in the root and nodules (24 hr after feeding $^{14}CO_2$) were considered as the indices of photosynthetic efficiency and availability of photosynthate respectively. Nitrogenase activity was estimated by the acetylene reduction method and mycorrhizal colonization was determined by staining the root samples with trypan blue[6].

Leaves of mycorrhizal *C. cajan* consistently recorded an increased $^{14}CO_2$ fixation. Synergestic interaction of *Rhizobium* and *G. fasciculatum* further improved the photosynthetic efficiency (table 1). Similarly, nitrogenase activity also increased due to dual inoculation, which was evident from the early stages of plant growth. Considerably high mycorrhizal colonisation was recorded in *Glomus* inoculated plants. Mycorrhiza alone inoculation also improved the nitrogenase activity; probably by activating the native rhizobia (table 2).

A relationship between mycorrhizal sink and nodule sink in drawing host photosynthate was evident from the ratio of ^{14}C present in a unit weight of root and nodule at different stages of plant growth (table 1). On the 35th day of plant growth, which was a stage having maximum nitrogenase activity and sufficient mycorrhizal colonisation (table 2), the ratio was around one in *Glomus fasciculatum* inoculated plants. Thus, when both the microsymbionts were in an active stage, their ability to draw host photosynthate was uniform.

The ratio of radioactivity present in a unit weight of root to nodule was always low in *Rhizobium* alone inoculated plants. This indicates the poor translocation of ^{14}C to the root compared to nodule; probably due to the absense of sufficient mycorrhizal colonisation. Irrespective of the treatment, the ratio was less than one on 25th day. This suggests that during early stages of plant growth the nodule sink is more effective than mycorrhizal sink. Similarly, senescence of nodule together with higher mycorrhizal

Table 1 *Photosynthesis and ratio of ^{14}C-activity in root and nodule of Cajanus cajan inoculated with G. fasciculatum and Rhizobium*

Treatments	^{14}C-activity in leaves ($\times 10^3$ CPM/20 mg) Age of the plant in days			Ratio of ^{14}C activity (root/nodule) Age of the plant in days		
	25	35	60	25	35	60
M_0R_0	1.68a	3.36a	0.78a	0 80	0.96	1.14
M_0R	1 86ab	4 86b	0.02ab	0.53	0.68	1.10
MR_0	2.34bc	5.52c	1.20bc	0 86	0.99	2.27
MR	2.40c	6.48d	1.32c	0.84	1.05	2.25

* Those means within a column not sharing a common letter differ significantly ($P = 0.05$).

Table 2 *Nitrogenase activity and mycorrhizal colonization in Rhizobium and VA mycorrhiza inoculated Cajanus cajan*

Treatments	Nitrogenase activity* (μmol. Ethyl./pl/hr) Age of the plant in days			Mycorrhizal colonization (infection percent) Age of the plant in days		
	25	35	60	25	35	60
M_0R_0	0.17a	1.02a	0.21a	12	25	46
M_0R	0.66b	1.59b	0.16a	11	27	45
MR_0	0.42c	1.43b	0.15a	39	63	91
MR	1.06d	5.24c	0.20a	42	65	89

* Those means within a column not sharing a common letter differ siglificantly ($P = 0.05$).

colonisation (60th day) brought about a sudden increase in the ratio of *Glomus* inoculated plants; probably due to the collapse of nodule sink. The fluctuation in the ratio, thus observed, emphasises the possibility for a competition between micro symbionts for the photosynthate translocated to the root system.

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LECYTHISPORA INDICA GEN ET SP NOV TO HYPHOMYCETES

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DURING a survey for Hyphomycetes an unusually distinct fungus was collected during September 1979 on horse dung from New Delhi. This fungus could not be accommodated in any described genus of Hyphomycetes; therefore it is being communicated through this paper as *Lecythispora* gen nov (*L. indica* Sp nov). The holotype material is kept at the Commonwealth Mycological Institute, Kew, England.

Lecythispora gen nov (figures 1–8)

(Etym. Lecythi-like stoppered bottle; Spora-spore) Colonies effuse, hairy. Mycelium superficial, branched, septate, smooth, hyaline. Conidiophores hyaline, macronematous, mononematous, erect, aseptate, simple or denticulate at apex. Conidiogenous cell monoblastic, terminal, cylindrical. Conidiogenesis sympodial holoblastic. Conidia dry, solitary, acrogenous, lecythiform, secession rhexolytic.
Type species: *Lecythispora indica*

Lecythispora gen nov

Coloniae effusae, pilosae. Mycelium superficiale, ex hyphis ramosis, septatis, levibus, hyalinis compositum. Conidiophora hyalina, macronematosa, mononematosa, recta, aseptata, simplicia vel denticulatosa in apice. Cellulae conidiogenae monoblastici, terminale, cylindricae. Conidiogenae sympodiales holoblastici. Conidia sicca, solitaria, acrogena, lecythiformia, rhexolytica secedentia.
Species typica: *Lecythispora indica*

Lecythispora indica sp nov

Colonies effuse. Mycelium superficial. Hyphae septate, hyaline, sparingly branched 3–4.5 μm diam. Conidiophores macronematous, mononematous, hyaline, aseptate, erect 45–100 μm alta, 5–8 μm in fundo minuentes ad 2–3 μm in apice, aut non ramosa aut 1–3 ramos denticulatosa in apice 5–25 μm longos. Conidiogenae sympodiales holoblastici. Conidia sicca, solitaria, acrogena, 0–1 septatae, hyalina vel sub hyalina, lecythiformia 18–30 × 8–12 μm, rexolytica secedentia.
Habitat: In Copro-equus, IARI, New Delhi, Indiae, Sept. 1979, P. N. Chowdhry, Ad positus CMI, Kew, England, IMI 287801 (Holotypus).

The new genus is comparable only with *Stylopage*[1] of family Zoopagaceae in which conidia-bearing small terminal protuberances with cytoplasm have only