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CATENULATE CONIDIA FORMATION IN
OPHIOBOLUS MIYABEANUS ITO ET KURIBAYASHI

BY
MASAYUKI SAKAMOTO

(With one plate and one text-figure)

Introduction

In December 1933, during the course of the investigation on physiologic specialization in Ophiobolus Miyabeaenus (the perfect stage of Helminthosporium Oryzae BREDA DE HAAN), the causal fungus of the sesame spot disease of rice plant, which had been isolated from the affected grains and leaves, the writer found the occurrence of a chain-form fructification which consisted of conidia much smaller than the ordinary ones. Such a case has never been reported in the present fungus nor in other congeneric species, so far as the writer is aware.

C. DRECHSLER 1), working with some graminicolous species of Helminthosporium, reported that Helminthosporium gramineum occasionally showed a tendency to produce a secondary spore successively from a primary conidium. Usually it gave rise to a single secondary spore, which sometimes might grow out into a sporophore bearing half a dozen spores. He 2) also reported that in Helminthosporium catenarium and Helminthosporium cyclops parasitic on Cinna arundinacea and Danthonia spicata respectively, a similar fructification usually occurred, and moreover in the latter species a small unicellular conidium was proliferated from a sporophore by a budding process. Y. NISHIKADO 3) also reported much frequent occurrence of Alternaria-like conidial production in Helminthosporium teres, occasionally forming seven to eight secondary conidia on a conidium, and he suggested that it was not appropriate to include this species in the genus Helminthosporium on account of such a critical characteristic.

In Helminthosporium Oryzae, however, as far as the writer is aware, there

2) C. DRECHSLER: ibid.
3) Y. NISHIKADO: Studies on the Helminthosporium Disease of Gramineae in Japan. 1928. (In Japanese)

has been no report concerning the occurrence of such an aberrant fructification. In the present paper the writer will give a brief description of catenulate conidia-production in the present fungus as well as the germination and the subsequent development of microconidia¹ in hanging drop cultures.

The writer wishes to express here his sincere appreciation to Prof. S. Ito for his constant kind directions, and also to present his heartiest thanks to Prof. Y. Tochinai for his valuable criticisms.

**Microscopical Observations**

A number of diseased grains and leaves of rice plant, sterilized superficially with 0.1 % aqueous solution of mercuric chloride, were put on rice-culm decoction agar plate in a Petri-dish. After a week’s incubation at a temperature of 26° C. in an incubator, the culture medium was covered with vigorous hyphal development extending from the affected materials. By microscope under a low magnification there could be readily observed among the abundant normal fructifications, many aberrant fructifications, in chain-form, usually branching, appearing somewhat similar to that characteristic in members of the genus *Alternaria* (Fig. 1).

They consist of a number of one or two celled, rarely three or more celled, microspores (Pl. IX, figs. 1–2). They are oval to elliptical, sometimes oblong or cylindrical in shape (Pl. IX, figs. 1–3), and lighter in color than an ordinary conidium, sometimes being almost hyaline. They are 20–42 x 7–42 μ in size, rarely up to 40 μ in length. The wall is more or less thick and the spores are slightly or not constricted at the septum (Pl. IX, figs. 1–3).

In a simple type of catenulate fructification the chain does not

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¹) In this paper the writer will call every small spore consisting of a chain-form fructification a “microconidium”, as in the case of the genus *Fusarium*. 

Fig. 1 A photomicrograph of catenulate conidia-production in *Helminthosporium Oryzae* on rice-culm decoction agar, x180.
branch, while in a compound type it branches three or four times, the number of spores amounting to fifty or more (Fig. 1). These microconidia may not readily separated from each other, when mounted in water on the slide, although there could be observed no "joint" connecting them with each other (Pl. IX, figs. 1-3). Sometimes certain microconidia were papillated at their apices to bear the proliferated spores, which have usually been observed on the microconidia localized at the branching point of a chain (Pl. IX, figs. 2-3). Moreover the distal part of the microconidia is not marked with a hilum as shown in the budding spore of Helminthosporium cyclops by C. DRECHSLER 1).

**Hanging Drop Culture**

In tap water these microconidia readily germinate at room temperature projecting an almost hyaline germ tube, about 5.6-7.0 μ in width (Pl. IX, figs. 10-13). Two or more celled conidia occasionally germinated at the cells at both ends (Pl. IX, figs. 15-16). Y. NISHIKADO and C. MIYAKE 2) stated that in the case of the germination of an ordinary conidium of the present fungus, the germ tube tightly adhered to the surface of the host plant or the slide glass by means of the mucilaginous outer layers of the wall, and that such mucilaginous layers were easily demonstrated by staining in a dilute gentian violet solution and mounting in water. In the case of germination of a microconidium of the present fungus a similar mucilaginous substance was produced as shown in Pl. XI, figs. 14-16. Such adhesive nature of the germ tube seems to indicate that these microconidia perhaps may be capable of infecting the tissues of the host plant.

The writer made monosporous hanging drop cultures in van Tieghem cells, in particular starting with a unicellular microconidium. Apricot decoction was used as a nutrient solution. Germination was secured in a few hours (Pl. IX, figs. 10-13), and after two days' incubation at a temperature of 26°C. the hyphal development was so vigorous that it could be seen with the naked eye. Hyphal fusion or anastomosis occurred very frequently. The manner of germination and the subsequent hyphal development was quite similar to that of a normal conidium. After three days' incubation only a few ordinary conidia were produced and after four days microconidia as well as ordinary conidia were developed abundantly.

At first an ordinary conidium grows out into an apical prolongation which is almost hyaline and more or less swollen, resembling an incipient germ tube

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1) C. DRECHSLER: Ibid., Pl. 33, Aa-Abb and Abc.
in its appearance (Pl. IX, figs. 6-7). This apical prolongation soon begins to constrict at the basal part growing into a primary conidium borne on the apical cell of the conidium (Pl. IX, fig. 8). This primary microconidium also may grow out again into an apical prolongation and produce a secondary spore by means of constriction (Pl. IX, fig. 9). The fructification thus produced becomes further complicated generally producing two or three lateral conidial chains (Fig. 1 and Pl. IX, fig. 2), which develop in a manner somewhat similar in appearance to that characteristic of the members of the genus *Alternaria*. Sometimes these catenulate fructifications are produced directly on the terminal of a sporophore in the same manner as above described (Pl. IX, figs. 2, 4 and 5).

The catenulate conidial production in the present fungus may be regarded as one of the characteristic features peculiar to certain strains of the fungus, rather than as the influence of environmental conditions, because such a catenulate tendency could not be found in the other strains of the fungus grown in the same Petri-dish.

**Explanation of plate**

The following figures are all drawn by the aid of a camera lucida and the magnification is × 530.

**Fig. 1.** Catenulate conidia proliferated from the terminal cell of an ordinary conidium.

**Fig. 2.** Catenulate conidia produced directly on a sporophore.

**Fig. 3.** Catenulate microconidia.

**Fig. 4 & 5.** Showing the progressive development of catenulate fructification by budding.

**Fig. 6-9.** Showing the proliferating process of a primary microconidium from an apical cell of an ordinary conidium.

**Fig. 10-13.** Germinating microconidia.

**Fig. 14-16.** Showing the mucilaginous sheath of a germ tube stained with gentian violet.