

# NUCLEAR DISTRIBUTION IN VEGETATIVE CELLS OF *OPHIOBOLUS GRAMINIS* AND OTHER CEREAL ROOT PATHOGENS\*

By S. C. CHAMBERS†

Difficulty is sometimes experienced in distinguishing between *O. graminis* and sterile fungi which form “*Ophiobolus*-like” runner hyphae on cereal roots. However, it is possible that nuclear distribution in mycelium may prove a differential character as different distributions have already been reported for *O. graminis* (Chambers and Flentje 1967) and a cereal root-attacking strain of *Rhizoctonia solani* (Flentje, Stretton, and Hawn 1963). This paper, therefore, describes comparisons of nuclear distribution in *O. graminis* and several other cereal root pathogens including a sterile fungus which formed *Ophiobolus*-like runner hyphae.

## Materials and Methods

(i) *Fungi*.—The fungi listed in Table 1 were used.

(ii) *Mycelial Preparations for Nuclear Studies*.—Inoculum of an isolate was placed on Cellophane overlying potato–Marmite–dextrose agar in a Petri dish. After incubation for 2–5 days at 20°C a sector was removed and stained with HCl–Giemsa (Robinow 1945) adapted from the method described by Hrushovetz (1956).

(iii) *Counts and Measurements*.—Nuclei of an isolate were counted in 200 cells from each of three sources: hyphae near periphery of a colony and hyphal tips both peripheral and internal. The same cells were measured with a calibrated eyepiece micrometer.

## Results

Details of counts and measurements are given in Table 1. These results demonstrate that *O. graminis* differed from all other fungi, including the sterile isolate, in that it had fewer nuclei per cell. In particular, *O. graminis* tip cells were predominantly uninucleate whereas those of other fungi were generally multinucleate. Considerable differences in nuclear distribution also occurred between other species.

## Discussion

Results indicate that nuclear distribution is a useful adjunct for distinguishing between *O. graminis* and other cereal root pathogens, including sterile fungi which form *Ophiobolus*-like runner hyphae. Results also showed that species of *Fusarium* differed considerably from one another in nuclear distribution. This is of significance, especially in view of taxonomic problems which have resulted in widespread usage

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† Victorian Plant Research Institute, Burnley, Vic. 3121.

of two different classifications (Wollenweber and Reinking 1935; Snyder and Hansen 1940, 1941, 1945) for the genus. Nuclear distribution was similar in the morphologically related *Curvularia* spp. and *Helminthosporium sativum* and is, therefore, of no value for differentiating between them.

TABLE 1  
SIZE AND NUCLEAR NUMBER OF CELLS OF SEVERAL FUNGI

| Fungus                          | Length of Cells (μm) |        | Width of Cells (μm) | No. of Nuclei/Cell |       |
|---------------------------------|----------------------|--------|---------------------|--------------------|-------|
|                                 | Mean                 | Range  |                     | Mean               | Range |
| Peripheral tip cells            |                      |        |                     |                    |       |
| <i>Ophiobolus graminis</i>      | 97.47 ± 4.65         | 22-224 | 2.32 ± 0.05         | 1.2 ± 0.04         | 1-2   |
| Unknown (sterile)*              | 63.79 ± 3.02         | 14-152 | 2.08 ± 0.03         | 4.1 ± 0.17         | 1-11  |
| <i>Curvularia ramosa</i>        | 177.42 ± 5.66        | 38-311 | 2.72 ± 0.06         | 13.8 ± 0.63        | 4-33  |
| <i>C. spicifera</i>             | 113.70 ± 6.66        | 12-294 | 2.64 ± 0.05         | 11.4 ± 0.67        | 1-24  |
| <i>Fusarium avenaceum</i>       | 209.50 ± 10.48       | 36-492 | 3.36 ± 0.09         | 3.0 ± 0.20         | 1-10  |
| <i>F. culmorum</i>              | 127.92 ± 6.55        | 30-428 | 3.12 ± 0.05         | 8.6 ± 0.36         | 2-19  |
| <i>F. graminearum</i>           | 141.06 ± 7.72        | 35-444 | 4.00 ± 0.09         | 21.5 ± 1.39        | 3-69  |
| <i>Helminthosporium sativum</i> | 174.19 ± 4.63        | 37-306 | 3.12 ± 0.06         | 12.9 ± 0.50        | 2-28  |
| <i>Wojnowicia graminis</i>      | 152.29 ± 5.73        | 50-324 | 3.52 ± 0.07         | 15.8 ± 0.71        | 4-38  |
| Internal tip cells              |                      |        |                     |                    |       |
| <i>Ophiobolus graminis</i>      | 24.72 ± 1.70         | 10-127 | 2.16 ± 0.05         | 1.1 ± 0.02         | 1-2   |
| Unknown (sterile)*              | 25.63 ± 1.10         | 9-65   | 2.29 ± 0.07         | 2.2 ± 0.12         | 1-7   |
| <i>Curvularia ramosa</i>        | 88.85 ± 5.59         | 14-308 | 2.64 ± 0.06         | 8.5 ± 0.53         | 1-28  |
| <i>C. spicifera</i>             | 71.86 ± 5.36         | 14-218 | 2.48 ± 0.04         | 6.2 ± 0.50         | 1-27  |
| <i>Fusarium avenaceum</i>       | 41.78 ± 1.98         | 10-104 | 2.64 ± 0.05         | 2.2 ± 0.10         | 1-6   |
| <i>F. culmorum</i>              | 68.59 ± 3.11         | 11-156 | 3.28 ± 0.07         | 5.9 ± 0.33         | 1-16  |
| <i>F. graminearum</i>           | 60.92 ± 3.69         | 16-226 | 3.92 ± 0.09         | 8.6 ± 0.54         | 1-23  |
| <i>Helminthosporium sativum</i> | 60.58 ± 4.43         | 9-184  | 2.80 ± 0.06         | 3.9 ± 0.30         | 1-15  |
| <i>Wojnowicia graminis</i>      | 37.48 ± 1.79         | 10-86  | 2.72 ± 0.06         | 3.4 ± 0.22         | 1-15  |
| Internal non-tip cells          |                      |        |                     |                    |       |
| <i>Ophiobolus graminis</i>      | 33.70 ± 1.94         | 8-111  | 2.56 ± 0.07         | 1.2 ± 0.05         | 1-4   |
| Unknown (sterile)*              | 25.45 ± 0.57         | 9-68   | 2.06 ± 0.04         | 3.8 ± 0.32         | 1-18  |
| <i>Curvularia ramosa</i>        | 47.41 ± 1.50         | 17-94  | 3.28 ± 0.10         | 5.4 ± 0.24         | 1-11  |
| <i>C. spicifera</i>             | 40.60 ± 1.50         | 15-83  | 2.80 ± 0.05         | 4.2 ± 0.21         | 1-12  |
| <i>Fusarium avenaceum</i>       | 42.31 ± 2.22         | 4-114  | 3.20 ± 0.08         | 1.9 ± 0.10         | 1-5   |
| <i>F. culmorum</i>              | 53.18 ± 2.51         | 17-206 | 3.60 ± 0.06         | 5.3 ± 0.28         | 2-13  |
| <i>F. graminearum</i>           | 46.79 ± 2.92         | 11-226 | 5.44 ± 0.11         | 5.6 ± 0.40         | 1-23  |
| <i>Helminthosporium sativum</i> | 30.52 ± 1.06         | 9-84   | 3.52 ± 0.06         | 3.7 ± 0.18         | 1-10  |
| <i>Wojnowicia graminis</i>      | 31.23 ± 1.24         | 13-82  | 3.76 ± 0.07         | 3.4 ± 0.17         | 1-8   |

\* Forms *Ophiobolus*-like runner hyphae on roots.

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