been recently demonstrated that application of certain herbicides also stimulate *Azospirillum* population in soils[5]. These studies also suggest that benomyl besides fungicidal in its effect also stimulates certain beneficial microorganisms involved in nitrog n fixation in soils under flooded conditions.

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Laboratory of Soil Microbiology,
Central Rice Research Institute,
Cuttack 753 006 (Orissa),
India, *April* 27, 1978.

P. B. B. N. CHARYULU.
V. RAJARAMAMOHAN RAO.

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A NEW RECORD OF PROTOMYCES MACROSPORUS UNG. ON *FOENICULUM VULGARE* L.

DURING a survey of diseases of Bareilly region, the authors observed for the first time the galls on the stems of *Foeniculum vulgare* in March 1978. The pathogen was identified as *Protomyces macrosporus* Ung. Characteristic tumor-like swellings initially observed on stem and leaf sheaths, subsequently spread on the peduncle and inflorescence. Peduncles were hypertrophied and curved. Some of them did not bear flowers due to cessation of growth while others had fewer flowers as compared to normal ones. In later stages seeds also got infected and hypertrophied (Fig. 1–A, B and C). Stem galls were about 3 mm broad and upto 20–25 mm long and were confined to upper region of the stem.

It was intersting to note that the disease was confined only to the plants growing among heavily infected coriander fields. The plants away from the coriander fields showed rare infection. The disease flared up after a brief spell of rain.

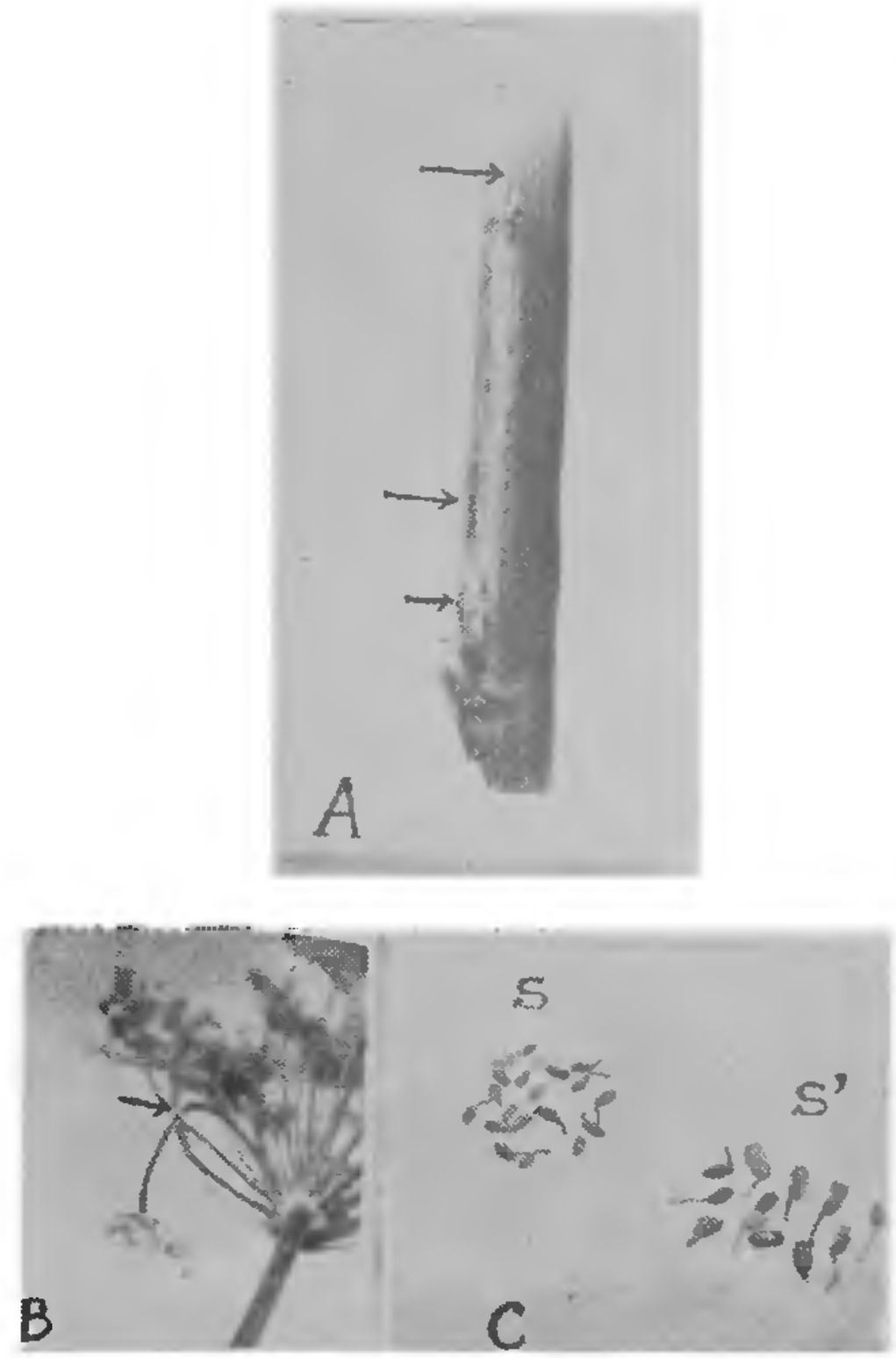

FIG. 1. Symptoms of *Protomyces macrosporus* Ung. on *Foeniculum vulgare* L. A—Tumor-like swellings on the stem (marked). B—Hypertrophied and curved peduncle (marked). C—Normal (S) and hypertrophied infected (S') seeds.

Microscopic investigation revealed the occurrence of chlamydospores and mycelium in the cortex, phloem, xylem parenchyma and pith of the host. The fungus was restricted to the tumors. Mycelium was intercellular, irregularly branched, closely septate, 10 to 12·5 μ broad; mature chlamydospores golden yellow, thick walled, three layered, attaining a diameter of 40 to 65 μ.

Foeniculum vulgare L. (vern. saunf, fam. Umbelliferae) is widely cultivated for its uses as medicine, spices and masticatories. The infection in floral parts and seeds severely damages the quality and yield. A perusal of available literature revealed that it is a first record of *Protomyces macrosporus* on *Foeniculum vulgare* from India and abroad. The report of Dr. Sivanesan of CMI, Kew, England, has confirmed that "*Protomyces macrosporus* Ung. has not been reported on *Foeniculum* before". The only host record of this fungus, so far available in India,

is *Coriandrum sativum* L. (Gupta,[1]; Gupta and Neergaard[2]; Gupta and Sinha[3]).

The specimen has been deposited at CMI, Kew, England (IMI-226784) and Department of Mycology and Plant Pathology, Bareilly College, Bareilly.

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Department of Botany, Bareilly College, Bareilly 243 001, *April* 27, 1978.

P. B. AWASTHI.
U. S. MISHRA.
B. N. PANDE.

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RECOVERY FROM DAMAGES INDUCED BY ULTRAVIOLET IRRADIATION IN *AZOTOBACTER VINELANDII* OP

Introduction

IT is presently an established fact, that living systems *invariably possess some* error correcting mechanisms to repair the damages in DNA produced by ultraviolet irradiation. Though extensive studies in these respects have been done in many organisms[1, 2], little is known in *Azotobacter* sp. This organism is unusually stable with respect to mutation induction and one of the reasons for this has been visualised to be due to the presence of an unusual DNA repair apparatus[3]. Nevertheless the situation at present is far from clear understanding. Goucher *et al.*[4] reported that photoreactivation is absent in *A. vinelandii* OP though it is present in other species of the same genus. Vela and Peterson[5] showed that the cysts of *A. vinelandii* 12837 possessed photoreactivation mechanism. Ahmad and Venkataraman[6] showed that liquid holding recovery (LHR) is absent in 6 strains of *A. chroococcum*. The present investigation shows that *A. vinelandii* OP also does not show liquid holding recovery in dark (dark repair) in the temperature range of 10° C to 38° C. However, liquid holding in the dark of ultraviolet treated suspension at elevated temperatures *i.e.*, from 40° to 45° C, showed significant increase in survival, pointing to the presence of a dark repair phenomenon in *A. vinelandii* OP, operative only at high temperatures.

Materials and Methods

Strain: *Azotobacter vinelandii* OP.

Medium: Burk's nitrogen free broth and agar was used throughout the experiment.

Radiation exposure: Log phase culture of *A. vinelandii* OP was centrifuged, washed twice and then resuspended in 0·1 M phosphate buffer, pH 7. 0·2 ml aliquot of this suspension containing about 10^7 cells per ml was transferred in petridishes (diameter 5 cm) and then irradiated with a Philips 15 Watt germicidal lamp for 40 seconds and 60 seconds with constant shaking of the suspension, operated by a mechanical vibrator. The energy output of the germicidal lamp was measured by a UV dosimeter (obtained from Dr. R. Latajaret of the Institute of Radium, Paris, France) and was found to be 100 ergs/mm²/sec. at a distance of 27 cm from the lamp.

After irradiation, both the irradiated and unirradiated suspensions were immediately diluted and plated on Burk's nitrogen free minimal agar to serve as control. For dark repair study at different time intervals, both the irradiated and unirradiated suspensions in 0·1 M phosphate buffer (pH 7) were wrapped with black papers and incubated at 30° C. At intervals of 1, 2, 4 and 6 hours, aliquots were withdrawn, diluted and plated as in control. The plates were incubated for 72 hours at 30° C. Survival percentages were then determined after counting the colonies developed on the plates. The entire experiment was carried out in a dark room illuminated with a 25 Watt amber coloured bulb to avoid photoreactivation of the UV-treated cells.

Temperature effect : To study temperature effect on dark repair system the same experimental procedure was followed except that, after performing the control set, the irradiated and unirradiated suspensions were kept at different temperatures *viz.*, 10°, 20°, 30°, 38°, 40°, 42°, 45° and 50° C for 2 hours time.

Result

No significant increase in survival was noticed in control and in bacterial suspensions subjected to liquid holding in dark for 1 to 6 hours at 30° C (Table I). Rather there was a slight decrease in the number of surviving cells as evident from 4 hour onwards retention in phosphate buffer in the dark. This decrease may be interpreted as due to fasting of the cells or due to osmotic disbalance.

Temperature effect : Increase in temperature from 0° C to 38° C was found to cause practically no change in survival. At 40° to 45° C a significant increase in survival was found (Table II).

Discussion

Results indicate that liquid holding of the ultraviolet treated suspensions in dark did not result in increased survival in *A. vinelandii* OP in the temperature range from 10° to 38° C. At 40° to 45° C however an increase in survival percentage was noticed. On liquid holding at 42° C and above in dark, it was