The Dillon Weston glass models of Microfungi

HENRY T. TRIBE

Wolfson College, Cambridge

Dr W. A. R. Dillon Weston was born and received his early education in Bristol, but spent all his professional life in Cambridge. He entered the University in 1919, reading Natural Sciences at St Catherines College, took the Diploma in Agriculture in 1922-3 and was then appointed a provincial advisory mycologist to the Ministry of Agriculture and Fisheries, stationed at the University School of Agriculture. He submitted his PhD, in 1930, on the relative resistance of some wheat varieties to *Tilletia caries*. At that time the Ministry Pathologists were stationed at Universities, to the advantage of both, since teaching and supervision of students were part of their duties. In 1946, as he later put it in when interviewed for the former undergraduate Cambridge University Newspaper *Varsity*, 'my line of work was put under State guidance and I was virtually nationalised'. He was appointed at the same time Principal Plant Pathologist in the Eastern Province of the newly-formed National Agricultural Advisory Service, and moved two miles from the School of Agriculture to Anstey Hall in Trumpington. Tragically, in 1953, Dr Dillon Weston died suddenly of a heart attack on returning from examining crops at Barton Mills. He was only fifty-four.

It was about 1936 that DW, as he was generally known, began to make models in glass, mostly of plant disease fungi. The majority of these he made at home, Howe Farm in Cambridge, and his daughter, Mrs Sally Robey, remembers that they were mainly made at night, between the hours of 10pm and 3am. His tools were simple, pliers and a bunsen burner, and he imported his glass from Czechoslovakia. He became very enthusiastic about his hobby and made very many models, mostly of fungi but sometimes of other subjects. From 1937-1939, he went on summer vacation with his young family to Frinton-on-Sea, taking a holiday house, and his bunsen burner and pliers went with him. Here, each year, he produced a number of delicate pieces which were then carefully transported back to Cambridge by car, a nerve-racking operation for all concerned.

Dr Dillon Weston became progressively busier during the war, and the making of models had to decline. Apart from himself, only Harry Wheeler and, later, Dr Eric Taylor were allowed to handle the models. Models were exhibited to the public on numerous occasions. A special table was built with a glass top and covered with paper from which circles were cut. A model would be placed on each circle and illuminated from below, when they sparkled with great beauty. This display went to the Royal Show and other large events. Dr Eric Taylor, who was Assistant Plant Pathologist during the war years, recorded in 1990 that he acted as guardian to the models at

Fig 1 Dr Dillon Weston with his models in 1952. Photograph by John S. Murray.

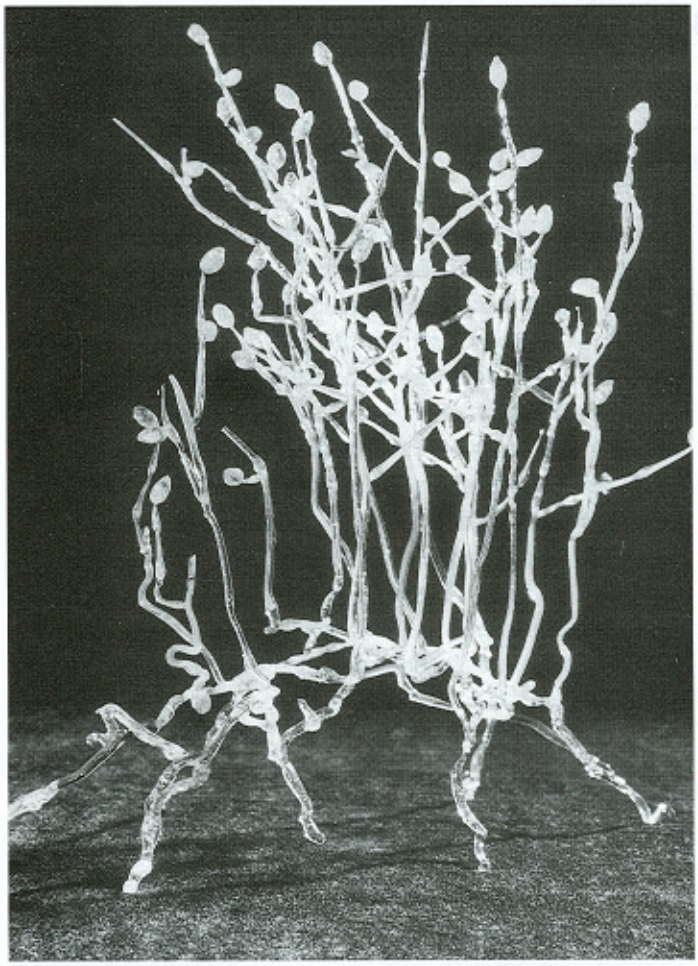

Fig 2 Model of *Phytophthora infestans*. Photo: Frank Bird, Cottenham, Cambridge.

very many displays including one at the Ford Motor Company showroom in Lower Regent Street in London and another at a television broadcast from Alexandra Palace. Some were exhibited at the Annual Conversazione of the Cambridge Natural History Society in 1940, and at the British Mycological Society Jubilee Meeting in 1946. Fifty years later, models were exhibited at the CNHS Vintage Conversazione in 1990 and at the Fungus 100 meeting in the BMS Centenary in 1996. DW had become a member of the BMS in 1923. He published eight short papers in the *Transactions* either by himself or coauthored with R. E. Taylor. Most of his output of papers, about 100 in number, went into more applied or agricultural journals.

The models were photographed and nine of these were reproduced in his book with R. E. Taylor *The Plant in Health and Disease* (Crosby Lockwood, 1948). At Anstey Hall, the models were kept on open shelves in DW's room; some are visible in the background in Fig 1. This is a posed photograph of Dr Dillon Weston holding the glass model of *Bremia* in one hand and a tube of soda glass in the flame of a bunsen burner with the other. Note the rose in his buttonhole: this was an invariable presence at almost any time of the year - he had a collection of roses in his garden. The photograph was reproduced in the *Varsity* article (see Sources, below) and it was later entered in the University Photographic Society Annual Competition and Exhibition of 1953 by John Murray of St John's College, where it was highly commended and awarded a Blue Star.

After Dr Dillon Weston died, the models were given to the University School of Agriculture. Some of them were exhibited in a glass case in the School, but none was labelled. Dr Eric Taylor told me recently that handsome blue labels were used at some exhibitions, but these did not survive into the School of Agriculture. In due course Anna Snowdon, then a plant pathology research student, was asked to arrange for the models to be named. The models were numbered with jewellers tags. One hundred and sixty-eight pieces of scrap paper were cut and numbered, and on each was placed a model. The models were laid out in a laboratory and visited by mycologists and plant pathologists from the School of Agriculture, Botany School and Ministry of Agriculture. Names, to genus, were offered and initialled by one or more of these persons, sixteen of whom took an active part in the exercise. Although many models were in good condition, some were broken or fragmentary. When the School of Agriculture transformed into the Department of Applied Biology in 1970-71 and moved across Downing Street to the Austin Building, the models were exhibited in a glass case built by the previous occupants into the room which became the Applied Biology tea room.

When the Department of Applied Biology was closed in 1989, the models were destined for the Cambridge University Whipple Museum of the History of Science, no more than 100 yards from the Austin Building. The perennial museum problem of lack of space to exhibit applied there however, and the then Curator of the Whipple, Dr Jim Bennett, was more than happy for the models to be let out on long term loan to a reputable museum. The local Haddenham Farm Museum had space in the Cambridgeshire

College of Agriculture and Horticulture at Milton, four miles from Cambridge, and its Curator, Michael Delanoy, was very pleased to accept the models. The author volunteered to move the models to Milton and also to clean them, because they had become covered in dust over the years. Each model was submerged in detergent solution for a period to loosen the dust, which was then removed using an artist's paintbrush. The author prepared an explanatory label for each model's and, also, by comparing direct measurements of the model reproductive structures with those in the literature, estimated the approximate degree of magnification of each one.

The accommodation which housed the farm exhibits, mostly historic machinery, was very soon required by the College, and the exhibits had to be moved. For the models, however, a glass cabinet was custom-built at the College Reception, which was being renovated, and they are there at the present day.

The Dillon Weston models fall into two categories. The majority are of microscopic fungi of plant pathological significance, mostly at a nominal magnification of 400 diameters (Table 1). They were generally made in clear uncoloured glass as is appropriate for hyaline fungi, but clear coloured glass was used where necessary, e.g. for brown resting spores. They range from about 5 to 25cm in height and 5 to 20 cm in the other dimensions and are extremely fragile (Figs 2 - 4). They stand on their mycelium, without a base. The others, mostly less than 10 cm in size, approximate to natural size or are somewhat reduced. These represent fungi such as small ascomycetes, or vegetables undergoing fungal parasitism, or stages in seedling infections. They are made in opaque glass of several colours and are somewhat more robust. Table 1 lists the 47 models presently exhibited. Others are in reserve, many needing attention, and will be listed in a future note.

The magnified models of microfungi are unique. Only one other collection of glass models showing any similarity is known to exist. In the Blaschka collection of Glass Flowers at the Botanical Museum of Harvard University, Cambridge, Massachusetts, there is an exhibit illustrating the complex life histories of fungi and a group of some 64 models showing fungal diseases of fruits of the Rosaceae (see R. E.

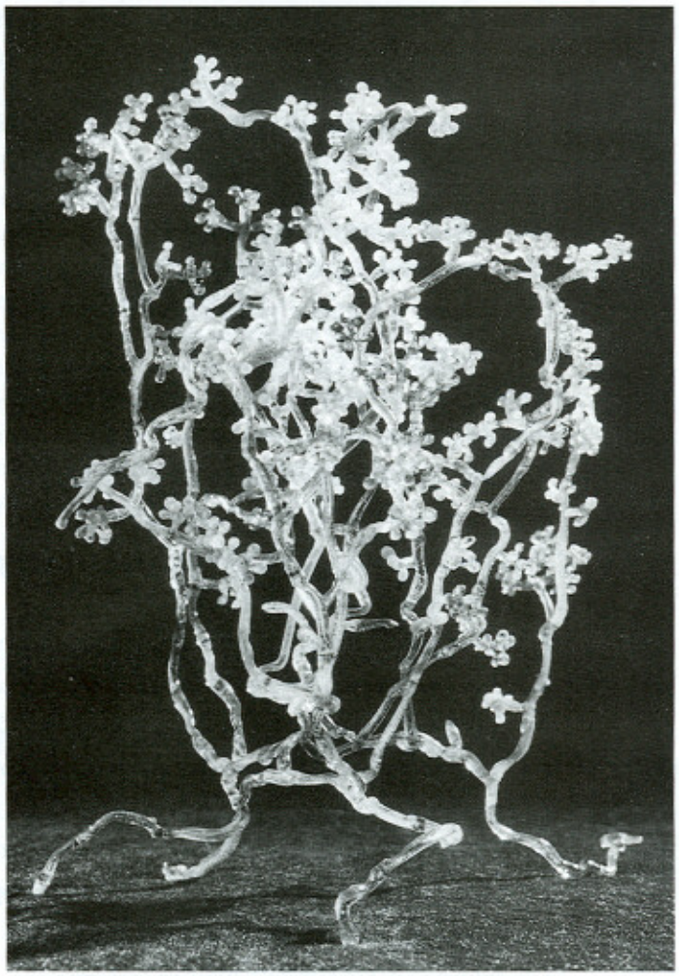

Fig 3 Model of *Botrytis cinerea*. Photo: Frank Bird, Cottenham, Cambridge.

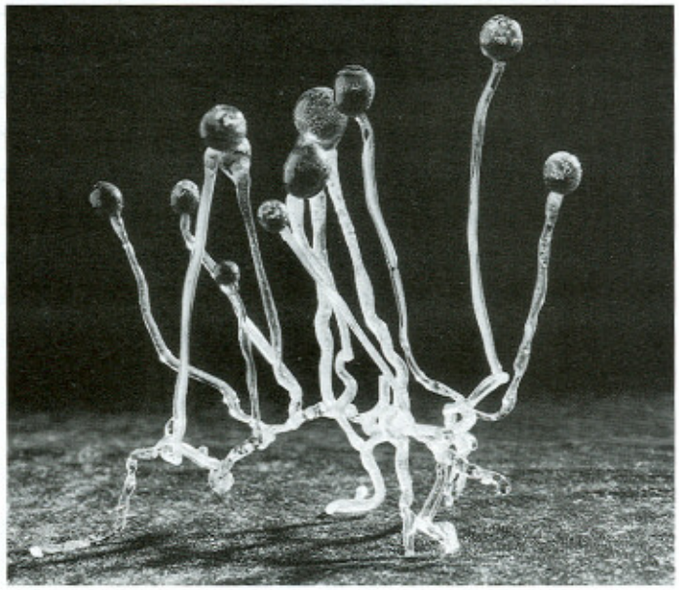

Fig 4 Model of a *Mucor* species. Note spores visible inside sporangia. Photo: Frank Bird, Cottenham, Cambridge.

Table 1 The Dillon Weston glass models presently exhibited at the Cambridgeshire College of Agriculture and Horticulture at Milton, Cambridge.

1. Clear glass models; all x400 except where stated:

Albugo candida. Conidiophores and conidia.
Alternaria brassicae. Conidiophores and conidia.
Alternaria tenuis. Conidiophores and conidia.
Ampelomyces quisqualis, parasitic on *Erysiphe*
asci containing ascospores
basidiospores on basidia
Bremia lactucae. Conidiophores and conidia
**Botrytis cinerea*. Conidiophores and conidia.
**Erysiphe graminis*. Conidiophores and conidia.
**Erysiphe graminis*. Cleistothecium and emerging ascus with ascospores
Fusarium species. Conidiophores and conidia
Helminthosporium species (= *Drechslera* sp.). Conidiophores and conidia
Helminthosporium species (= *Drechslera* sp.). Conidiophores and conidia, x800
Monilia fructigena. Conidiophores and conidia, x200
Mucor species. Sporangiophores and sporangia (containing spores), x100
Mycogone perniciosa. Conidiophores, conidia and resting spores
Penicillium species. Conidiophores and conidia, x500
Penicillium species (nearer *Paecilomyces*). Conidiophores and conidia, x500
Pestalotia species. Conidiophores and conidia
**Phoma* species. Pycnidium and pycnospores
**Phytophthora infestans*. Sporangiophores and sporangia, x200
Phytophthora infestans sporulating on a leaf in section, x200
Pilobolus species. Sporangiophores and sporangia, x40
Pilobolus species. Sporangiophores and sporangia, x20
Puccinia graminis. Part of a sorus of uredospores
Puccinia graminis. Part of a sorus of teleutospores
Puccinia graminis. Aecium with chains of aeciospores
Puccinia graminis. Teleutospore germinating to form basidiospores, x1200
Pythium ultimum. Sporangia and mycelium
Rhizopus species. Sporangiophores and sporangia, x20
Saprolegnia species. Sporangiophores, sporangia containing spores, x20
Tilletia caries. Teleutospore germinating to form sporidia (basidiospores), x600
**Verticillium* species. Conidiophores and conidia

Schultes & W. A. Davis (1982) *The Glass Flowers at Harvard*, 120pp., Dutton, New York).

The author hopes that this article may stimulate both scientists and artists to emulate Dr Dillon Weston's creativity in this field.

Sources and acknowledgments

Dr Dillon Weston's daughter, Mrs Sally Robey, has kindly given her reminiscences of her father's model-making. Dr Eric Taylor contributed memories over the telephone.

Two popular articles have proved useful, one by Clifford Troke in *Picture Post (London)* for May 18, 1946, pp 23-25, entitled 'The microscope fights famine' and the other a Profile: 'Dr Dillon Weston, Mycological modeler', by an interviewer for the former Cambridge University weekly *Varsity* of 22 November 1952, page 4. Obituaries of Dr Dillon Weston were published in *Nature*, 172, 480, 1953, by W. C. Moore and in *The Grower*, 40, 346, 1953, by E. C. Large.

2. Opaque glass models; these are natural size or somewhat reduced

Clavaria species in grass
Claviceps purpurea. Germinating ergots
Cordyceps militaris. Young fruiting bodies emerging from dead caterpillar
Cordyceps militaris. Mature fruiting bodies emerging from dead caterpillar
Geoglossum species in grass
Helicobasidium purpureum. Mycelium on carrot (reduced)
Helicobasidium purpureum. Mycelium on horse radish (reduced)
Lycoperdon species. Puff balls in grass
Plasmodiophora brassicae. Galls on horse radish (reduced)
Sclerotinia sclerotiorum. Mycelium on carrot (reduced)
Sclerotinia trifoliorum. Apothecia in grass
Sclerotium cepivorum. Sclerotia on young onion bulbs (reduced)
Tomato seedlings showing symptoms of damping-off
Xylaria hypoxylon on wood.

* = illustrated in Dillon Weston & Taylor (1948)

A Simple Method for storing and transporting Fungal Cultures

Investigations relating to biodiversity and the search for bioactive compounds of fungi result in a substantial number of cultures to be handled (Monaghan *et al.*, 1995). Maintaining such a large number of fungal cultures in glass tube slants can be cumbersome, especially when other alternatives such as lyophilization are not available. During our studies on fungal endophytes of tropical grasses and forest trees, we isolated many fungi and found that their maintenance was easier when Eppendorf tubes were used for preparing slants.

Eppendorf microcentrifuge tubes are made of polypropylene and are autoclavable. They are provided with attached caps and hence sealing with cotton wool is not necessary. Colourless and graduated tubes of 1.5 ml capacity can be used for preparing slants, with about 0.7 ml of medium added to each tube. The tubes have frosted writing surface for labelling. Polypropylene is transparent to near ultraviolet radiation and hence photoinduction of sporulation may be encouraged. The advantages are that the tubes are light and occupy very little space, compared with the glass tubes routinely used for culturing. Hundreds of them could be stored in a container kept in a refrigerator. The attached cap prevents spilling of mineral oil when cultures are topped with it to prevent drying (Smith & Onions, 1994). The disadvantage of this method is the limited growth of the fungus due to a small surface area of agar slope. However, this is overcome by maintaining multiple cultures of a single isolate.

References

Smith, D. & Onions, A. H. S. (1994) *The preservation and maintenance of living fungi*. CAB International, Wallingford, UK.

Monaghan, R. L., Polishook, J. D., Pecore, V. J., Bills, G. F., Nallin-Omstead, M. & Streicher, S. L. (1995) Discovery of novel secondary metabolites from fungi - is it really a random walk through a random forest? *Canadian Journal of Botany* **73**: 925 - 931.

T. S. Suryanarayanan & V. Kumaresan
Department of Botany,
Ramakrishna Mission Vivekananda College,
Chennai 600 004, India