SUMMARY

Studies on Alternaria blight of some oil-seed crucifers were carried out with a view to focus attention on various aspects of the disease and the pathogen, *Alternaria brassicae* (Berk.) Sacc. with special reference to conditions prevailing in the plains of Uttar Pradesh (India).

Seedlings of rapeseed and mustard attacked by the pathogen developed damping-off. The symptoms of disease became visible with the emergence of seedlings on the leaves. Spots were circular, zonate, light brown to dark brown with concentric rings, sometimes coalescing to each other. The spots were oblong or linear and shunken on the midrib of leaves where as they were in the form of lesions, circular, dark brown and black on the pods. As the disease progressed, several lesions coalesced and tended to cover large areas of pods resulting in their death. Several elongated lesions were also observed on stems which developed black sooty colour as they enlarged.

On the basis of pathogenicity and morphology, the fungus responsible for causing the blight of rapeseed and mustard was identified as *Alternaria brassicae*.

The pathogen was grown on various solid and liquid states of natural and synthetic media. Amongst liquid media,
Kirchoff's medium supported highest mycelial growth as well as excellent sporulation. It was followed by Richard's medium. Oat-meal medium was the poorest. Potato dextrose agar was best amongst solid media. It was followed by Richard's agar medium. Cultural and morphological characters of the pathogen were examined and variations in the colony characters of the pathogen were invariably observed on different media employed during present investigation. Kirchoff's medium was selected as liquid basal medium and potato dextrose agar as solid basal medium.

The growth of the pathogen occurred at a range of temperature from 5 to 30°C. The optimum range was found as 23 to 25°C. The best mycelial growth was, however, recorded at 23°C. Sporulation was also excellent at 23 to 25°C; good at 21°C; fair at 15° and 28°C and it was poor at 10 and 30°C. At 5°C, there was no sporulation.

Exposure to alternate light and darkness was found to be more favourable as compared to complete darkness or continuous light for growth and sporulation of the pathogen.

The optimum range of relative humidity for mycelial growth and sporulation of the pathogen was found as 95-100 per cent. At 100 per cent relative humidity, the growth and sporulation was best. At 95 per cent relative humidity, sporulation was also excellent. At 30 per cent, growth occurred but sporulation was nil.
The pathogen could grow on a wide range of pH varying from 2.9 to 9.2, producing maximum mycelial growth at pH 6.5 and minimum at pH 2.9. Sporulation was also excellent at pH 6.5. Generally good mycelial growth was correlated with excellent sporulation. At pH 2.9 and 9.2, no sporulation occurred.

Out of eleven carbon sources tested, starch was found as the best source followed by cane sugar, sucrose, D-glucose dextrin, D-galactose, D-mannitol, lactose, sorbitol and maltose. Minimum mycelial growth was on glycerol. Starch, cane sugar and sucrose encountered excellent sporulation while D-glucose, dextrin, D-galactose and lactose induced good sporulation. In the rest, it was poor to fair.

Various nitrogen sources were also tried to ascertain their relative effectiveness. Out of 14 sources tested, maximum growth of the pathogen occurred on peptone closely followed by sodium nitrate and potassium nitrate. Ammonium molybdate supported the poorest growth. The three best compounds named above for vegetative growth also induced excellent sporulation. Other sources induced good to poor sporulation. It was, however, nil on thio-urea.

Out of nine amino acids tested, only four namely DL-threonine, DL-valine, L-cystine and L-proline induced better growth than in control. Other were found to be inhibitory both for growth and sporulation.
Amongst the phosphorus sources tested, dibasic potassium phosphate yielded maximum growth of the pathogen followed by potassium dihydrogen phosphate and tribasic potassium phosphate. The sporulation was, however, uniformly excellent on all these sources. Minimum growth and the poorest sporulation occurred on potassium phosphate. Other phosphorus sources also proved superior over control but they varied in their relative efficacy.

Addition of sulphur exogenously irrespective of the kind of the source significantly improved the growth and sporulation of A. brassicace. Response, however, varied. Potassium sulphate as well as magnesium sulphate proved to be the best amongst all the thirteen compounds tested whereas manganese sulphate effected the minimum growth. Sporulation, in general, was positively correlated with the extent of mycelial growth.

Amongst the ten vitamins tried, only four viz., biotin, nicotinic acid, ascorbic acid and thiamine encouraged the vegetative growth. The role of rest of the vitamins proved to be inhibitory both for vegetative and reproductive growth of the pathogen.

Response to seven growth regulators was almost similar to those of vitamins. Growth was positively influenced by the addition of Beta-indol butyric acid and 2,4-dichlorophenoxy acetic acid. The effect of remaining growth regulators was found to be inhibitory.
Spore were found germinating within four hours of their placement in water as well as in the basal liquid medium. Germ tubes were observed emerging from each cell and even from the beak cells. Spores germination occurred at all the temperature levels tried i.e. from 5-30°C. The optimum range, however, varied between 21 and 25°C, the best being 23°C.

Conidia of the pathogen though germinated even at 84 per cent relative humidity, germination was found maximum at 100 per cent relative humidity followed by 97 per cent.

Out of eleven carbon sources tested, starch proved to be the best carbon source for the spore germination of the pathogen. It was followed by cane sugar, sucrose, D-glucose, dextrin and D-galactose. Remaining ones were relatively inferior in their performance. Glycerol was almost similar to the control giving poorest results.

Out of 14 nitrogen sources tested, highest spore germination was secured in the medium containing peptone followed by sodium nitrate. The lowest germination was obtained on the medium containing ammonium molybdate.

Like growth and sporulation of the pathogen, spore germination was also adversely affected by the majority of the vitamins. But biotin, nicotinic acid, and ascorbic acid did not suppress spore germination. Other vitamins were inhibitory for spore germination.
Response of the pathogen to growth regulators also exhibited a trend similar to that observed for vitamins. Even bare medium, devoid of any growth regulator, accounted for as high as 89.75 per cent germination. Only two growth regulators i.e., Beta-indol butyric acid and Alpha-napthalene acetic acid did not suppress spore germination. Rest of the growth regulators checked the germination remarkably.

The pathogen was found viable both in plant debris and in the seeds of diseased plants for more than 12 months in virulent form and thus diseased plant debris and diseased seeds were found as serving the primary sources of inoculum. Internally seed-borne nature of the pathogen was established. Secondary spread of the disease was observed to be caused by air-borne spores produced on the spots on the aerial parts of the plants.

The pathogen could attack the plants of any age but susceptibility decreased with the age; most vulnerable age being the 10 day-old plants. Thenafter, the susceptibility gradually tended to decline.

It was ascertained that 48 h of incubation in moist chamber was necessary for disease development. An incubation for 72 h was best for the maximum disease development. Incubation for 96 h resulted in maximum infection also but plant leaves became yellowish.
Environmental factors like humidity and temperature were observed to have profound influence on the disease intensity. The period between first fortnight of December 1985 to second fortnight of January 1986, during which temperature ranged between 5.73-9.40°C (minimum), 20.13-24.90°C (maximum) and relative humidity fluctuated within a limit of 30.12-47.75 per cent (minimum), 77.60-88.56 per cent (maximum), the intensity of disease was observed to be highest. Higher or lower limits proved relatively less favourable for the outbreak of Alternaria blight.

Disease was found to affect oil content of the seeds severely. Diseased seeds from infected plants yielded less oil as compared to healthy ones. There was, however, some varietal variation. Heaviest loss (35.97 per cent) was recorded in "Yellow sarson" cv. T-42 while cv. Kranti suffered the minimum (14.12 per cent). On the other hand, disease tended to increase the protein content. Highest gain of 12.82 per cent was recorded in the cv. Varuna while in other cultivars it was restricted between 5.87-12.04 per cent.

Host range studies revealed that plants belonging to Cruciferae family, particularly those of genus Brassica were commonly attacked by A. brassicae. Besides these plants Chenopodium album, Convolvulus arvensis and Anagallis arvensis were also attacked by the pathogen.
Several cultures/varieties of rapeseed and mustard were observed for their resistance under natural conditions in fields. Some of the cultures/varieties of 'Lahia', 'Toria' and 'Rai' were found free, resistant or moderately resistant to Alternaria blight. But all the cultures/varieties found free, resistant and moderately resistant under natural conditions became susceptible or highly susceptible under artificial inoculations.

Dithane M-45, Dithane Z-78, Ziram, Difolatan-80, Blitox-50, Thiram, Brestan-60 and Benlate proved most effective in vitro studies as they completely inhibited fungal development in the culture.

The performance of Benlate as seed dresser was best. It was followed by Dithane M-45, Dithane Z-78, Ziram, Difolatan-80 and Blitox-50.

In field applications, Dithane M-45 was found to be the best. It was followed by Dithane Z-78, Ziram, Difolatan-80, Benlate and Blitox-50 in descending order.

A schedule of 4 sprays (30, 45, 60 and 75 days after sowing) of the crop of *B. campestris* var. yellow sarson (cv. K-88) with Dithane M-45, was found to be economically profitable.