HYMENOGASTER ALBUS — A MYCORRHIZAL FUNGUS OF EUCALYPTUS IN NEW ZEALAND

MYRA CHU-CHOU and LYNETTE J. GRACE

Forest Research Institute, New Zealand Forest Service,
Private Bag, Rotorua, New Zealand

(Received for publication 6 April 1981)

ABSTRACT

Sporocarps of **Hymenogaster albus** (Klotzsch.) Berk. et Br. were found to be associated with roots of several species of **Eucalyptus**. The fungus was isolated from the mycorrhizal roots of **E. delegatensis** R.T. Bak., **E. nitens** Maiden, and **E. sieberi** L. Johnson. Seedlings of **E. saligna** Sm. inoculated with spore suspensions of **H. albus** formed pale-brown to golden simple pyramidal mycorrhizas.

INTRODUCTION

The association of *Hymenogaster albus* (Klotzsch.) Berk. et Br. sporocarps with *Eucalyptus* spp. was first recorded by J. D. Hooker in 1830 in potted plants at the Botanic Garden, Glasgow (Hawker 1954). To our knowledge there has been no further report of such an association, and the symbiotic relationship has yet to be confirmed.

This paper reports the occurrence of *H. albus* in association with eucalypts in New Zealand, the isolation of this fungus from the mycorrhizas, and the results of synthesis tests.

OCCURRENCE OF H. ALBUS IN EUCALYPTUS STANDS

During a survey of the occurrence of sporocarps of *Hydnangium carneum* Wallr. in *Eucalyptus* stands in 1978 (Chu-Chou & Grace 1981), sporocarps of *Hymenogaster albus* were incidentally discovered. This led to a detailed survey of its occurrence in nurseries and stands of various *Eucalyptus* species in different age groups (*E. delegatensis, E. fastigata* Deane et Maiden, *E. nitens, E. regnans* F. Muell., *E. saligna,* and other species, from seedlings to trees over 50 years old) in the North Island of New Zealand.

The results of this survey are summarised in Table 1. Although sporocarps of this fungus occurred commonly in outplantings of several *Eucalyptus* species of different ages, no sporocarps had been observed in any of the nurseries surveyed. It is noteworthy that sporocarps of this fungus were also seen to be associated with young New Zealand native silver beech trees (*Nothofagus menziesii* (Hook. f.) Oerst.) on the Forest Research Institute campus.

TABLE 1—Occurrence of sporocarps of **H. albus** in **Eucalyptus** stands of different species and ages

Species	Age of trees (years)						
	1–3	4–6	7–10	11–20	21–30	31–40	41–51
E. delegatensis	—	+	+	+	—	+	+
E. saligna	—	+	+	+	—	n.a.	+
E. nitens	—	+	+	+	n.a.	n.a.	n.a.
E. fastigata	—	+	+	—	+	n.a.	—
E. regnans	—	+	+	+	+	n.a.	n.a.
Other species*	n.a.	n.a.	n.a.	—	+	+	+

\+ Positive result

— Negative result

n.a. Trees not available

* Other species include **E. sieberi**, **E. pilularis** Sm., **E. botryoides** Sm., and the peppermint group of eucalypts

Identification of the Fungus

The sporocarps are 1–2 cm in diameter, globose or subglobose, white at first becoming lemon yellow, and drying to flavous yellow. Gleba are at first ochraceous becoming umber; cavities are large. A small sterile base is present. Each basidium bears two spores. Basidiospores are broadly ellipsoid or citriform, size 19.6 (17.1–22.7) × 13.6 (10.5–16.8) μm (measurement includes the exospore), apex obtuse, basal end showing claw-like process. The epispore is golden brown to dark brown, minutely verrucose, covered with a prominently gelatinous exospore (or utricle).

Cunningham (1942) reported that three species of *Hymenogaster* were present in New Zealand but our specimens do not fit the descriptions of any of them. The morphology of the sporocarps we collected agrees reasonably well with the description of *H. albus* reported by Hawker (1954) in Great Britain except that the basidiospores of our specimens are slightly larger (17.1–22.7 × 10.5–16.8 μm *v.* 11–20 × 8–13μm). Our specimens were compared with those labelled *H. albus* at Kew Herbarium and were found to be identical.

Figures 1 and 2 show the morphology of the sporocarps and the basidiospores respectively.

Isolation of the Fungus from Mycorrhizas

Isolations were attempted from two to five sets of mycorrhizal root samples collected from each age group (1–5, 6–10, 11–20, 21–30, 31–40, 41–51 years) of different *Eucalyptus* species, by the method previously described (Chu-Chou & Grace 1981).

The only successful isolations of *H. albus* were from the mycorrhizal roots collected from a 4-year-old *E. delegatensis* stand, an 11-year-old *E. nitens* stand, and a 30+-year-old *E. sieberi* stand.

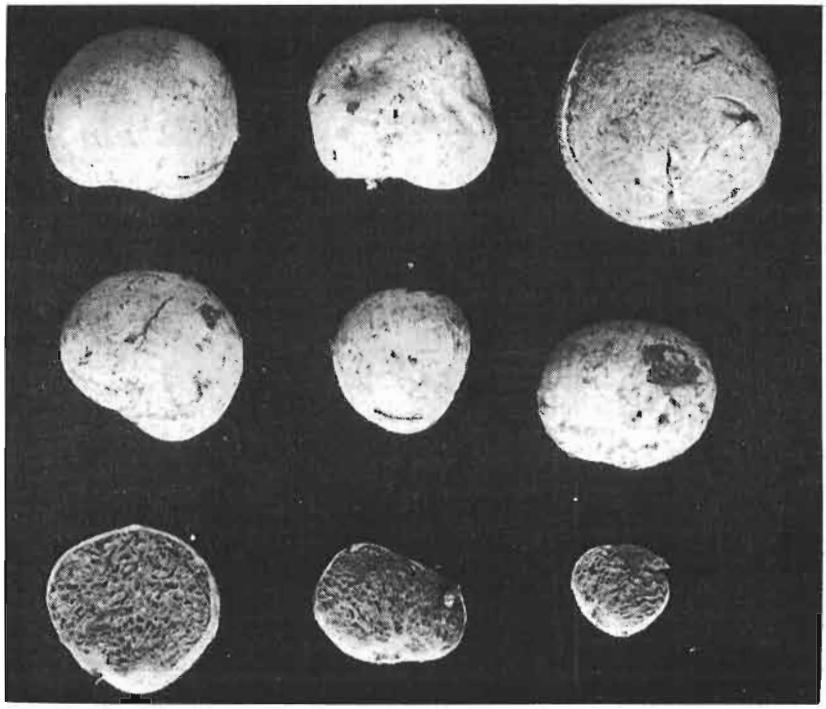

FIG. 1—Sporocarps of **Hymenogaster albus** (×2)

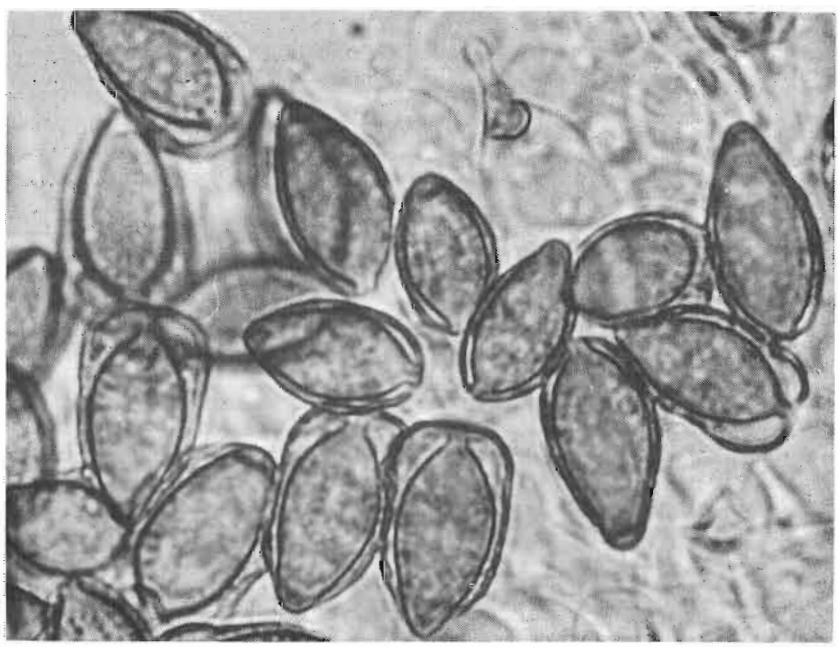

FIG. 2—Basidiospores of **H. albus** showing the minutely verrucose episporesand gelatinous exospores (×1050)

Synthesis Test

The method of synthesis test was as described in a previous study (Chu-Chou 1979) with slight modifications. Twelve aseptic 3-week-old *E. saligna* seedlings were planted into individual test tubes (40 × 200 mm) containing autoclaved nursery potting mixture (soil : peat : pumice = 3 : 3 : 1). At 5 weeks after planting, six seedlings were inoculated with a spore suspension prepared from fresh sporocarps of *H. albus*. After 3 months the seedlings were removed from the tubes; the root systems were washed from the soil substrate; the mycorrhizas were examined microscopically and re-isolation of the mycorrhizal symbiont was made from the synthesised mycorrhizas.

All the inoculated seedlings developed mycorrhizal roots during the 3-month period but no mycorrhizas were present on the root systems of the uninoculated seedlings. The mycorrhizas were pale-brown to golden-brown in colour and they occurred as simple open pyramidal systems. The surface of the fungal mantle was covered with a large number of pin-shaped "cystidia" and many straight, unbranched, golden-brown hyphae with clamp connections grew out between them (Fig. 3). This type of mycorrhiza was similar to the Type 3 mycorrhiza described by Chilvers (1968) in Australia.

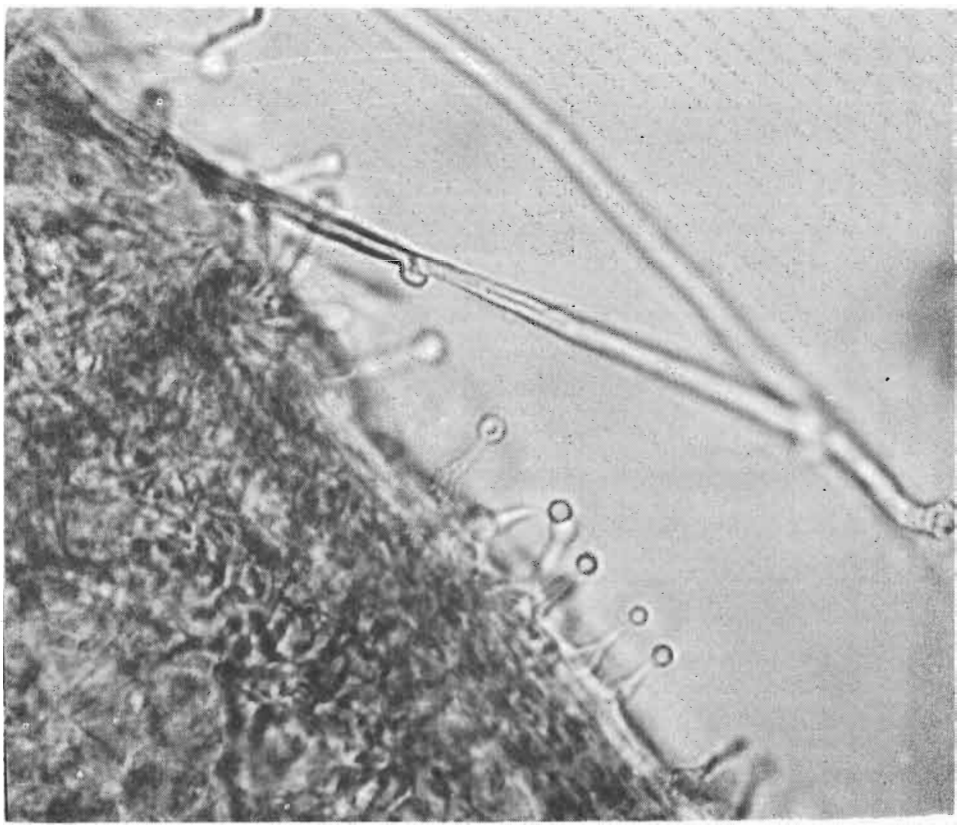

FIG. 3—The surface of the fungal mantle of the mycorrhiza showing pin-shaped "cystidia" and unbranched hyphae (×800)

Re-isolation of the fungus from the synthesised mycorrhizas was not successful. One reason was that this fungus grew poorly on the media used in our study. Secondly, the eucalypt mycorrhizas were extremely fine and delicate, hence may have been sensitive to sterilisation damage.

REFERENCES

CHILVERS, G. A. 1968: Some distinctive types of eucalypt mycorrhiza. **Australian Journal of Botany 16:** 49–70.

CHU-CHOU, M. 1979: Mycorrhizal fungi of **Pinus radiata** in New Zealand. **Soil Biology and Biochemistry 11:** 557–62.

CHU-CHOU, M.; GRACE, L. J. 1981: **Hydnangium carneum** – a mycorrhizal fungus of **Eucalyptus** in New Zealand. **Transactions of the British Mycological Society** (in press).

CUNNINGHAM, G. H. 1942: "The Gasteromycetes of Australia and New Zealand". McIndoe Printer, Dunedin, New Zealand.

HAWKER, L. E. 1954: British hypogeous fungi. **Royal Society of London, Philosophical Transactions; Series B – Biological Sciences 237:** 429–546.