

Studies on some leaf spot diseases of tomato plant

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The present investigation was planned to study the causes of leaf spot diseases of tomato plant and the effect of some physiological and biological factors governing the outbreak and control of the diseases caused by *Exserohilum halodii* (Dre6h81.) Leonard & Suggs and *Ulocladium botrytis* Preuss on tomato plants. The findings can be summarized as follows: 1- Two isolates from both *Alternaria porri* and *Ulocladium botrytis* and one from each of *Exserohilum halodes*, *Cladosporium oxysporum*, *Curvularia verruculosa* and *Alternaria alternata* were isolated from spotted tomato leaves. 2- Pathogenicity studies revealed that *E. halodes* U. botrytis isolate No.1 & No.2 were the most virulent fungi. The first fungus caused the highest disease index under laboratory conditions whereas, *U. botrytis* isolate No.1 caused the highest disease index under greenhouse conditions. 3- Czapek's medium was the best one for fungal growth while Brown's medium was the lowest in this respect. However, PDA medium gave best sporulation of all tested fungi and glucose peptone was the lowest one in this respect. 4- Sodium nitrate, peptone and gelatin were the best nitrogen sources for linear growth of *E. halodes*, and *U. botrytis* isolates No.1 and No.2 respectively. However, asparagine, sodium nitrate and gelatin were better for sporulation of the aforementioned fungi respectively. Ammonium salts (sulfate, nitrate and chloride) were unfavourable for both growth and sporulation of all tested fungi. Ammonium nitrate had a moderate effect in this respect. 5- Growth and sporulation of *E. halodes* were better on sucrose and xylose. However, glucose and dextrin were the best for both isolates of *U. botrytis*. Arabinose as sole source of carbon suppressed both the growth and sporulation for all the tested fungi. 6- *E. halodes* grows better under all tested light wavelengths and reaches its maximum under red light wavelengths its sporulation was supported under green light followed by complete darkness. However, darkness, red and green light waves were favourable for both growth and sporulation of *botrytis* isolates. 7- Leaf leachates of healthy Super Marmande the resistant cv., contained the highest amounts of both total and reducing sugars on contrast with the susceptible Pritchard cv.. On the other hand, leaf leachates of Pritchard cv. enhanced both the percentage of spore germination and germ-tube lengths of all tested fungi, meanwhile, there were no significant differences between those of Super Marmande cv. and distilled water in this respect. 8- Brestan 60 WP was the most effective fungicide and checked both linear and amount of growth of all tested fungi at the concentration of 100 ppm followed by Dithane Z 78 in case of *E. halodes* and isolate No.2 of *U. botrytis* and Dithane M 45 for isolate No.2 of the last fungus concentration of 6400 ppm. However, fungal growths of all tested fungi were less affected by the tested concentrations of systemic fungicides. Topsin 50 WP followed by Bavistin 50 W11 were the most effective systemic fungicides at concentrations of 6400 ppm against *E. halodes* and *U. botrytis* isolate No.1 and followed by Vitavax 5 WP in case of isolate No.2 of the last fungus at the same concentration. 9. Both spore germination and germ-tube lengths were completely checked at a concentration of 1, 50 and 25 ppm of Brestan 60 WP, for *E. halodes*, isolate No.1 and N6421 of *U. botrytis* respectively. Dithane Z 78 ranked second at the rates of 750, 50 and 50 ppm respectively. Both Bavistin 50 WP and Topsin 50 WP reduced spore germination and germ-tube lengths of *E. halodes* till the concentration of 10 ppm then increased again. However, these measurements were completely checked at 25 ppm of Bavistin-50 WP and 750 ppm of Topsin 50 WP for isolate No.1 and No.2 respectively. 10- All tested fungi could produce toxic substances on liquid

Czapek's medium. However, isolated crude toxin(s) could produce typical symptoms of leaf spot diseases similar to those produced by fungal infection. Leaves of Super Marmande cv., (resistant) was more affected with the isolated fungal toxins than Pritchard one (susceptible cv.) The different extracts of fungal crude toxin(s) of all tested fungi could affect a wide range of host plants i.e. Broad bean, gourd, Eggplant, Pepper, Olive, Durum, Ficus, Begonia and Datura. The effect of different crude toxin(s) ranged between a limited circular black or brown spots on leaves of Olive and Ficus respectively and irregular and wider on leaves of Begonia. Root-formation on tomato cuttings was completely checked and inhibited in case of isolate No.1 of *U. botrytis*-crude toxin(s) followed by crude toxin(s) of *E. halodes*. The increasing in the concentrations of fungal crude toxin(s) caused rapid wilt symptoms especially in case of *U. botrytis* isolate No.1 Percentage of tomato seed germination and length of seedlings were greatly reduced by treating seeds with fungal crude toxin(s). The reduction increased with the increasing in crude toxin(s) concentrations. Also, fungal toxin(s) clearly retarded the time required for tomato seedling emergence especially with the higher concentration (800 ppm) of *E. halodes*-crude toxin(s).

11- All the different tested fungi were able to degrade and utilize pectin, cellulose, starch gelatin and casein when grown on media containing any of these compounds.

12- In vitro both PG and Cx enzymes were most active at a wide range of pH values (4.0 to 8.0) especially those of isolate No.1 and No.2 of *U. lactuca*. However, pH 6.8 and 7.0 were more favorable for *B. halodes*. The relative activity of fungal PG and exoenzymes increased with the increase in time of reaction as well as the increase in culture age. *E. halodes* showed the lower activities of both enzymes in its culture filtrates at all culture ages. All tested fungi could be induced to secrete big amount of these enzymes by growing them on certain specific media.

13- Both PG and Cx enzymes were detected in both healthy and artificially inoculated leaves of Pritchard and Super Marmande cv. However, infected leaves showed higher activities which was 4 to 6 times that of the healthy ones. Super Marmande, (the resistant cv.) showed lesser activities than Pritchard cv. (the susceptible one) in this respect.

14- Peroxidase activity was detected in both mycelial matrix and culture filtrates of all tested fungi, however, its activity was higher in the first one. Also, the highest peroxidase activity was detected in 21 days-old mycelial matrix. As for polyphenol oxidase it was not detected in either mycelia or culture filtrates of any of the tested fungi. In vivo, the healthy leaves of the resistant Super Marmande cv. showed high peroxidase activity than the susceptible Pritchard cv. Peroxidase activity generally increased in infected leaves of both cvs., after 7 days* from inoculation. then decreased with time. Similar trend was noticed as regards polyphenol oxidase activity.

15- Brestan 60 WP was the most effective fungicide as it checked PG activities for 50 ppm after: 4 hours for *B. halodes* and isolate No.2 of *U. botrytis* and: at 100 ppm for isolate No.2. Dithane 78 ranked the second in this respect. However, Cx activities were much tolerant against Bavistin 50 and Topsin 50 WP. In this respect PG activities were more sensitive to fungicidal action than the Cx ones, there Brestan 60 WP at the rates 5 and 10, Ppm checked.. PG activities of *B. halodes* and *U. botrytis* isolates respectively: Topsin 50:0 and Bavistin: could completely check PG activities at 50 ppm after 4 hours for all tested fungi.

16- Inoculation with the different tested fungi caused increases in the Percentage of dry weight matter especially in case of Super Marmande cv. after 10 days from infection.

17- Both reducing a total sugars percentages increased! greatly after infection with any of the tested fungi in case of the resistant -Super Marmande cv., on contrast With the susceptible Pritchard cv., As regards the non-reducing sugars, it was greatly increased in Pritchard cv. after inoculation with both isolates of *U. botrytis* then decreased with time.

18- Free phenols were produced and accumulated at a faster rate in Super Marmande resistant cv. than that of Pritchard susceptible cv. As regards the conjugated phenols an opposite trend in both tested cvs. was noticed, except of leaves of Pritchard cv. infected with *B. halodes* Free phenols and Ortho-dihydroxy phenols decreased and conjugated phenols increased after 20 days from inoculation with any of the tested fungi in case of the resistant-cv.

19- Disease incidence increased progressively by the increase in inoculum potential, however, the increase was not proportionally parallel to the degree of inoculum at the three highest inoculum concentrations.

20- Super Marmande Cv., among the tested cvs., seemed to be the most resistant one. whereas, cultivars Aoe and Strain-B ranked second to it respectively, However, Pritchard cv. was the most susceptible one in this respect. High relative Humidity with

warmth conditions seemed to be necessary for increasing disease index. The resistant Super Marmande cv. showed slight disease incidence under these conditions. 21- The percentage disease index increased with the increase in plant age. 22- Systemic fungicides, Bavistin 50 WP and Topsin 50 WP could persist on the surfaces of sprayed leaves - till the 30th days from spraying. However, Brestan 60 WP persist till the 10th day, whereas Dithane Z 78 was the least fungicide and could not persist more than 5 days especially with the highest concentrations of 1500 ppm. 23- In pot experiments, contact fungicides i.e. Brestan 60 WP and Dithane Z 78 were most effective to prevent disease index and percentage of diseased leaves when used just before inoculation with any of the tested fungi. Disease index gradually increased by increasing period between fungicidal application and fungal inoculation. However, little increase in disease index occurred when inoculation was applied 5 to 10 days after fungicidal application. On the other hand, systemic fungicides i.e. Bavistin 50 WP and Topsin 50 WP showed opposite behaviour in comparison with the contact ones. Disease index and percentage of diseased leaves gradually decreased by increasing the period between fungicidal application and fungal infestation. The best results for disease control were obtained when Bavistin 50 WP or Topsin 50 WP was sprayed on leaves 20 days before inoculation. 24- In pot experiment Indol Acetic Acid (IAA) gave the lowest disease index when used as foliar spray, 30 days before inoculation with *E. halodes* at 100 or 200 ppm followed by MR-30 T at 100 ppm, but the latter was the best either sprayed at 5 or 30 days before inoculation with any of the tested fungi. Alar (B-9) at 200 ppm was the best growth regulator when sprayed 30 days before fungal inoculation contrast in the case of 15 days which caused the highest disease index. On the other hand, GA3 caused high disease index in all cases either used 15 or 30 days before fungal inoculation. 25.0. In pot experiment, addition of Ammonium nitrate Calcium super phosphate or tetrasium sulphate singly decreased the percentage of disease index of all tested fungi. As regards *B. halodes* the best results for disease control were obtained with addition of N₃P₂ (200 g/pot) or N₃P₂K₁ i.e. (2.25 : 0.75 : 0.50 gram/pot) in both tested cvs. respectively. However, the addition of late P₂ singly or P₂ i.d. (1.50 : 0.50 gram/pot) increased seasonal disease index to its maximum in both cvs. - As for infection with isolates of *U. botrytis*, the increasing in levels of N with P fertilizers reduced disease incidence, also N₂ (1.50 : 1.50 gram/pot) or N₃ P₂ with or without K fertilizer gave the best results in this respect. Plants without fertilizers N P₂ K₀ 0 0 (without any fertilizers) showed the highest disease index. 26- Under field conditions spraying with 375 ppm of active ingredients of Bavistin 50 WP and Topsin 50 WP was effective to prevent disease index. However, the highest yields were obtained with 750 and 1500 ppm of both fungicides respectively. Brestan 60 WP gave promising results for disease control and yield when applied at the rate of 1500 ppm and 750 ppm in 1978 and 1979 seasons respectively. 27- Under field experiment IAA followed by MH-30T gave the lowest disease index respectively. However, GA3 caused the highest disease index in both tested cvs. As regards the yield HH-301 followed by IAA was the best in season 1978 and IAA followed by Alar (B-9) in season 1979. On the other hand, the lowest yields of both tested cvs., was associated with GA3 treatments. 28- Under field conditions, the addition of N fertilizer with or without P or X reduced disease incidence, also P₂ level gave best results than P₂ level. However, the increase in levels of all fertilizers increased the yield per feddan than treatments without fertilizers. The least disease index was obtained by addition of N₂ P₂ X₁ (300:300:100 kg/feddan) followed by N₃ P₂ X₁ (450:150:100 kg/feddan) followed by N₃ P₂ X₁ for Super Marmande cv. However, the highest yield from both cvs., was obtained at the rate of N₂ P₂ X₁ (300:300:100 kg/feddan).