It might be seen from Table I that the reaction of the host was influenced by mixing the inocula of virulent and less virulent isolates. The virulent isolate E produced the longest lesion while the less virulent isolate F produced the shortest lesion. The lesion length was significantly reduced in direct proportion to the ratio of virulent and less virulent cells in the inoculum. There was no significant difference in lesion length between 25 : 75 and 0 : 100 proportion of mixing virulent to less virulent cells.

Similar results have been reported with inoculation of mixture of isolates of *Pseudomonas solanacearum* by Averre III and Kelman,[1] and Buddenhagen.[2]

It is clear from this study that the disease intensity can be influenced to a great extent by mixing the isolates possessing different degrees of virulence. Therefore, the most virulent isolate occurring in a region has to be used in breeding for disease resistance.

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STUDIES ON DARKENING OF WHOLE WHEAT MEAL DOUGH

IN India, most of the wheat is consumed in the form of *Chapatties*, a kind of un-leavened pan-baked bread. For this purpose, wheat grains are ground to a whole wheat meal. Until recently, a number of varieties were available in this country which were acceptable to the consumer for *Chapati*-making. This acceptability is based on amber-coloured grains, creamish flour, sweetness, palatability and good puffing characteristics of *Chapatties*.[1]

Recent introduction of Mexican germ plasm under *High Yielding Varieties Programme*[2] has resulted in the availability to the consumer of wheat grains of inferior quality from the view-point of *Chapati*-making. Studies have been initiated in this laboratory to investigate the causative factors which lead to the browning of the whole wheat meal dough, commonly referred to as *'atta'*, early onset of fermentation, gluten characteristics which lead to leatheriness of *Chapatties* on storage. In this communication, biochemical factors responsible for darkening of whole wheat meal dough of Mexican varieties are reported.

Experiments were conducted with three Mexican varieties, *viz.*, Lerma rojo, Sonora 64 and Sonalika and three Indian varieties, *viz.*, Pb. C 273, Pb. C 591 and Pb. C. 281. The grains were ground in Labconco Mill to pass through 40 mesh. Various milling fractions were obtained by using a micro-mill following Seaborg and Barmore's method.[3] Preliminary findings showed that whole wheat meal dough of Mexican varieties turns brown and subsequently dark in colour within a period of 6–8 hours when kept at 30–32° C. while the dough of Indian varieties remains creamish, *viz.*, retains its original colour (*see* Fig. 1).

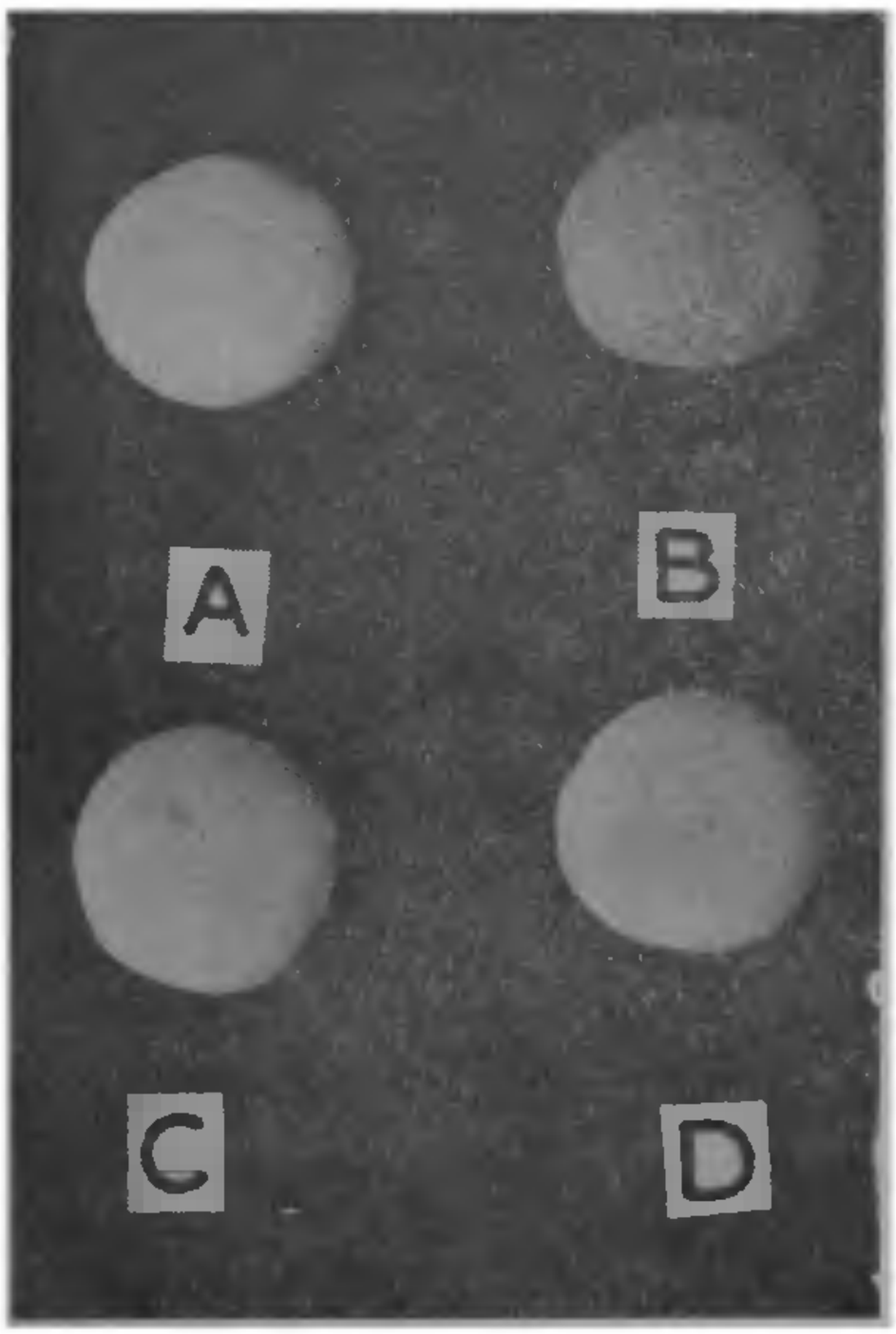

FIG. 1. Whole meal dough colour. Mexican wheat variety, *viz.*, Sonalika. A—At 0 hour. B—After 8 hours keeping at 32 ± 2° C. Indian wheat variety, *viz.*, Pb. C 281. C—At 0 hour. D—After 8 hours keeping at 32 ± 2° C.

To elucidate the nature of the browning reaction, wheat grains of Mexican varieties, prior to preparation of whole meal were soaked

in distilled water for two hours, immersed in boiling water for thirty minutes and then dried in an oven at 100° C. It was observed that this treatment results in cessation of browning, suggesting thereby that certain enzymatic reactions are responsible for this characteristic.

Tyrosinase activity and subsequent polymerisation of quinones to melanin is known to be responsible for the browning of various biological materials.[4,5] To study the role of tyrosinase, doughs of Mexican varieties were prepared in 0·1% sodium diethyl dithiocarbamate which acts as a chelating agent for copper. Observations after 6–8 hours showed that doughs retain their original colour. This suggests the possible involvement of tyrosinase activity in darkening reaction.

Addition of various substrates, *viz.*, L-tyrosine, phenol, catechol and DL-dihydroxy phenylalanine results in darkening of the doughs of Mexican varieties within 30 minutes while the dough of Indian varieties remained creamish in colour.

For assay of tyrosinase activity, colorimetric method of Horowitz *et al.*[6] was followed using DL-dihydroxy phenylalanine as substrate. Increase in O.D. per mg. protein is given in Table I. Tyrosinase activity is high in the Mexican varieties as compared to that of Indian wheats studied. Subsequently, tyrosinase activity was determined in the various milling fractions so as to locate the enzyme. The study shows that major amount of the enzyme activity is detectable in the bran. The other two fractions, *viz.*, shorts and white flour show little or no activity (Table I).

TABLE I

Tyrosinase activity (Change in O.D./mg. protein) in whole meal and various milling fractions of Mexican and Indian wheat varieties. DL-DOPA was used as a substrate[6]

Varieties	Tyrosinase activity			
	Whole meal	Bran	Shorts	White flour
Lerma rojo ..	0·10	0·35	0·02	0·00
Sonalika ..	0·10	0·40	0·01	0·02
Sonora'64 ..	0·12	0·36	0·01	0·01
Pb. C 273 ..	0·02	0·12	0·01	0·02
Pb. C 281 ..	0·03	0·13	0·00	0·02
Pb. C 591 ..	0·02	0·16	0·01	0·00

From the above findings one can conclude that tyrosinase activity and subsequent formation of melanin are responsible for the darkening of the whole wheat meal dough of Mexican varieties.

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A NEW SPECIES OF *CLADOSPORIUM* FROM THE SAND DUNES OF WESTERN RAJASTHAN, INDIA

THE rhizosphere microflora of ten different plants which were found all the year round on the sand dunes of Masuria, Jodhpur, was studied. The rhizosphere fungal flora associated with the plants was determined at regular intervals of one month. The fungi were isolated by the soil dilution and plate count method.[11] During these studies colonies of *Cladosporium* were isolated from the rhizosphere region of *Acacia nilotica* (Linn.) Del. sub. sps. *indica* (Benth.) Brenan. The conidial morphology of the isolate was compared with all the known species of *Cladosporium*. The culture was sent to C.M.I., Kew, where it was examined by Dr. Ellis, but it could not be assigned to any specific position. Dr. Ellis wrote "This *Cladosporium* is quite new to our herbarium and may well be an undescribed species".

The present isolate shows a pronounced difference from all other species of *Cladosporium* in its conidial morphology. The conidia of the present isolate are usually three- to four-celled, rarely they are one-to two-celled. The size and shape of the conidia are also quite different from all the known species of the genus (Saccardo,[9] Dale,[6] Waksman,[12] Abbot,[1] Bisby *et al.*,[3] Chaudhuri,[5] Galloway,[8] Subramanian[10] and Arya and Panwar[2]). The isolate is, therefore, being designated as *Cladosporium acaciæ* sp. nov.