Pak. J. Bot., 9 (2): 115—118, 1977.

CONIDIUM ONTOGENY IN HYPHOMYCETES

THE HOLOBLASTIC CONIDIA OF *HYPOMYCES ROSEUS* (=*CLADOBOTRYUM MYCOPHILUM* (OUDEM.) W. GAMS & HOOZEM.)

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Abstract

Conidium ontogeny in *Hypomyces roseus* (=*Cladobotryum mycophilum* (Oudem.) W. Gams and Hoozem.) is analyzed by time-lapse photomicrography. The fungus is shown to produce conidia holoblastically from a determinate, retrogressive conidiogenous cell.

Introduction

The modern concepts of conidium ontogeny have developed mainly from studies on hyphomycetes. An international conference on criteria and terminology in the classification of Fungi Imperfecti was held in 1969 at Kananaskis, Alberta and results were edited by Kendrick (1971). According to its recommendations, conidial developmental types are relegated either to blastic mode in which there is a marked enlargement of a recognizable conidial intial *before* it is delimited by a septum, or the arthric mode in which any such enlargement occurs only *after* septal delimitation. However, in an earlier description of conidiogenesis in the *Monilia* state of *Neurospora sitophila* Shear and Dodge and *Sclerotinia laxa* Alderh. and Ruhl., Hashmi et al. (1972a) demonstrated an intergradation between blastic and arthric modes of development. The blastic mode of conidiogenesis is further divided into enteroblastic and holoblastic types. Enteroblastic conidia may be either phialidic or tretic, and in neither case does the outer wall of the conidiogenous cell contribute to the formation of the condium wall.

A holoblastic conidium is one in which all wall layers of a conidiogenous cell are involved in the formation of the conidium wall. A determinate, retrogressive conidiogenous cell ceases extension growth at or before the onset of conidiogenesis and does not resume vegetative growth during or between formation of successive conidia (Cole & Kendrick, 1971).

Hypomyces roseus (=*Cladobotryum mycophilum* (Oudem.) W. Gams & Hoozem.) produces conidia that merge imperceptibly with the conidiogenous cell in gradually maturing basipetal order, the hallmark of Hughes' section V of his classification of Fungi Imperfecti (Hughes, 1953). Although Cole & Kendrick (1971) inferred its mode of conidiation from plate cultures as holoblastic, they were unable to provide an unequivocal evidence in support of their observation. Now a time-lapse analysis of conidiogenesis of this fungus is presented here.

Materials and Methods

The culture of *C. mycophilum* was isolated from a decaying log in Scarborough, Ontario and maintained on PDA at room temperature. The sequence of photomicrographs in Figs. 1-9 was taken by using the modified plate culture method of Cole et al. (1969).

Observations

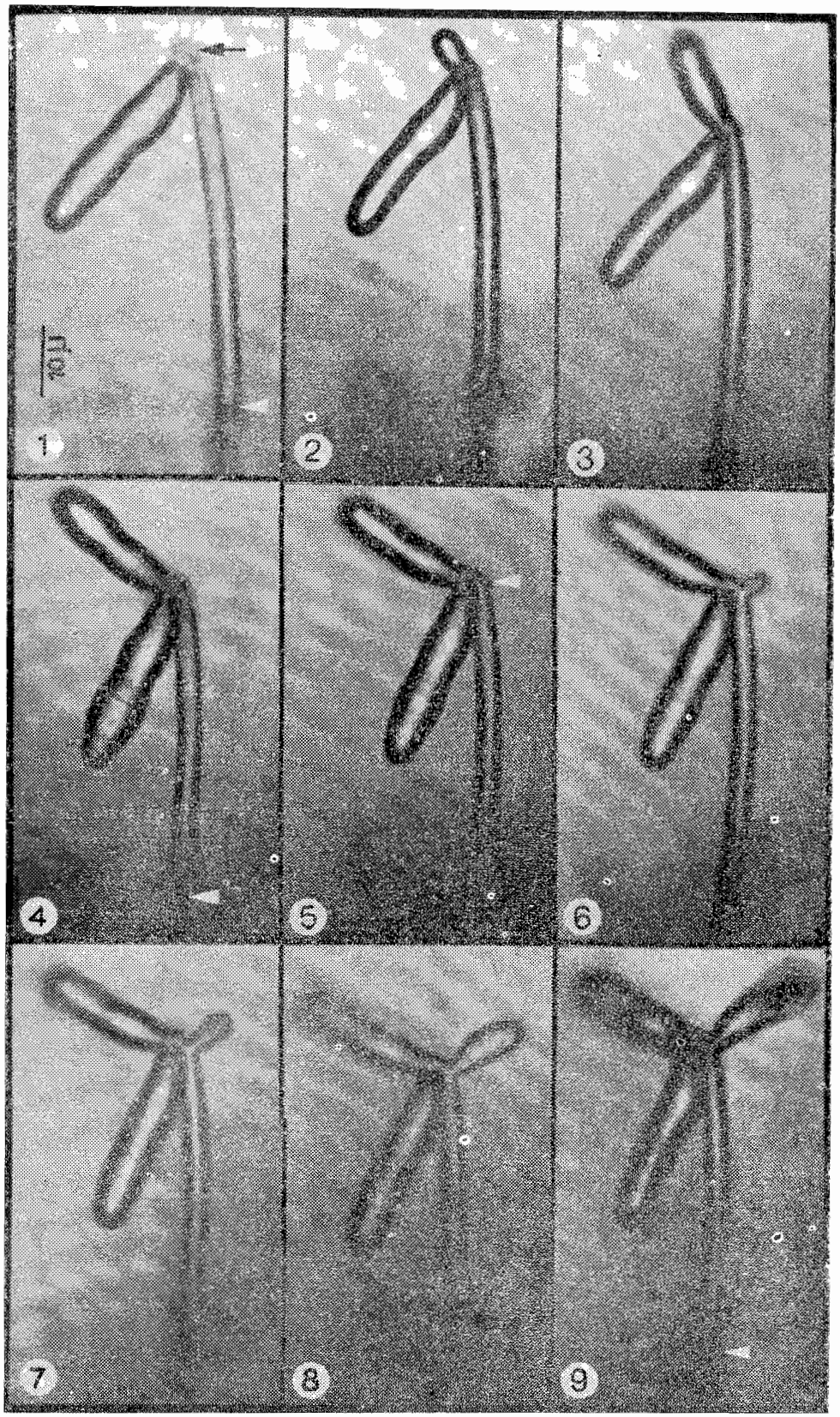
At the beginning of the sequence (Fig. 1) one conidium has already been formed at the apex of the conidiogenous cell. A small protuberance (arrow in Fig. 1) is the precursor of the second conidium. After 30 min (Fig. 2) this protuberance shows a pronounced growth and in further 60 min (Fig. 3) it assumes the form of a recognizable conidium. In Fig. 4, taken 90 min later, this conidium has enlarged and matured. If we compare the measurements from a reference point lower down the conidiogenous cell (arrowhead in Figs. 1 and 4) to the base of the second conidium, we can see that the length of the conidiogenous cell has decreased appreciably. Apparently a small part of the conidiogenous cell has been incorporated into this conidium. Eight hours after formation of the second conidium a small papilliform initial emerges (arrow in Fig. 5) and dilates in next 35 min (Fig. 6). A small area of the wall of the conidiogenous cell is presumably replasticized before formation of this initial which subsequently grows to form the succeeding conidium in next 120 min. (Figs. 7-9). Measurement of the distance from the reference point (arrowhead in Fig. 9) to the base of third conidium shows that more of the conidiogenous cell has been converted into conidia. No further growth was observed after this stage probably due to restricted oxygen supply in present experimental conditions.

It seems relevant here to indicate that once a conidium is initiated its full development and delimitation occur fairly quickly, whereas there is comparatively a long time lapse between the formation of a conidium and the initiation of the next. During the latter period mitotic nuclear division presumably occurs. This phenomenon has been demonstrated by Hashmi et al. (1972b) in the phialidic conidiogenous cells of *Torulomyces lagena* Delitsch and *T. indicus* (Saksena) Hashmi, Kendrick & Morgan-Jones. A similar situation probably occurs in *C. mycophilum*.

Discussion

The time-lapse sequence of conidium ontogeny in *C. mycophilum* obtained during this study shows that the fungus produces conidia from a determinate, retrogressive condiogenous cell. All wall layers of the latter are assumed to be involved in forming conidia and there is a marked enlargement of a recognizable conidium initial before any delimiting septum is formed. The conidia differentiate from *part of* the conidiogenous cell and therefore, according to the definition offered by Kendrick (1971), are truly holoblastic. An identical mechanism of conidiogenesis has been observed in *Basipetospora* state of *Monascus ruber* van Tieghem (Cole & Kendrick, 1968), *Trichothecium roseum* (Pers.) Link ex S.F. Gray (Kendrick & Cole, 1969) and *Cladobotryum variosporum* (Link) Hughes (Cole & Kendrick, 1971).

On the basis of certain variations in the formation of holoblastic conidia, Cole & Kendrick (1968, 1971) subdivided Hughes' section V (Hughes, 1953) into VA and VB. In section VA they included those fungi where during conidiogenesis a cytoplasmic continuity is maintained along the chain of basipetally developing conidia. In section VB they segregated the conidial *M. ruber*, *T. roseum* and *C. variospermum* on the basis that the meristematic zone is restricted to the formation of a single



Figs. 1-9. *Cladobotryum mycophilum:* 35-mm time-lapse sequence of conidium formation taken with the 100X oil-immersion objective.

conidium at any one time and that the conidiogenous cell gives rise to a basipetal chain of cytoplasmically independent conidia.

The holoblastic mode of conidiogenesis of *C. mycophilum* presented here conforms with the conidial developmental concept of the genera of section VB. This study agrees with the observation of Cole & Kendrick (1971) that the formation of conidia in *C. mycophilum* during early stages of development indicates a natural relationship with *C. variospermum*, the type species of *Cladobotryum* and justifies retaining it in the genus. However, their contention that the conidiogenesis of *C. mycophilum* shows a possible transition from holoblastic to enteroblastic type is not tenable unless established by an ultrastructural study of the wall relationship of its conidiogenous cell.

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