Molecular Detection of Peronospora effusa during the Latent Period

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Downy mildews are a serious disease of many crops in coastal California. In spinach, downy mildew is caused by the plant pathogenic microorganism Peronospora effusa. In California, where nearly 75% of the US fresh spinach is grown, downy mildew disease causes millions of dollars in losses annually. Currently, the disease is controlled by fungicide applications, and some of these fungicides are applied whether or not infection has occurred on spinach because of the explosive nature of these epidemics. It was therefore hypothesized that if downy mildew infection could be detected before symptoms appear (during the latent period), fungicide applications could be targeted only when the pathogen is present. This in turn may prevent epidemics from developing. For specific detection of P. effusa or Peronospora, polymerase chain reaction (PCR) with P. effusa-specific primers were used to detect the pathogen DNA from potential infections on 50 samples weekly for six weeks. Spinach plants were randomly sampled every 3 m from a 36 m plot, consisting of four beds. For the first four weeks, primers to detect generic Peronospora species and for the last two weeks, primers specific for P. effusa were used in the PCR. Only a few of the 50 samples (usually in clusters throughout the plot) provided Peronospora-specific bands (amplicons). However, a few weeks later, about 90% of the samples were positive. Initial samples were asymptomatic and yet, the PCR enabled detection of downy mildew infection, validating the hypothesis. In conclusion, using PCR, downy mildew pathogen DNA was detected on symptomless spinach plants, and application of fungicides on these plants is expected to prevent further downy mildew development. The approach requires validation in larger commercial fields.

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