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SOMATIC MITOSIS IN THE *CHALARA* STATE OF *THIELAVIOPSIS PARADOXA* (DE SEYNES) HOHNEL

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Abstract

Vegetative nuclear division in the *Chalara* state of *Thielaviopsis paradoxa* was studied and illustrated by time-lapse, phase contrast microscopy. During this process, the chromatinic material and the nucleolus divide by elongation and constriction comparable to that described in some phycomycetes. An intranuclear spindle, nuclear envelope and centrioles have not been observed in this study.

Introduction

Our previous observations of nuclear division in the *Chalara* state of *Thielaviopsis* (Hashmi *et al*, 1972) using fixed and stained material showed the process to be essentially similar to the direct mode of mitotic division described by Robinow (1962) in a number of phycomycetes. It was inferred that an intranuclear spindle, not discernible by light microscopy, probably provides the impetus for nuclear division.

The present study based on phase contrast microscopy of living nuclei of the same strain of the *Chalara* state of *Thielaviopsis paradoxa* as used previously, was undertaken to corroborate our observations.

Materials and Methods

The culture of *T. paradoxa* was obtained from the mycology culture collection of the Biology Department, University of Waterloo (UW 174). It was maintained on 2% malt extract agar. The procedures and techniques followed were as described by Robinow & Caten (1969).

Results

The vegetative nucleus in the actively growing hyphal tip of *T. paradoxa* has continuously changing smooth contours. It contains a dense, eccentrically placed spherical nucleolus (Fig. 1A) surrounded by a narrow band of chromatinic material (clustered chromosomes). Continuous observation of this nucleus (indicated by large arrow in Fig. 1A) shows that it becomes larger and the nucleolus exhibits slow, random movements (Figs. 1B—1E). As division approaches (Fig. 1F) the chromatinic material elongates further and the nucleolus stops its overt activity. During the next few minutes (Fig. 1G) the nucleus develops a median constriction and its nucleolus, though still visible, decreases in density at this stage. One to two minutes after constriction of the chromatinic material and nucleolus has begun, the two ends of the dividing nucleus

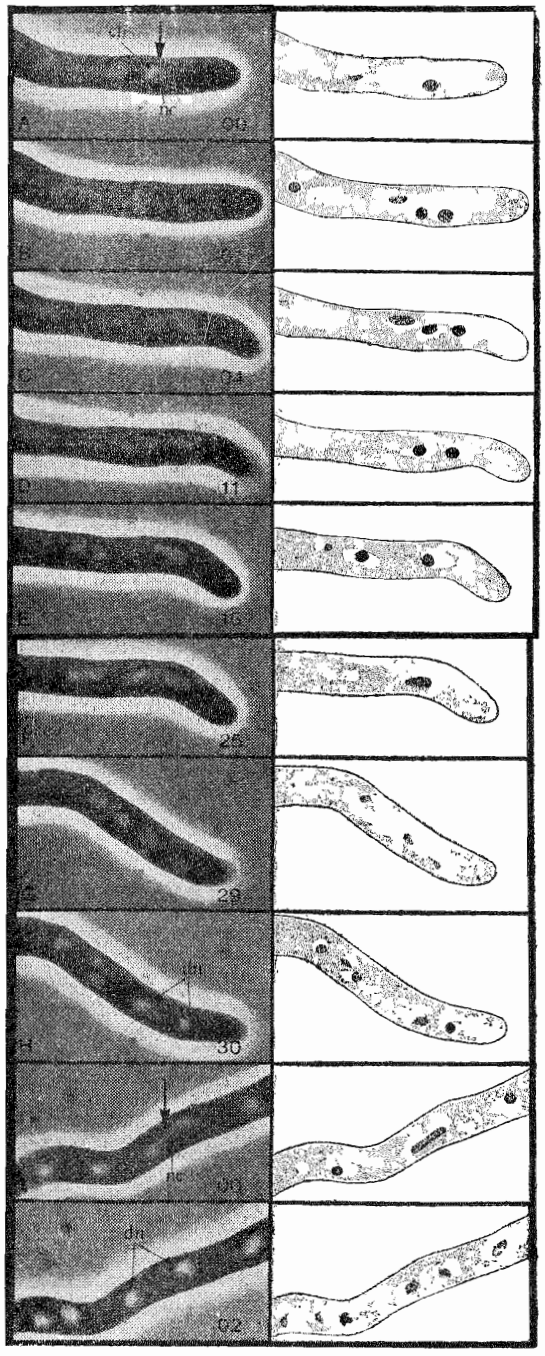

Fig. I. Time-lapse phase contrast sequence of mitotic division at the hyphal tip of the *Cnalara* state of *Thielaviopsis paradoxa* Figs. A—F, time intervals in minutes. Figs. I and J. division figures away from the tip; ch, chromatinic material; nc, nucleolus; dn, daughter nuclei.

separate (Figs. 1G and 1I). The two small resultant daughter nuclei (Figs. 1H and 1J) separate quickly but soon return to close proximity. This quick back and forth movement was clearly seen but could not be easily photographed. The daughter nuclei, each with a nucleolus, increase in size rapidly and attain normal shape.

Discussion

The division of the chromatinic material and the nucleolus during mitosis in hyphal nuclei of *T. paradoxa* offers an interesting parallel with the pattern observed in several phycomycetes (Smith, 1923; Robinow, 1957a, 1957b, 1962, Bakerspigel, 1960; Turian & Cantino, 1960). The spindle, it any exists, must be intranuclear and is not discernible by light microscopy. The pattern of nuclear division in *T. paradoxa* is clearly different in a number of respects to the sequence of events reported by Aist (1969) in *Ceratocystis fagacearum* and *Fusarium oxysporum*. In the latter fungi a nuclear envelope and clusters of chromosomes, attached to a thin spindle, are formed between the divided halves of a peripheral centriole. These structures have not been seen in the nuclei of *T. paradoxa*. Our phase contrast observations confirm those made from fixed and stained material. While not revealing the fine detail of the process of division these observations establish the sequence of events. Stages observed in static stained preparations can thus be assigned to particular related phases of the division process. The elongating and dividing nucleolus remains visible throughout the division process. Although it decreases in density at one stage (Fig. 1G), it is not expelled from the division figure into the cytoplasm as reported in *Schizophyllum commune* (Bakerspigel, 1959) and *Lipomyces lipofer* (Robinow, 1961). In *T. paradoxa* the interval of time between the first signs of nuclear division, as indicated by decreasing density of the nucleolus, to the emergence of daughter nuclei was approximately 5—6 minutes.

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