

# Studies on the nature of resistance to fusarium wilt of cotton

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reaction of the resistant cotton variety to Fusarium wilt was studied. It was found that the resistant variety showed a higher level of resistance to Fusarium wilt compared to the susceptible variety. The resistant variety was found to have a higher level of lignin and cellulose in its cell walls, which may contribute to its resistance to the fungus. The susceptible variety showed a higher level of free amino acids in its roots, which may be a result of the infection. The resistant variety showed a higher level of proline in its roots, which may be a result of the infection. The resistant variety showed a higher level of phenolic compounds in its roots, which may be a result of the infection. The resistant variety showed a higher level of lignin and cellulose in its cell walls, which may contribute to its resistance to the fungus. The susceptible variety showed a higher level of free amino acids in its roots, which may be a result of the infection. The resistant variety showed a higher level of proline in its roots, which may be a result of the infection. The resistant variety showed a higher level of phenolic compounds in its roots, which may be a result of the infection.

both varieties. The di- and polyphenols were present in comparable concentrations in the healthy organs of both resistant and susceptible varieties. Upon infection, these two groups of phenols increased in organs of the susceptible variety, whereas the opposite was true, in most cases, with the resistant one. As to the monophenols, the two varieties exhibited comparable concentrations in roots and leaves at early stages and in stems at relatively later stages. Following infection, the susceptible variety always exhibited a DROP in the monophenol level compared with the healthy tissues, whereas the opposite was mostly the case for the resistant variety. Such interconversion of phenolic substances could be accomplished by the enzymes of the pathogen and/or the host in response to infection, and the type of phenolic compounds that predominate could play a role in determining the type of host reaction as these compounds differ in their toxicity.

5- With respect to certain hydrolytic enzymes, comparative studies showed that: a) Healthy tissues of both susceptible and resistant varieties contained some activity of PMB but none of the pectin-degrading enzymes. Upon infection, 80% increase in PU activity occurred; however, to a greater extent in the susceptible than in the resistant variety. On the other hand, the pectin-degrading enzymes were not found except in the infected susceptible tissues. b) Very low activity of cellulases was found in the healthy tissues of both resistant and susceptible varieties. Infection was usually followed by some increase in activity; however, to a greater extent in the susceptible variety. The magnitude of increase was relatively low to warrant a major role of these enzymes in pathogenesis.

6- Certain oxidative enzymes, i.e., polyphenol oxidase, peroxidase, catalase, and ascorbic acid oxidase were studied in various host-parasite combinations. Results obtained could be summarized as follows: a) With respect to PPO, comparable activity was found in most cases in the healthy susceptible and resistant varieties. As a result of infection, the enzyme activity increased in root tissues of both varieties; however, to a greater extent in the susceptible one. At later stages, the activity in the two varieties was not too much different. In stem tissues, a similar situation was found, except that the activity in the resistant variety maintained a somewhat higher level than the control at later stages. The enhanced activity of PPO in the roots of infected susceptible variety could account for the oxidation of phenolics to non-toxic polymeric substances leading to the production of the brownish products characteristic of vascular discoloration. On the other hand, the resistant varieties result in a low oxidation products such as lignin, which are highly reactive and more toxic. Such products could inhibit the enzyme; thus, partly account for the low activity level observed. b) Ascorbic acid could have a varied effect on the host-parasite relationship depending on the extent of infection. c) AS to the peroxidase, it was found that their activity, as enhanced following infection in roots of both susceptible and resistant varieties. Later, such activity dropped in the former but continued to increase in the latter. Such continued enhanced activity of peroxidase in the resistant variety could be one of the determinants of such resistance. However, it is difficult to pinpoint the affected processes since peroxidases have quite a varied effect on different vital processes. c) AS to catalase, it was found that infection resulted in an increase in their activity in both varieties, with the magnitude of increase being higher in the resistant variety. d) Ascorbic acid oxidation, the increase in activity in response to infection was higher in roots of the susceptible variety, whereas the reverse was true for stems. e) The enhanced activity in the stems of resistant tissues could exert a drainage effect on the concentration of ascorbic acid, thus lowering the reducing power and rendering the phenolic compound to maintain their oxidized toxic form. Furthermore, such an enzyme could also be involved in the reoxidation of NADH produced through the modified metabolic pathway in response to infection.

7- Employing the electrophoretic techniques in polyacrylamide gels, certain enzymes were studied in extracts of healthy and diseased plants as well as in extracts of fresh, gelatinized, and dried tissues. The following results were obtained: a) No difference was observed between the healthy susceptible and resistant varieties as to the peroxidase activity or the isozyme pattern. b) As a result of infection, the level of activity increased, as evidenced by band width and staining density. The magnitude of increase was greater in the susceptible than in the resistant variety. An activity band corresponding to that found for the fungal peroxidase appeared in the diseased extracts. The multiplicity of peroxidase

iso~es was not evident with pyrogallol as the substrate, unless the activity was too low, thus preventing the coalescence of bands. b) With respect to esterases, ten healthy cotton varieties showed a high degree of similarity in their isozyme pattern. Stems were more active than roots. Similarly, nine fungal isolates were similar in their esterase pattern, regardless of their virulence. When a susceptible and a resistant variety subjected to infection were compared, it was found that healthy roots of both varieties exhibited similar patterns; however, the level of activity dropped as the plants grew older. Comparing diseased with healthy extracts, the former was always poorer in activity as judged by the band staining density. As to the stem tissues, healthy extracts showed a high degree of similarity in both resistant and susceptible varieties; however, there was an indication of an additional band in the former. No consistent trend of change was found in response to infection except that the diseased susceptible tissues maintained the usual esterase activity at later stages while the corresponding healthy tissues were almost devoid of such an activity. The role of esterase in disease physiology is unclear at present; however, it appears to have a valuable diagnostic value in view of the high degree of similarity in isozyme pattern among different cotton varieties and among different fungal isolates. 8- Certain groups of growth regulating substances were studied in both healthy and diseased susceptible cotton varieties. The results are summarized as follows: -a) With respect to auxin activity, as judged by the extent of root elongation in cowpea seedlings, it was found that infection resulted in a state of hyperauxinism; however, to a greater degree in the susceptible variety particularly at the early stages of disease development. b) With respect to gibberellins, it was found that infection led to a reduction in the activity of this group of compounds; however, the magnitude of reduction was greater in the infected susceptible variety than in the infected resistant one. This could partly account for the stunting symptoms which characterize the wilt disease.