To examine the possibility of staggered germination, oospores sown on water agar with furfural/ seedlings were removed after 3–4 days from the agar surface, rinsed 8–10 times in sterile distilled water, and then transferred to petri dishes containing water agar with furfural/seedlings.

In the test for staggered germination, up to 2% of the oospores germinated when they were plated for the second time on water agar with furfural/ seedlings.

Non-fluorescent but non-germinated oospores of *P. sorghi* are in a state of dormancy. The occurrence of staggered germination of oospores confirms this view. Kaveriappa[8] also suggested that all the viable oospores do not germinate simultaneously.

Wu and Warren[6] observed natural autofluorescence in the cytoplasm of conidia, pycnidiospores, ascospores and mycelia of 12 species of fungi incubated on agar plates, soil or in suspension. The authors concluded that natural autofluorescence in fungal materials indicated their death, and found a relationship between autofluorescence and viability. The same procedure is useful for determining viability of the oospores of *P. sorghi*. The technique may be suitable for determining viability of other downy mildew fungi.

We thank Dr K. Gopinath, Department of Zoology, for his valuable suggestions. Two of the authors (PSBG and NSD) acknowledge financial assistance from CSIR and UGC, New Delhi, respectively.

7 December 1988

1. Renfro, B. L. and Bhat, S. S., In: *The Downy Mildews*, (ed.) D. M. Spencer, Academic Press, London, 1981, p. 636.
2. Williams, R. J., In: *Advances in Plant Pathology*, (eds) D. S. Ingram and P. H. Williams, Academic Press, London, 1984, p. 303.
3. Pratt, R. G., *Phytopathology*, 1978, 68, 1606.
4. Gowda, P. S. B. and Bhat, S. S., *Trans. Br. Mycol. Soc.*, 1986, 87, 653.
5. Anonymous, In: *Strategies for Control of Graminaceous Downy Mildew*, (eds) R. D. Durbin, R. A. Frederiksen, A. Kelman and B. L. Renfro, The Rockefeller Foundation, USA, 1980, p. 63.
6. Wu, C. H. and Warren, H. L., *Mycologia*, 1984, 76, 1049.
7. French, R. C. and Schmitt, C. G., *Phytopathology*, 1980, 70, 877.
8. Kaveriappa, K. M., Ph.D. thesis, University of Mysore, 1973, p. 171.

IN VITRO GROWTH OF SOME FUNGI ISOLATED FROM WHEAT PHYLLOPLANE IN RELATION TO SO_2 TREATMENT

A. K. SINGH and BHARAT RAI
Department of Botany, Banaras Hindu University, Varanasi 221 005, India

SULPHUR dioxide adversely affects microbes on aerial plant surfaces and suppresses the pathogenicity of many plant pathogens[1]. A number of field observations have been made on the effects of SO_2 on saprophytic and parasitic micro-organisms with special reference to diseases of plants grown in SO_2-polluted localities. Singh[2] observed that the population of some test fungi inoculated on the phylloplane of wheat decreased on prolonged exposure to SO_2 at $2669 \pm 105\ \mu g/m^3$ concentration. However, little is known about effects of SO_2 on growth of phylloplane fungi. The present communication deals with effects of SO_2 on growth of some phylloplane fungi *in vitro*.

The experimental system was designed according to the method described by Magan and Lacey[3]. The following fungi, isolated from the phylloplane of wheat, were selected for the study: *Alternaria alternata*, *Aspergillus flavus*, *A. niger*, *Cladosporium cladosporioides*, *Curvularia lunata*, *Drechslera australiensis*, *Epicoccum purpurascens*, *Fusarium oxysporum*, *Penicillium chrysogenum* and *P. citrinum*. Mycelial blocks (5 mm each) cut from actively growing margins of colonies of the fungi were transferred separately onto petri plates, in triplicate, containing 20 ml of potato dextrose agar (PDA) medium. The lids of the plates were raised slightly using sterile paper clips, and the plates containing the mycelial blocks were placed in a fumigation chamber. Dishes of glycerol/water were placed in the bottom of the chamber to provide required humidity. The petri plates were exposed to sterilized air–SO_2 mixture for 10, 30 and 60 min, with the concentration of SO_2 adjusted to $2669 \pm 105\ \mu g/m^3$ air. Plates exposed to gas-free air served as control. The plates were incubated at $24 \pm 2°C$ after the treatment and growth was measured after 24 h of incubation. Percentage growth stimulation/inhibition was cal-

Table 1 *Effect of sulphur dioxide (2669 ± 105 μg/m³), expressed as per cent inhibition/stimulation of growth, on some phylloplane fungi*

Species	Exposure time (min)		
	10	30	60
A. alternata (Fr.) Keissler	−9.25 ± 0.58*	−15.13 ± 0.33**	−22.68 ± 0.67**
A. flavus Link ex Fries	+2.09 ± 0.67	− 4.20 ± 0.33*	− 8.39 ± 0.33**
A. niger van Tiegham	+4.41 ± 0.58*	− 1.96 ± 0.33	−10.78 ± 0.67**
C. cladosporioides (Fresen.) de Vries	−6.05 ± 0.33	−13.64 ± 0.58**	−19.69 ± 0.88*
C. lunata (Wakker) Boedijan	−1.76 ± 0.33	− 5.29 ± 0.67*	−10.60 ± 0.67**
D. australiensis (Bugnicourt) Subram. and Jain	−3.00 ± 0.67	−10.45 ± 1.15*	−17.90 ± 0.67**
E. purpurascens Ehrenb. ex Schlecht.	+7.79 ± 0.33*	− 5.22 ± 0.33	− 7.79 ± 0.33*
F. oxysporum Schlechtendahl	+1.74 ± 0.33	− 3.05 ± 0.58*	− 7.86 ± 0.38*
P. chrysogenum Thom	−13.70 ± 0.33*	−23.52 ± 0.58*	−29.41 ± 0.33**
P. citrinum Thom	− 7.71 ± 0.58	−15.41 ± 0.33**	−19.94 ± 0.33**

All values are mean ± SE.
+, Stimulation; −, inhibition.
*t significant at $P = 0.05$; **t significant at $P = 0.01$.

culated as [Per cent stimulation/inhibition = (Difference in colony diameter (mm) of test species between control and treated/colony diameter of control) × 100].

Colony growth of all the test fungi was significantly ($P = 0.05$) inhibited on prolonged SO_2 exposure (table 1). Growth of *A. alternata, C. cladosporioides, C. lunata, D. australiensis, P. chrysogenum* and *P. citrinum* was inhibited by all three durations of exposure, and the inhibition was more significant ($P = 0.01$) for the 60 min exposure (table 1). The maximum inhibition was of *P. chrysogenum* and the minimum, *E. purpurascens*, for the longest exposure time. *A. flavus, A. niger, E. purpurascens* and *F. oxysporum* showed growth stimulation at the shortest exposure time (10 min). Per cent growth inhibition of all the test fungi increased with increasing exposure time. In general, the order of inhibitory effect of SO_2 was *P. chrysogenum > A. alternata > P. citrinum > C. cladosporioides > D. australiensis > A. niger > C. lunata > A. flavus > F. oxysporum > E. purpurascens* (table 1).

It is reported that SO_2 inactivates the sulphhydryl groups of enzymes[4]. Inhibition of acid phosphatase activity by SO_2 has been reported[5]. The increased colony growth of some of the test fungi after short exposure may be due to their resistance and ability to neutralize the toxic effects of SO_2 or because of their ability to use SO_2 as nutrient source to a certain extent.

Financial help provided by CSIR, New Delhi, is thankfully acknowledged.

26 September 1988; Revised 6 January 1989

1. Heagle, A. S., *Annu. Rev. Phytopathol.*, 1973, 11, 365.
2. Singh, A. K., Doctoral thesis, BHU, Varanasi, 1988.
3. Magan, N. and Lacey, J., *Trans. Br. Mycol. Soc.*, 1984, 82, 305.
4. Saunders, P. J. W., *Ann. Appl. Biol.*, 1966, 58, 103.
5. Krieg, W., *Angew Bot.*, 1981, 55, 93.

A NEW RECORD OF DIPLOID CYTOTYPE OF *SCHIZANDRA GRANDIFLORA* HOOK. F. & THOMS. FROM INDIA

P. S. SANDHU*, LATE S. K. MANN and MANJU KAPIL*
Department of Bio-Sciences, Himachal Pradesh University, Shimla 171 005, India
**Present address: Department of Forest Biology and Tree Improvement, Dr Y. S. Parmar University of Horticulture and Forestry, Solan 173 230, India*

SCHIZANDRA GRANDIFLORA (family Schizandraceae), common in dense forests, is a large, glabrous, woody climber with unisexual, white, fragrant axillary flowers. Of the six species of *Schizandra* reported from India[1], *S. grandiflora* is the only species found in the Western Himalaya between 1900 and 3100 m