molecular weights of 15 500 and 14 600. The same changes could be detected in systemically invaded leaves with a delay. The first differences were detectable before symptoms were visible. Recovered leaves, first harvested three weeks after inoculation, showed similar patterns. There was a correlation between increases in the levels of the new proteins and recovery.

In inoculated and recovered leaves the appearance of the newly formed proteins could completely be suppressed by actinomycin D. After 14 days there were only small amounts of these proteins in systemically infected leaves. Plants treated with actinomycin D showed more severe symptoms and did not recover completely.

Although there is no direct evidence for an involvement of the proteins in plant resistance and recovery, they may play a role in the development of these mechanisms.

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Comparison of soluble leaf protein patterns during the first stages of pathogenesis in tobacco ringspot virus-infected tobacco

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Tobacco plants *(Nicotiana tabacum* cv. Xanthi-nc) infected with tobacco ringspot virus develop necrotic ringspots on the inoculated leaves and necrotic line patterns and leaf deformation on the systemically infected leaves.

The pH 8.0-soluble proteins of inoculated and systemically infected leaves were extracted and separated electrophoretically in 11% polyacrylamide gels containing SDS. The soluble leaf protein patterns of the infected plants were compared with those from leaves of corresponding stages of buffer-inoculated plants.

Apart from changes in the intensity of different protein bands of higher molecular weights, no significant alterations in the protein constitution of inoculated leaves could be detected. Electrophoretic separations of extracts from systemically infected leaves showed an increase of a constitutional protein with Rf 0.88 from the seventh to the fourteenth day after inoculation. In addition, a novel protein appeared with an electrophoretic mobility of 0.77.

Further electrophoretic studies at all stages of infection and with special regard to the recovery phenomenon must be made to determine a possible role of the increasing and newly appearing proteins in the recovery stage of pathogenesis.

Occurrence and possible role of thionin-like proteins in apple, tomato, melon and rice seed

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Initial studies focused on revealing the nature of the agglutination of *Erwinia*

amylovora, the bacterium causing fireblight of apple in xylem vessels of apple leaf petioles (1). The agglutinin appeared to be a protein (2). Subsequently a protein with agglutinating activity was isolated from apple seed, stem and leaf tissue (3, 4). The protein is highly positively charged with a high content of the basic amino acids arginine and lysine and a high level of cystine from which the term thionin is derived. Thionins with antibacterial activity have been previously reported (5, 6), and the first of these, purothionin, isolated from wheat (7, 8) was shown to be inhibitory to yeast and hence its presence in flour interfered with the making, leavening, of bread. The apple protein, named malin (4), displays a sharp peak of agglutinating activity at pH 3.5 (3). The affinity of malin is intense for the non-capsular, virulent wild-type of *E. amylovora*. Comparative titers from avirulent and virulent isolates are 2048 and 36 respectively. Initially, malin was believed to be a lectin; however its agglutinating activity was not suppressed by 35 sugar and amino sugar haptens. Its agglutinating activity is neutralized by the polysaccharide capsular material (EPS) of the pathogen by a charge-charge interaction. This reaction may explain at least in part the basis for the virulence of *E. amylovora.*

Extraction of melon, tomato and rice seed with 50 mM H_2SO_4 revealed similar intense agglutinating activity against acapsular isolates of *E. amylovora.* Comparative rocket immunoelectrophoresis of these proteins with malin found them to form similar precipitin patterns against the same antigens. In antibiotic cup-plate bioassays, these seed-derived proteins exhibited similar and intense antibiotic activity against a number of plant pathogenic bacteria.

Hence these proteins exhibit a direct antimicrobial effect which may in part explain their ability to immobilize plant pathogens *in planta.*

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