Enteroblastic first macroconidia in *Fusarium crookwellense*

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The first conidium in *Fusarium crookwellense* can be produced enteroblastically following disintegration of the apex of the conidiogenous cell. Collarettes are morphologically distinct from those that arise when the first conidium develops from holoblastic replacement of the apex of the conidiogenous cell. Conidiogenous cell remnants may be present at the apex of the first conidium as a result of enteroblastic development.

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Chez le *Fusarium crookwellense* la première conidie peut être produite entéroblastiquement suite à la désintégration de l'apex de la cellule conidiogène. Les colerettes sont morphologiquement distinctes de celles qui se forment lorsque la première conidie se développe par remplacement holoblastique de l'apex de la cellule conidiogène. Les vestiges de la cellule conidiogène peuvent demeurer à l'apex de la première conidie, suite au développement entéroblastique.

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Introduction

A number of different ways in which the first macroconidium in *Fusarium* spp. can be produced have been suggested by Van Wyk *et al.* (1987). These authors postulated that a continuum exists between a thallic form of development on the one extreme, such as that reported for *F. culmorum* (W. G. Smith) Sacc. (Marchant 1975) and *F. decemcellulare* Brick (Subramanian 1971), and strictly enteroblastic conidium production with apparent disintegration of the conidiophore apex, as illustrated by Schneider and Seaman (1982, referred to as a fibrillar layer) for *F. sulphureum* Schlecht. Disintegration of the conidiophore apex prior to production of the first conidium in *F. crookwellense* Burgess, Nelson & Toussoun was not observed by Van Wyk *et al.* (1987), who considered such a process unlikely in this species. However, in more recent studies, development of the first conidium in a manner similar to that reported for *F. sulphureum* by Schneider and Seaman (1982) was observed in *F. crookwellense* and is illustrated here.

Materials and methods

An isolate of *Fusarium crookwellense* from necrotic wheat crowns was lyophilised and deposited in the culture collection of the South African Medical Research Council (MRC), Tygerberg, South Africa, as MRC 3852 (= ATCC 64237). Water agar plates with pieces of carnation leaves (Fisher *et al.* 1982) were inoculated with a conidial suspension of this isolate and incubated at 25°C under a combination of white fluorescent tubes and near-ultraviolet light with a 12-h photoperiod. Colonies were inspected after 48 h at 5-h intervals for the commencement of sporodochium development at the edges of the carnation leaf pieces. Leaf pieces (approximately 2 × 2 mm) were cut and fixed in 3% glutaraldehyde in 0.1 M phosphate buffer (pH 7.0) for 24 h at 4°C.

The tissue was rinsed in a buffer solution and fixed in osmium tetroxide (Sabatini *et al.* 1963) for 2 h before a second rinse in buffer. The material was dehydrated in a graded series of alcohol and embedded using the methods of Spurr (1969). The epoxy was polymerized at 70°C for 8 h.

Ultrathin sections (60 nm) were mounted on copper grids and stained for 20 min in a saturated uranyl acetate solution, followed by 10 min in lead citrate (Reynolds 1963). Sections were viewed with a Phillips EM300 electron microscope.

Agar discs from cultures bearing young developing sporodochia were fixed in 1.5% glutaraldehyde in 0.1 M phosphate buffer for 1 h, followed by 1% osmium tetroxide for 2 h, dehydrated in a graded acetone series, critical point dried, coated with gold palladium, and viewed with a ISI scanning electron microscope (SEM).

Results and discussion

Disintegration of the conidiophore apex (Figs. 1, 2) apparently leads to the production of a first conidium by means of apical wall building (Minter *et al.* 1982). As a result of the disintegration of the apex, remnants of the disintegrated wall may be present on the apex of the newly formed first conidium (Figs. 3, 4). The extent of these remnants may be substantial (Fig. 3) or may represent only a small portion of the disintegrated apex (Fig. 4). Disintegration of the apex is also evident from SEM micrographs of young developing conidiophores (Fig. 8).

Disintegration of the conidiophore apex can also lead to the formation of a collarette (Figs. 1, 2). The morphology of the collarette formed in this way is different from that of collarettes that have developed as a result of the production of the first conidium by enlargement (Minter *et al.* 1982) of the apex of the conidiogenous cell, and diffuse wall building, as described by Van Wyk *et al.* (1987) and Marchant (1975). Collarettes with definite edges (Figs. 5, 6), in contrast to those with indefinite edges (Figs. 2, 7), may originate as a result of

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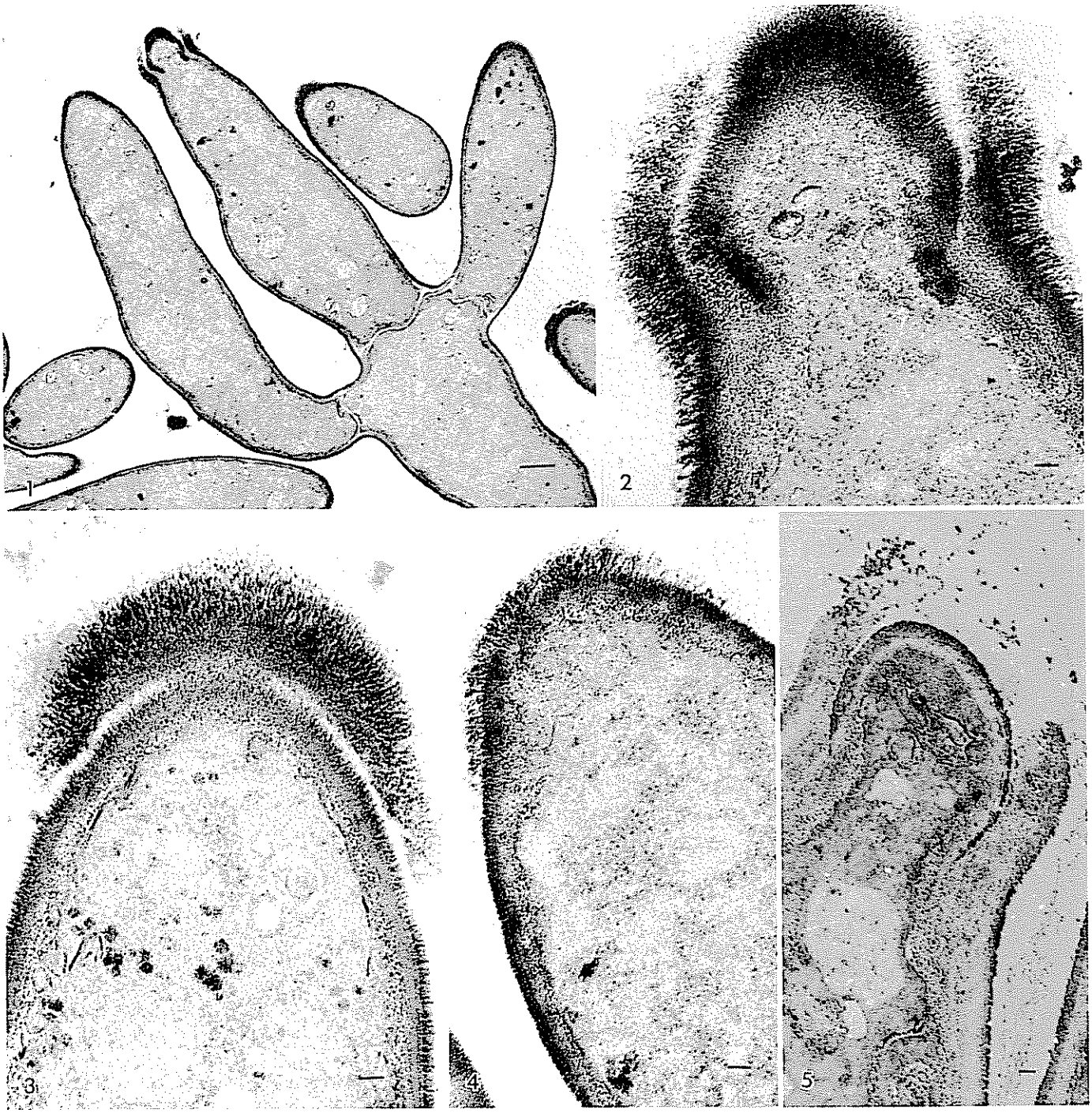
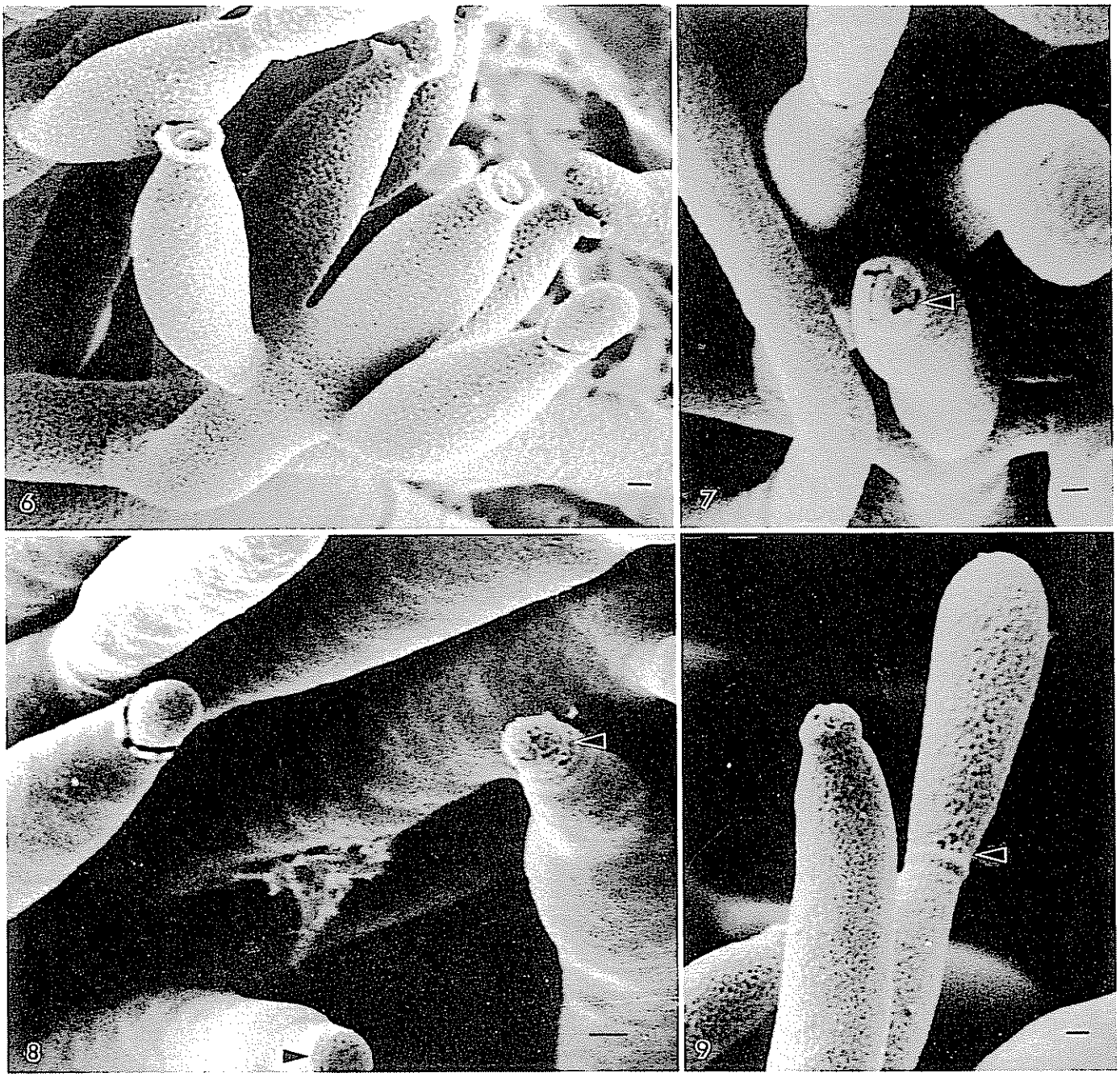


FIGS. 1–5. Collarette morphology and production of first macroconidia in *Fusarium crookwellense* (TEM; bar = 0.1 μm, unless otherwise indicated). Fig. 1. Section through branched monophialides showing development of the first conidium (bar = 1 μm). Fig. 2. Development of the first conidium illustrating morphology of the collarette. Figs. 3 and 4. Different amounts of apical remnants of the conidiophore at the apex of developing first conidia. Fig. 5. Collarette with definite edges as a result of thallic development of the first conidium. A new conidium initial, illustrated, is being produced from the same locus.

different patterns of development of the first conidium. Disintegration of the conidiophore apex leads to the formation of a collarette at the early stages of conidium development (Fig. 8). In contrast, where the first stage of production of the first conidium is thallic (Marchant 1975), a collarette is not seen in the early stages of conidium development (Fig. 9). It is apparent that the first macroconidium formed from a conidiogenous cell in *Fusarium* spp. can develop in distinctly different ways. These differences can be observed within the same species and within the same strain and probably depend on cultural conditions. Efforts to manipulate this process have not been successful but deserve further study.



FIGS. 6–9. Different types of collarettes and production of first macroconidia in *Fusarium crookwellense* (SEM; bar = 1 μm). Fig. 6. Branched conidiophores with young developing conidia. Note collarettes with definite edges. Fig. 7. Young developing conidium. Note collarette (arrowhead) with indefinite edges. Fig. 8. Disintegration of conidiophore apex prior to enteroblastic production of the first conidium (arrowheads). Fig. 9. Absence of a collarette during the early stages where development of the first conidium is thallic (arrowhead).

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