Brit. J. Ophthal. (1976) **60**, 607

Mycotic keratitis in Nigeria
A study of 21 cases

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Mycotic keratitis is being increasingly recognized as an important problem in ophthalmic practice in several parts of the world (Emmons, Binford, and Utz, 1970). Reports on it from various countries have been comprehensively reviewed by DeVoe and Silva-Hutner (1972). Except for one record from Egypt of a corneal ulcer due to *Beauveria* sp. (Lichaa, 1933), information on the incidence and aetiology of mycotic keratitis in the African continent has been lacking. Therefore a report of 21 cases of this condition diagnosed during a period of two years at the University of Nigeria Teaching Hospital, Enugu, is of interest. This series of cases of fungal corneal ulcers, proved by culture, is one of the largest to be reported.

Materials and methods

The study was limited to cases in which the corneal ulcers were strongly suggestive of a fungal infection. Thirty-six such cases were investigated. A thorough clinical examination together with observation by slit lamp of the size, shape, position, and depth of the ulcer and the type of slough was undertaken, and satellite lesions on the cornea were looked for whenever possible. The patient's occupation, history of onset of the disease or injury, and previous treatment with corticosteroids or broad spectrum antibiotics were recorded. Scrapings for mycological investigation were taken from the edge or the base of the ulcers with a platinum loop under sterile conditions, taking as deep a scraping as possible. A portion of the scrapings was examined microscopically in 10 per cent potassium hydroxide and the remaining material cultured on slopes of freshly prepared Sabouraud's agar supplemented with chloramphenicol (0·05 mg/ml). Cultures were incubated at 28°C for 7 days and regularly examined. In cases in which microscopical examination of scrapings in KOH was negative and the culture was positive, or vice versa, more scrapings were collected and processed.

Results

Mycotic keratitis was diagnosed by the demonstration of fungal elements in corneal scrapings and positive cultures in 21 out of the 26 cases investigated. The salient clinical features and the infecting fungi in the 21 cases are shown in the Table. Twelve were caused by *Fusarium solani,* four by *Aspergillus fumigatus,* one by *A. flavus,* two by *Penicillium citrinum,* one by *P. expansum,* and one by an unidentified *Penicillium* sp.

Most of the cases were aged between 20 and 60 years. Eight of the 21 cases were women, and this possibly was because Nigerian women take an active part in outdoor and farm work. In 10 of the 15 patients with a history of trauma the injury was from vegetable matter—mainly palm tree, thorn or leaf—and in the remaining five from other causes.

The clinical features of the corneal ulcers were similar whatever the causative fungus. Most cases had a big central or paracentral ulcer with a dry slough at the base and raised edges. There was a greyish-white hypopyon in all cases except two which were seen at an early stage. Lack of vascularization was characteristic of these two cases. Satellite lesions were seen in one case, the causal agent being *F. solani.* In two cases, one due to *F. solani* and the other to *A. fumigatus,* the ulcer was in a very advanced stage of sloughing leading to panophthalmitis with no perception of light and faulty projection in all quadrants (Figs 1 and 2). Three cases due to *F. solani* had big central slough-

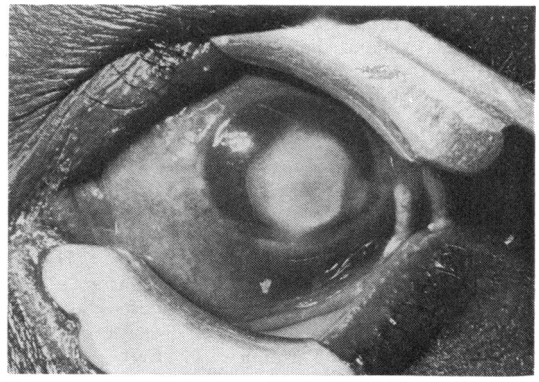

FIG. 1 *Corneal ulcer caused by* F. solani

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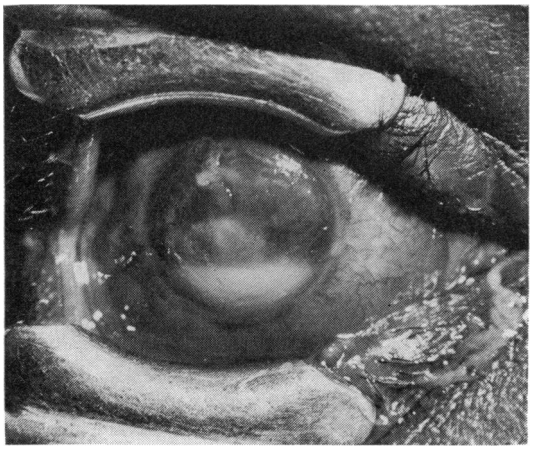

FIG. 2 *Corneal ulcer caused by* A. fumigatus

ing ulcers with hypopyon filling more than half of the anterior chamber; corneal abscess and endothelial plaque formation was observed in these cases. Fig. 3 illustrates the abundant hyphal elements of *F. solani* in the scrapings from a case of corneal ulcer. Histopathological studies of infected eyes in two cases of corneal ulcers in which the diagnosis was confirmed by culture showed invading hyphae of *A. fumigatus* in the corneal tissue (Fig. 4) and in the sclera. The tissue reaction in these cases manifested as necrosis accompanied by acute inflammatory cellular infiltration. The main morphological features of representative isolates of *F. solani, A. fumigatus,* and *P. citrinum* are shown in Figs 5 to 8. All the 12 isolates of *F. solani* grew well at 37°C and survived at 40°C for more than three weeks.

Treatment with amphotericin B eye drops was tried along with the routine supportive treatment of ulcers and hypopyon in six cases, four of which were caused by *F. solani* and two by *A. fumigatus.* The response was satisfactory in three cases, in which the ulcer healed and left a leucomatous corneal opacity. In some other cases repeated cauterization with pure carbolic acid was tried but it helped only to salvage the eye for cosmetic reasons. Evisceration had to be done in three cases in which the hypopyon had organized causing an endothelial plaque and leucoma formation. In one case, due to *F. solani,* in which hypopyon could not be reduced, paracentesis was tried without any significant improvement. However, it helped to confirm the diagnosis as the material collected showed fungal hyphae on direct microscopical examination and *F. solani* was recovered in culture.

Table *Salient clinical features and causative fungus in 21 cases of myotic keratitis*

Case no.	*Age (years)*	*Sex*	*Occupation*	*Eye affected*	*History of trauma*	*Previous treatment*	*Causative fungus*
1	70	Male	Farming	Left	Palm tree thorn	Natural medicine	*Aspergillus fumigatus*
2	50	Female	Farming	Right	—	—	*Fusarium solani*
3	24	Male	Fitter	Left	Mechanical tool	Corticosteroids	*F. solani*
4	22	Female	Farming	Right	Palm kernel	—	*F. solani*
5	22	Female	Housewife/ farming	Left	Palm kernel	—	*F. solani*
6	35	Male	Farming	Right	Dust particles	—	*F. solani*
7	45	Male	Farming	Left	Palm tree thorn	—	*A. fumigatus*
8	18	Female	Student	Right	Hit by stone	—	*F. solani*
9	40	Male	Farming	Right	Palm tree thorn	—	*Penicillium* sp
10	30	Female	Farming	Left	—	—	*A. fumigatus*
11	35	Male	Farming	Left	—	—	*F. solani*
12	54	Male	Farming	Right	Bush plant injury	Corticosteroids	*P. citrinum*
13	44	Male	Colliery worker/ farmer	Left	Palm tree thorn	—	*F. solani*
14	44	Female	Housewife	Right	—	—	*P. citrinum*
15	60	Female	Housewife	Right	—	—	*A. flavus*
16	51	Male	Farming	Left	Hit by stone	—	*F. solani*
17	45	Male	Farming	Right	Stick injury	Self medication with eye drops	*F. solani*
18	16	Female	Student	Left	Hot-oil burn	—	*P. expansum*
19	16	Male	Student	Right	—	—	*F. solani*
20	44	Male	Student	Left	Stick injury	Self medication with ointment	*A. fumigatus*
21	33	Male	Farming	Left	Cashewnut tree branch	—	*F. solani*

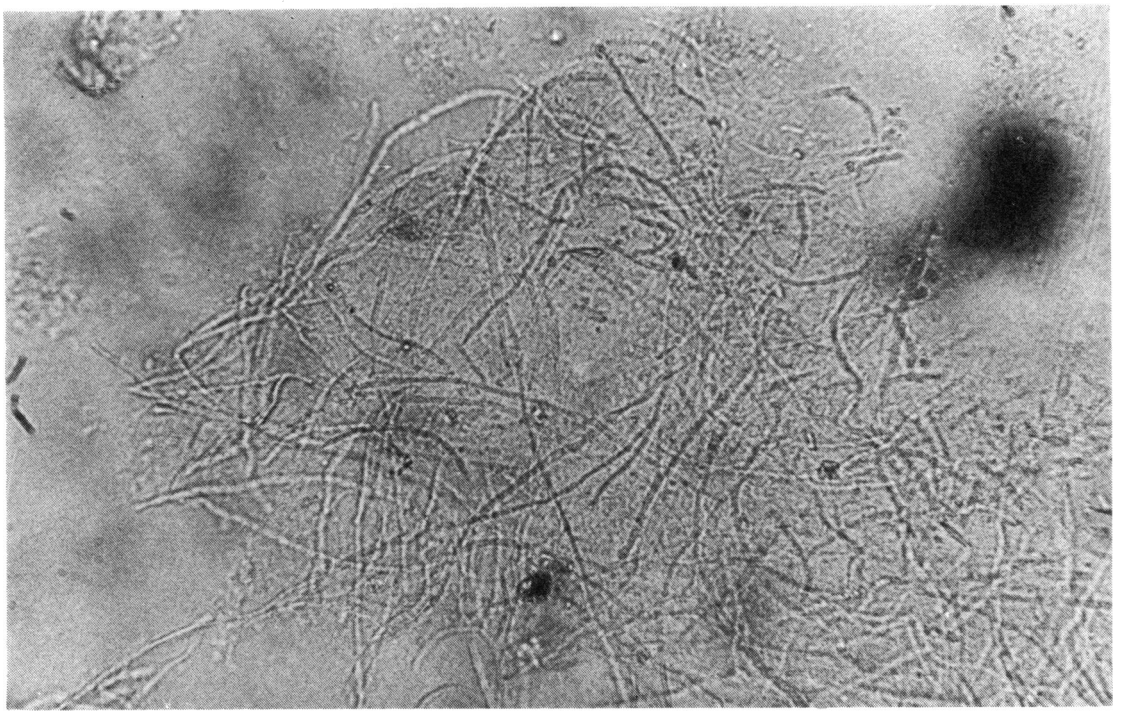

FIG. 3 *Hyphae of* F. solani *in corneal scraping. KOH preparation.* ×460

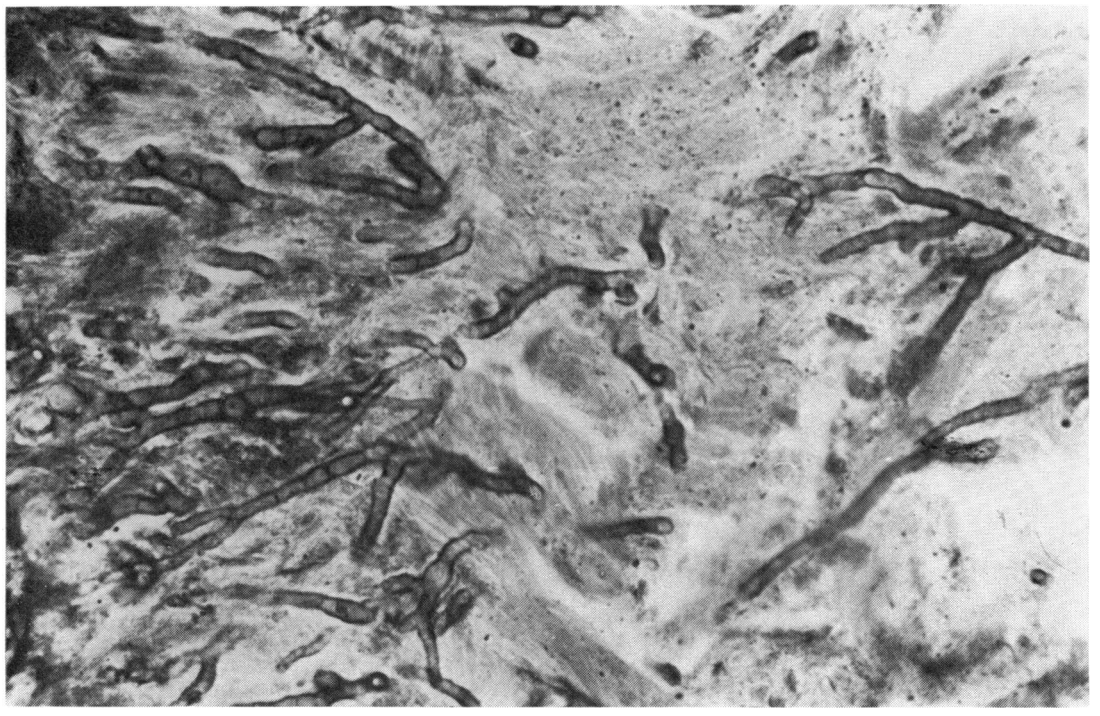

FIG. 4 *Histological section showing septate, dichotmously branching hyphae characteristic of* A. fumigatus *in the corneal tissue. Haematoxylin and eosin.* ×410

FIG. 5 F. solani *in culture showing clusters of inequilaterally fusoid macroconidia with pointed apical cells. Lactophenol blue mount.* ×375

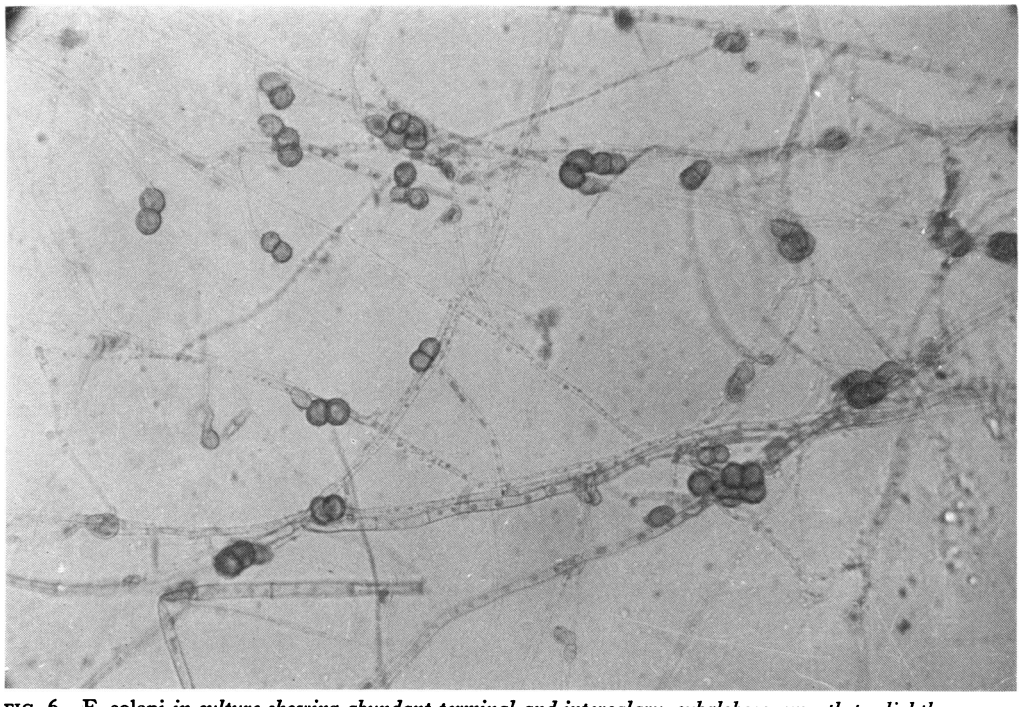

FIG. 6 F. solani *in culture showing abundant terminal and intercalary, subglobose, smooth to slightly rough-walled chlamydospores. Lactophenol blue mount.* ×375

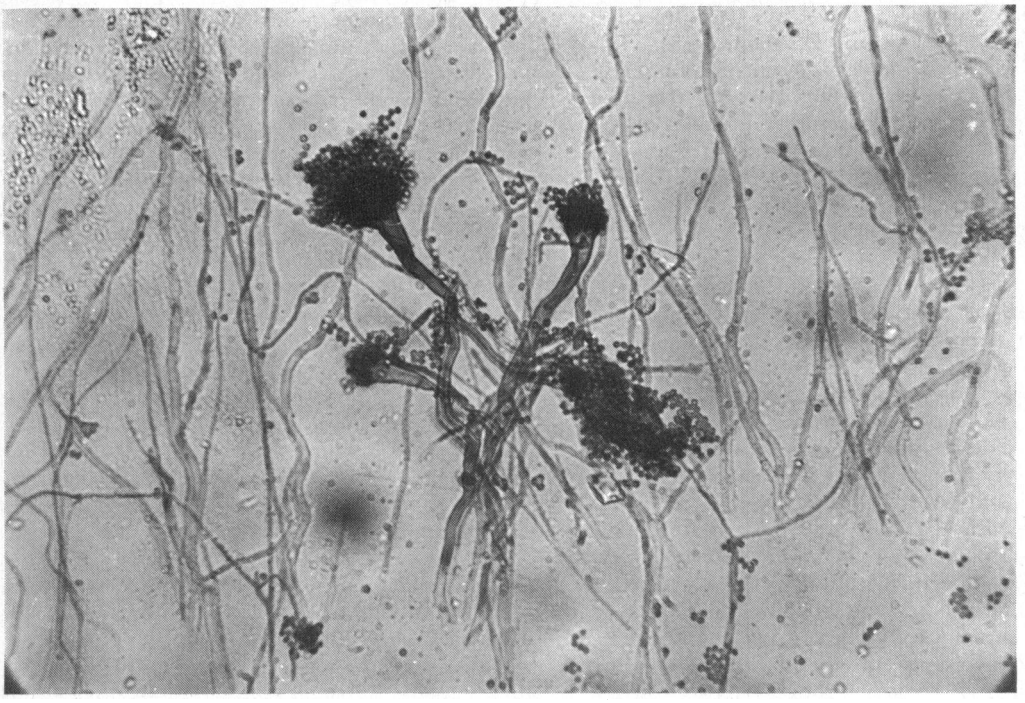

FIG. 7 A. fumigatus *in culture showing typical conidiophores with clavate vesicles and uniseriate sterigmata (phialides) bearing chains of conidia. Lactophenol blue mount.* ×375

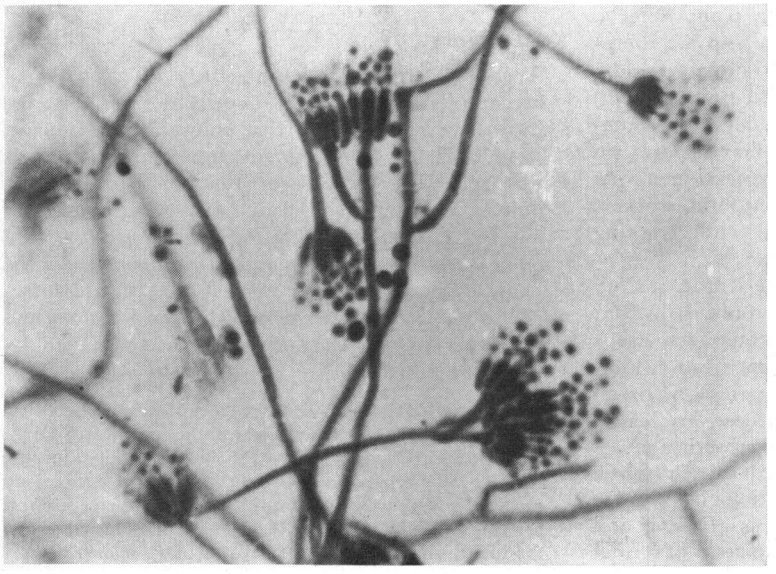

FIG. 8 Penicillium citrinum *in culture showing monoverticillate heads of conidia occurring singly and in bunches. Lactophenol blue mount.* ×375

Enucleation was done in another two cases in which the whole of the anterior segment was involved and there was no perception of light or projection. It was in these two cases that histological examination showed the presence of hyphae of *A. fumigatus* in the corneal tissue and in the sclera. Therapeutic keratoplasty could not be undertaken owing to lack of facilities. The new drug natamycin (Pimaricin), reported to be successful in treatment of *F. solani* keratitis (Jones, Forster, and Rebell, 1972), was not locally available. However, with a small quantity of the pure anti-

biotic kindly supplied to us by Gist-Brocades, Research and Development Division, Delft, Holland, we have tested the *in vitro* sensitivity of eight isolates of *F. solani* from our cases by the tube dilution method in Sabouraud's dextrose broth. These isolates were found to be sensitive to the antibiotic at a concentration of 5 to 10 μg/ml.

Discussion

This is the first report of cases of mycotic keratitis from Nigeria or West Africa. The actual incidence of mycotic keratitis may be much higher since, owing to pressure of work, we could not investigate several other suspected cases among the large number of patients with corneal ulcers attending our clinic. The incidence of cases by age and sex is similar to that reported by Sood, Ratnaraj, Balaraman, and Madhavan (1968).

Previous corneal trauma and topical application of corticosteroids or broad spectrum antibiotics, or both, have been significantly associated with mycotic keratitis in man. (Chick and Conant, 1962; Zimmerman, 1963; DeVoe and Silva-Hutner, 1972). Although only 15 out of our 21 patients gave a history of trauma, probably the remaining six had also sustained some mild injury which went unnoticed at the time. Notably, most of our patients were farmers and trauma was most often from palm tree leaf, thorn, kernel, or other plant objects. Most Nigerians work in agriculture and are therefore more prone to outdoor trauma. Reddy, Satyendran, Satapathy, Kumar, and Reddy (1972) and Dasgupta, Gupta, Ray, Sunderaraj, Ramamurthy, and Lamba (1973), in their reports on keratomycosis in India, have also mentioned that most of their patients were agricultural workers with a history of trauma sustained while working in the fields.

Only a few of our patients gave a definite history of topical application of corticosteroids. However, probably in a few other cases the unknown drops or ointment used in earlier self-medication may have been preparations of corticosteroids or broad spectrum antibiotics since both these are easily available in local markets without prescriptions.

A wide range of fungi are known to cause mycotic keratitis and the predominant aetiological agents vary in different geographical areas (DeVoe and Silva-Hutner, 1972). The 21 isolates of fungi from corneal ulcers in our series represented three different genera—that is, *Fusarium, Aspergillus,* and *Penicillium—F. solani* being the predominant aetiological agent represented by 12 isolates. In an earlier study of 38 cases of fungal corneal ulcers from Florida, USA (Jones, Sexton, and Rebell, 1969), 29 were proved to be caused by *Fusarium* sp., the commonest being *F. solani,* represented by 11 isolates. A few cases of *F. solani* keratitis have also been reported from other areas in the USA (Halde and Okumoto, 1966), Argentina (Zapater and Arrechea, 1975), Venezuela (Cordero-Moreno, 1973), Colombia (Greer, Brahim, and Gonzalez, 1973), Ceylon (Nityananda, Sivasubramaniam, and Ajello, 1962), Japan (Matsumoto, 1972; Suga, 1972), and Singapore (Jones, Jones, Lim, Bron, Morgan, and Clayton, 1969).

F. solani is a saprophyte of world-wide distribution and a well-known plant pathogen affecting a host of economically important plants (Booth, 1971). Although we could not procure *F. solani* isolates of plant origin for a comparative study, the ability of our clinical isolates of the fungus to grow well at 37°C and survive at 40°C for more than three weeks confirms the observation made by Jones and others (1969). As suggested earlier (Emmons and others, 1970), strains of *F. solani* which cause human disease have possibly a tropical or subtropical distribution.

Summary

A clinical and mycological study of 21 cases of mycotic keratitis, a clinical entity not yet reported from Nigeria or West Africa, showed that *Fusarium solani* was the predominant aetiological agent. It was isolated from 12 cases. Four of the remaining nine cases were caused by *Aspergillus fumigatus,* one by *A. flavus,* two by *Penicillium citrinum,* and one each by *P. expansum* and *Penicillium* sp. All the 12 isolates of *F. solani* grew well at 37°C and survived at 40°C. Two cases, one due to *F. solani* and the other to *A. fumigatus,* were accompanied by panophthalmitis.

We thank Mr A. J. Brooks, head of the Medical Illustration Unit, for the clinical photographs and Dr A. V. Suseelan, Department of Morbid Anatomy, for the histological preparations. We also thank the University Senate Research Grant Committee for financial support for the study and Dr C. Booth, of CMI Kew, Surrey, for identifying some of our isolates of *F. solani.*

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