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.

The authors are thankful to Dr. Sivanesan of CMI, Kew, England, for confirming the identification of the pathogen and to post-graduate students for the help rendered during survey.

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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

TABLE I

Liquid holding recovery after UV treatment at different time periods

Time in hours of liquid holding (in dark) at 30°C	Percent survival — UV dose	
	4000 ergs/ mm²/sec.	6000 ergs mm²/sec.
0 hr.	0·334	0·00155
1 hr.	0·336	0·00153
2 hrs.	0·333	0·00159
4 hrs.	0·312	0·00146
6 hrs.	0·286	0·00139

TABLE II

Effect of temperature on liquid holding recovery

Time in hrs. of liquid holding (in dark)	Temperature of liquid holding	Per cent survival — UV dose	
		4000 ergs/ mm²/sec.	600 ergs/ mm²/sec.
0 hr.	..	0·334	0·00155
2 hrs.	10° C	0·330	0·00153
2 hrs.	20° C	0·333	0·00155
2 hrs.	30° C	0·333	0·00156
2 hrs.	38° C	0·336	0·00156
2 hrs.	40° C	0·450	0·00170
2 hrs.	42° C	0·665	0·00308
2 hrs.	45° C	9·000	0·03875
2 hrs.	50° C	Nearly all cells die	

observed that the total number of bacteria in the untreated suspension had been reduced to a considerable extent, while in the ultraviolet treated suspension the number was not reduced to a similar extent. This obviously caused a relatively higher percentage of survival. Further, it was interesting to note that, at 45° C the survival percentage was consistently increased twenty-five fold of the initial survival rate, although at 42° C only two fold increase was noticed. At still higher temperature, *i.e.*, by liquid holding at 50° C for 2 hours time, it was found that none of the cells could survive and so the question of heat reactivation of UV damaged cells in this case could not arise (Table II). This phenomenon is in sharp contrast to the normal liquid holding recovery found in most other organisms, where LHR occurs maximally at room temperature.

The present finding may be best explained as a kind of "thermal reactivation" operative in dark and without an energy source. Here the reactivation may be due to (1) increased decay rate of labile photoproducts at elevated temperatures or (2) due to the presence of some other mode of repair operative at 40° C or above. The exact mechanism of this recovery is however not yet clear. Experiments to elucidate the mechanism concerned are now in progress.

The authors express their gratitude to Professor A. K. Sharma, Head of the Department of Botany, University of Calcutta, for encouragement and providing facilities to carry on this work. They are thankful to UGC for financial assistance to one of them (S. M.).

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SPOROSTATIC ACTIVITY OF VOLATILE CULTURE METABOLITE(S) OF *ASPERGILLUS FLAVUS*

VOLATILE sporostatic activity of culture metabolite(s) of *Aspergillus flavus* was demonstrated against the macroconidia of *Fusarium solani f. coeruleum* a rot causing pathogen. Delaying as well as inhibition of spore germination was found, due to the volatile metabolite(s).

Introduction

The failure of spores to germinate in contact with parent cultures or of other fungi is well known in a wide range of fungi. Biologically active fungal volatile metabolites (Dick and Hutchinson[1]; Hora and Baker[2])