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# Sources of resistance against early blight (*Alternaria solani*) in tomato (*Solanum lycopersicum*)*

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Early blight incited by *Alternaria solani* (Ellis and Martin) Sorauer is one of the most damaging diseases of tomato [*Solanum lycopersicum* L. (Pevalta *et al.* 2005), previously *Lycopersicum esculentum* Mill.]. The earliest symptoms of early blight are small, dark, necrotic lesions, usually on the leaves, which progress upward as the plants grow older. Huge yield losses occur due to early blight disease in tomato every year. The disease starts appearing from seedling stage till fruiting stage. Though fungicide use is effective control, but economically not feasible in all areas of the world and may not be effective under weather conditions favourable for epidemics. Moreover, fungicides also cause environmental pollution and health hazards to human beings and animals. Development of resistant cultivars is the most economical and sustainable control measure of early blight. Hence, the present work was planned to identify sources of resistance against early blight in tomato genotypes, which could provide a broader genetic base to facilitate the development of resistant cultivars.

A total of 14 germplasm/lines were used in this screening during winter (*rabi*) season of 2006–07 and 2007–08. Tomato seeds were grown in nursery and 4-week old seedlings were transplanted in pots and grown under natural conditions at Indian Institute of Vegetable Research (IIVR), Varanasi, India. Three plants of each germplasm from 3 replications were taken for evaluation for resistance to *Alternaria solani*. A Varanasi isolate of *Alternaria solani* was propagated on Potato Dextrose Agar (PDA) in 90-mm Petri-dishes. The dishes were incubated at 25ÚC under a cool-white fluorescent diurnal light with 12 hr photoperiod for 10–15 days. Ten days old mycelial culture with thickening of conidiogenous hyphae and chlamydospore-like structures having proper aggressiveness and potential as described by Pandey *et al.* (2003) was used for inoculation. The plants were inoculated with a concentration of 157 cfu/ml inoculums during the screening process. Plants were transferred to growth chamber and grown at temperature range of 23°–28°, with a 12 hr photoperiod. During the late seedling stage (6–7 weeks old), plants were individually spray-inoculated with *A. solani* 'Varanasi isolate'. All inoculated plants were kept moist by maintaining more than 95% relative humidity (RH) and 25–30° C temperature for continuous 3 days. The plants were closely observed each day after inoculation. In subsequent step, relative humidity was reduced to 85% and plants were maintained at 12 hr photoperiod. The relative humidity light and temperature were controlled by a computer-regulated system. This resulted in the proper development of disease symptoms, ie distinct concentric rings and blightening. Disease severity was scored on 0–5 point scale as suggested by Pandey *et al*. (2003) and per cent disease incidence (PDI) was calculated following McKinney (1923) formula. After 7 days of inoculation, plants were individually evaluated for disease scoring and further all inoculated plants were transferred in screen house to expose them to sunlight, dew and other diurnal weather changes.

The host plant reaction was classified based on the mean PDI as described by Pandey *et al.* (2003) as highly resistant (0–5%), resistant (5.1–12%), moderately resistant (12.1–25%), moderately susceptible (25.1–50%), susceptible (50.1–75%) and highly susceptible (>75%).

Plant response against *A. solani* was measured by observing symptoms developed after inoculation. Of the 14 tomato lines screened for resistance against early blight under controlled conditions, 'EC 520061' was found to be resistant with mean PDI of 9.99%, and 'NC EBR 4' was moderately susceptible (with mean PDI of 43.33%). The plant type of

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'NC EBR 4' is determinate (*sp*) with dense foliage cover. NC EBR 4 is a reported resistant line against early blight, however, during this experimentation, it was found to be moderately susceptible. 'EC 520061' is a wild (*S. habrochaites*) relative of tomato having small green fruits in clusters with indeterminate growth habit. Fruits and upper part of plants are hairy. Rest of the genotypes was either susceptible or highly susceptible for early blight. The average PDI ranged from 6.66 to 86.67%. The reaction of tomato genotypes may vary depending upon the climatic conditions prevailing under field condition. Best expression of early blight symptoms are observed during January–March in Varanasi under field condition. Similar results have been reported by Foolad *et al.* (2000) where significant differences among genotypes in their response to *A. solani* infection in the field, greenhouse, and growth chamber experiments were observed. In the field and greenhouse experiments, disease response varied from near-complete resistance in some accessions of the wild tomato species, *L. hirsutum*, to complete susceptibility in some tomato cultivar. Godika *et al*. (2001) reported that the incidence of Alternaria blight on leaves of Indian mustard increased when sown after 15 October under Rajasthan condition, however, infection on pods was decreased, probably due to rise in temperature and lowered humidity during pod formation.

These results suggested that screening against early blight disease provided information on new and broad source of resistance that could be useful to breeders in order to develop improved cultivars with resistance against early blight. It was observed that 'EC 520061', the green-fruited wild species of tomato showed appreciable resistance and can be utilized in early blight breeding programme. However, there is need for further evaluation of more numbers of lines against early blight to find more resistant materials.

## SUMMARY

Fourteen tomato genotypes, representing two *Solanum* species were screened for resistance against early blight disease. Evaluations were conducted in growth chamber for disease severity and host resistance of the plants. 'EC520061' (*S. habrochaites*) showed resistance against infection, 3 genotypes 'NCEBR 4', 'FEB 4' and 'VRT 2' were moderately susceptible, while other genotypes were found either susceptible or highly susceptible. The resistant material found in this study is useful in the tomato improvement programme, especially for early blight disease.

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