

ENTROPHOSPORA, A NEW GENUS IN THE ENDOGONACEAE

R. N. AMES and R. W. SCHNEIDER

*Department of Plant Pathology, University of California,
Berkeley, California 94720*

Fungal spores which closely resembled *Glomus infrequens* Hall (1977) were wet sieved from a celery field soil in California. However, the mode of spore formation is unlike any described for the genera of Endogonaceae (Gerdemann and Trappe, 1974). Initially, a vesicle similar to that of *Acaulospora* spp. (Gerdemann and Trappe, 1974; Ames and Linderman, 1976; Trappe, 1977) is formed but the spore develops inside the vesicular stalk rather than laterally. No hyphae have been observed within the vesicle or vesicular stalk to indicate the presence of two fungi. In all other respects, the spores matched *G. infrequens* as contained in the type collections of Hall (Hall #437, 1, and 30, DSIR, Auckland, N.Z.). Specimens from our collections were sent to I. R. Hall and J. M. Trappe for observation. Personal communications from them supported our view that *G. infrequens* was incompletely described and should be placed in another genus in the Endogonaceae. Therefore, we are describing the new genus, *Entrophospora*, with *E. infrequens* (Hall) Ames & Schneider comb. nov. as the type species.

Entrophospora infrequens is similar to *Acaulospora* spp. (Gerdemann and Trappe, 1974) in the shape and color of the spore-producing vesicle. Even the pointed projection frequently observed at the apex of the vesicle has been observed for *E. infrequens*. The spores, which form inside the stalk of the vesicle, remain enclosed by the expanded vesicular wall material even though the spore may become detached from the vesicle itself. Mycorrhiza formation has not been established with *E. infrequens* despite numerous attempts.

ENTROPHOSPORA Ames & Schneider, gen. nov.

Type species: *Entrophospora infrequens* (Hall) Ames &

Schneider comb. nov.

DESCRIPTION: Azygosporae singillatim in terra ortae, in vesiculae stipite crescentes. Vesiculae exili tunica, principio densae albaeque, deinde exhauriuntur dum materia in adolescentem sporam transfertur. Crescente spora, tunica stipitis panditur et membrana fit hyalina sporaeque appressa. Sporis tunica continua excepto poro densa materia occluso qui, forma fundibuli, vesiculam init.

Azygospores produced singly in soil by expansion within the stalk of the mother vesicle. Mother vesicle thin walled, dense white, becoming empty as contents are transferred to developing spore. Walls of vesicular stalk expand to accommodate spore, forming a clear outer membrane tightly appressed to the spore. Spore wall continuous except for funnel-shaped portion which extends into the mother vesicle and is closed by a thickened plug.

ETYMOLOGY: Greek, en (within), trophos (nourished or reared), and spora (spore), referring to the spore being reared within the vesicular stalk.

ENTROPHOSPORA INFREQUENS (Hall) Ames & Schneider comb. nov. (Figs. 1 and 2) \equiv *Glomus infrequens* Hall. Trans. Br. mycol. Soc. 68(3):345-347 (1977).

DESCRIPTION: Sporocarpia ignota. Azygosporae singillatim in terra ortae, crescens quaeque hyphali in cellula, levi nec ramosa, quae in vesicula subglobosa terminatur vel ellipsoidea sive obovoida 126-214 x 157-227 μm diametro. Vesiculae, densa primo albaque materia, paulatim in adolescentem sporam exhaustae. Sporae principio albae, deinde obscure luteae vel brunneae, 69-183 (-225) x 69-164 μm diametro, subglobosae vel ellipsoideae, tunica hyalina stipitis vesicularis inclusae, quae 2.5 - 10.0 μm crassitudinis habet. Eis tunica simplex, ut videtur, spinis (sive digitis) vacuis et 2.5 - 5.0 μm longitudine extentis, spissis ac perpetuis excepto poro qui forma fundibuli vesiculam init et densa tunicae materia occlusus est. Interior-em sporae materiam exilis membrana continet. Quomodo sporae germinent, utrum mycorrhizae formentur, adhuc ignotum.

Sporocarps unknown. Azygospores produced singly in soil by expansion within a smooth, unbranched hyphal cell that terminates in a subglobose to ellipsoid or obovoid vesicle, 126-214 X 157-227 μm diam.; vesicle contents dense white, emptying as the spore develops. Spores white

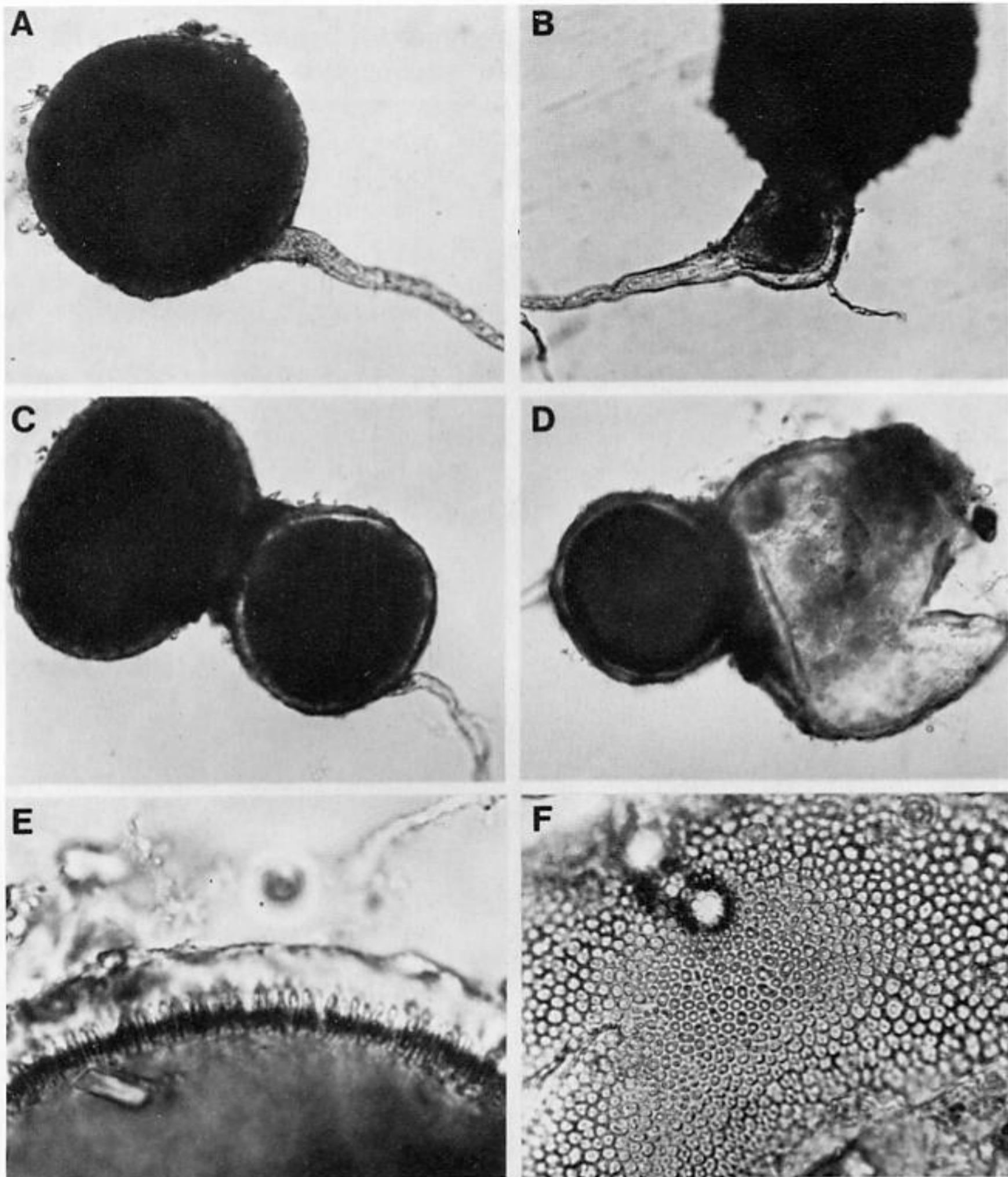


Fig. 1. (A-D) Fresh specimens mounted in water, X 160. (A) Vesicle prior to spore formation. (B) Developing spore within vesicular stalk. (C) Young spore and vesicle. (D) Mature spore with attached empty vesicle. (E-F) Squashed spore mounted in water, X 800. (E) Optical cross section showing vacuolated projections of inner spore wall and clear outer membrane. (F) Surface view of inner spore wall.

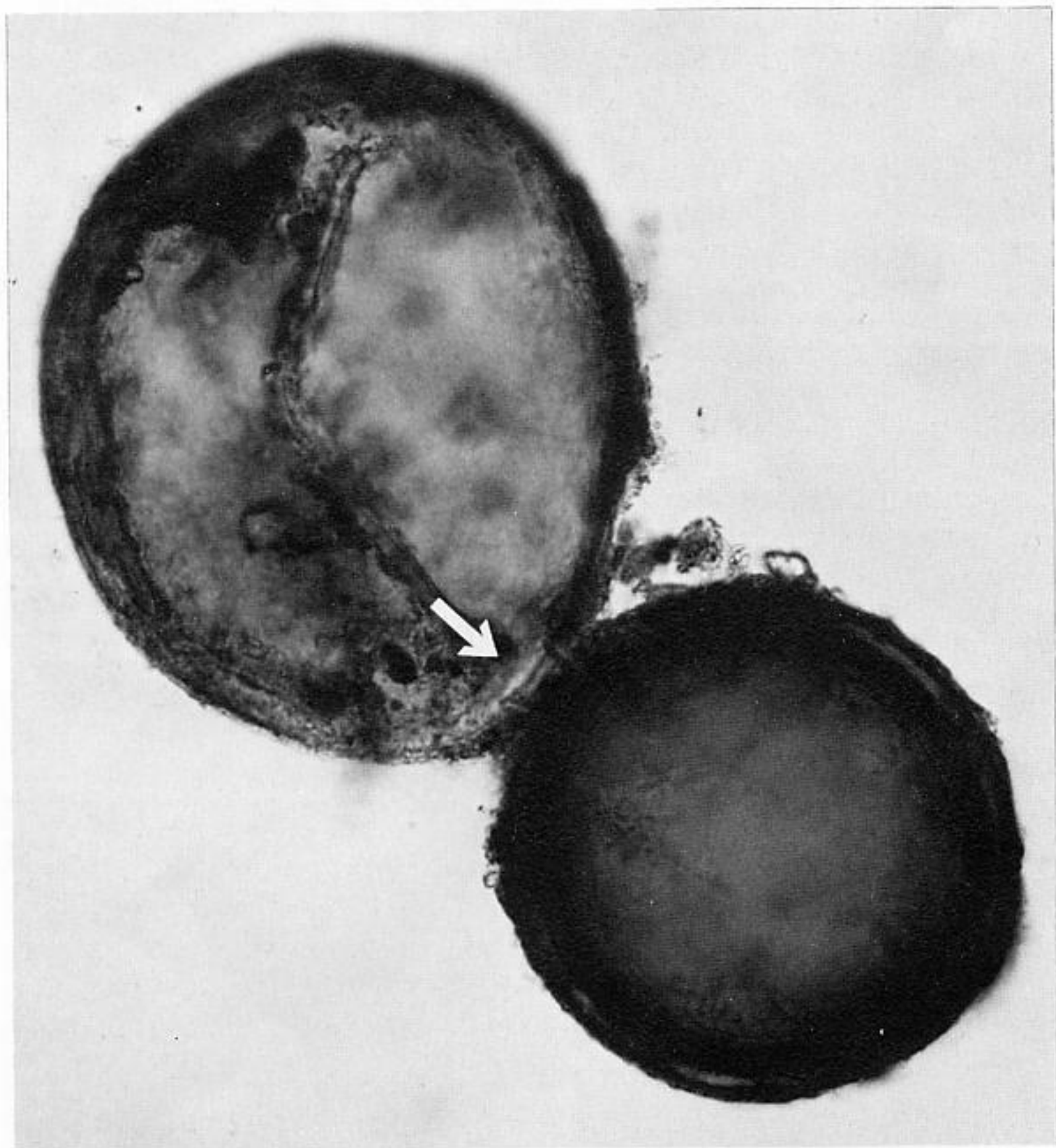


Fig. 2. Spore in lactophenol showing funnel shaped connection from spore to vesicle with thickened plug, X 320.

at first, becoming dull orange to brown, 69-183 (-225) X 69-164 μm diam., subglobose or ellipsoid. Spore enclosed by hyaline wall of vesicular stalk 2.5-10.0 μm thick; spore wall apparently one layer with vacuolated spines, 2.5-5.0 μm long, continuous except for funnel-shaped connection to the mother vesicle which is plugged with thickened wall material. Spore contents of variably sized oil globules enclosed by a thin, separable membrane. Method of spore germination undetermined. Mycorrhiza formation unknown. Vesicle and vesicular wall around spore stain blue with .05% trypan blue in lactophenol. No reaction in Melzer's reagent.

DISTRIBUTION AND HABITAT: *E. infrequens* was originally reported from New Zealand by Hall (1977). We observed it from two celery fields in the central California coast area and as a contaminant in a pot culture of *Glomus mosseae* (Nicol. & Gerd.) Gerdemann & Trappe from Oregon State University. C. Walker at Iowa State University (personal communication) found *E. infrequens* in soil under poplar trees (*Populus* sp. L.) and from soils cropped with soybean and corn in Iowa, Illinois, and Wisconsin.

MYCORRHIZAL ASSOCIATIONS: We have failed to establish mycorrhizae in pot culture using several different hosts. In other tests, trap tubes similar to those used by Ames and Linderman (1977) were inoculated with surface-sterilized spores and planted with strawberry for mycorrhiza establishment. *Glomus mosseae* and *Gigaspora margarita* Becker & Hall readily formed mycorrhizae under these conditions but *E. infrequens* did not.

COLLECTIONS EXAMINED: TYPE: NEW ZEALAND, Leith Saddle, Hall #437. PARATYPES: NEW ZEALAND, Long Bush, Hall #1, House Road, Akatore Forrest, Hall #130. Type and paratype specimens are deposited with the Herbarium, Plant Diseases Division, Dept. of Scientific and Industrial Research (DSIR), Auckland, New Zealand. Our collections are deposited in the herbaria of Oregon State University (OSC), Corvallis, Oregon 97331, and DSIR, Auckland, New Zealand. CALIFORNIA, Ventura Co., 13 km east of Oxnard and 3 km southwest of Camarillo, adjacent to U.S. Highway 34, September, 1977, Ames #03 (OSC). OREGON, Oregon State University, Corvallis, leg. B.A. Daniels, as a contaminant from pot culture of *Glomus mosseae* (Nicol. & Gerd.) Gerdemann & Trappe, Ames #04 (OSC, DSIR).

Details of the life cycle of *E. infrequens* are yet to be learned. Cotton, strawberry, celery, alfalfa, and su-

dan grass did not form VA mycorrhizae four months after inoculation with up to 70 spores of this fungus. Strawberry plants in small trap tubes dually inoculated with *E. infrequens* and either *Gigaspora margarita* or *Glomus mosseae* became mycorrhizal with infections typical of *G. margarita* or *G. mosseae* only. No parasitic activity by *E. infrequens* was observed on spores of *G. margarita*, *G. mosseae*, or on strawberry roots. *E. infrequens* may be an obligate parasite on other fungi. Spores did not germinate on water agar or potato dextrose agar after two weeks at room temperature.

Because we could not demonstrate saprophytic growth and because of the strong resemblance to *Acaulospora* spp., we feel that *E. infrequens* belongs in the Endogonaceae. The fact that mycorrhiza formation was not demonstrated by us does not present a conflict since this is apparently true for some species of *Endogone* and *Glomus* (Gerdemann & Trappe, 1974).

The authors wish to thank Dr. Charles E. Murgia for the Latin descriptions included in this article and for his assistance in choosing the Greek term for the genus.

LITERATURE CITED

- Ames, R. N. and R. G. Linderman. 1976. *Acaulospora trappei* sp. nov. Mycotaxon, Vol. 3(3):565-569.
- Ames, R. N. and R. G. Linderman. 1977. Vesicular-arbuscular mycorrhize of Easter lily in the northwestern United States. Can. J. Microbiol. Vol. 23(12):1663-1668.
- Gerdemann, J. W. and J. M. Trappe. 1974. The Endogonaceae in the Pacific Northewst. Mycologia Memoir No. 5, 1-76.
- Hall, I. R. 1977. Species and mycorrhizal infections of New Zealand Endogonaceae. Trans. Br. mycol. Soc., Vol. 68(3):341-356.
- Trappe, J. M. 1977. Three new Endogonaceae: *Glomus constrictus*, *Sclerocystis clavispora*, and *Acaulospora scrobiculata*. Mycotaxon, Vol. 6(2):359-366.