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Issue Article

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PATHOGENICITY OF SPECIES OF ALTERNARIA ON POTATOES AND TOMATOES

***Abstract**: Early blight is a dangerous disease affecting potatoes, primarily caused by Alternaria alternata and Alternaria solani in Western Europe. In Russia, it may also be caused by A. tomatophila, A. tenuissima, A. infectoria, and A. arborescens. A. grandis has been identified as the causative agent in Brazil. Different perspectives exist on the Alternaria species' significance in Early Blight, with some believing only A. solani is pathogenic, while others consider both species or a pathogen complex involving A. alternata and A. solani. Early blight symptoms include tiny, 1-2 mm black or brown lesions on leaves, concentric bands of dark pigmentation on stems, and "collar rot" on seedlings. Lesions can grow to significant sizes and infect both green and ripe tomato fruit. Potato tuber symptoms are irregular, sunken lesions, often encircled by a raised purple border.*

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Introduction

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In many areas where potatoes are grown, early blight is a dangerous illness. The illness can be managed with strategic fungicide sprays. Alternaria alternata and Alternaria solani are the two Alternaria species that are primarily regarded as causative infections in Western Europe. According to Russian studies, the Early Blight disease may also be caused by the species A. tomatophila, A. tenuissima, A. infectoria, and A. arborescens. A. grandis has been identified as the Early Blight's causative agent in Brazil. Spores from A. solani, A. tomatophila, and A. grandis are larger than those from A. alternata, A. tenuissima, A. arborescens, and A. infectoria. Different perspectives exist regarding the Alternaria species' significance in the Early Blight. It is debatable if small spored species-primarily A. alternate have an impact. Some studies believe that just A. solani is pathogenic, while others consider both species to be causative agents or describe a pathogen complex involving A. alternata and A. solani. The last scenario involves A. alternata, which is a saprophyte and a secondary invader that colonizes leaf lesions wherever they originate (e.g., ozone damage, variety specific, produced by A. solani, etc.). There is general agreement amongst the differing viewpoints that A. solani is pathogenic. A variety of tests were conducted in an effort to clarify the role that A. alternata plays in the Early Blight disease.

The fruit, stem, and foliage of tomatoes, as well as the stem, foliage, and tubers of potatoes, exhibit signs of early blight. The first signs on leaves are tiny, 1-2 mm black or brown lesions that get larger and frequently have a golden halo surrounding them in favorable environmental circumstances. In lesions larger than 10 mm in diameter, concentric bands of dark pigmentation are common. This lesion, known as a "bullseye" variety, is quite typical with early blight. Entire leaves may become chlorotic and dehisce as lesions grow larger and new lesions form, resulting in severe defoliation. On stems, lesions frequently exhibit the characteristic concentric rings and are deep, lens-shaped, and have a bright core.

Lesions on early tomato seedlings may completely girdle the stem; this is a stage of the disease called "collar rot," which can cause the plant to become less vigorous or even die.

Lesions can occasionally grow to a significant size and are typically transmitted by the calyx to infect both green and ripe tomato fruit. The lesions may have the recognizable concentric rings and have a leathery appearance. Fruit that is infected will often drop before its time. Potato tuber symptoms are typified by irregular, sunken lesions, frequently encircled by a raised purple border. The tuber tissue has a dark hue and is leathery or corky beneath the lesion's surface. Compared to lesions caused by other tuber rots, early blight lesions on tubers are often dry and less vulnerable to invasion by secondary organisms. Severely infected tubers may shrivel after extended storage.

Fig. 1 Symptoms of early blight disease caused by Alternaria solani in tomato plants. a Development of concentric rings in tomato leaves due to early blight disease. b Early blight on tomato stem showing

Alternaria solani is the fungus that causes early blight. Since no sexual stage is known, it is categorized as a Deuteromycete. Numerous serious diseases are caused by a vast and major group of pathogenic fungus belonging to the genus Alternaria. The fungus grows easily on synthetic media like V 8 juice, where it forms a densely pigmented, hairy, grayish-black colony. The septate, haploid mycelium darkens in color as it ages. Fluorescent light exposure can promote sporulation in culture. On separate conidiophores, the asexual conidia are carried singly or in pairs. Normally, the beaked conidia have nine to eleven transverse septae.

Mostly on contaminated agricultural waste, Alternaria solani overwinters. The mycelium's dark coloration boosts resistance to lysis, allowing it to survive in the soil for several years. Although they are rare, thick-walled chlamydospores have been reported. In temperate regions, the disease can endure season to season on weedy Solanaceous hosts like horsenettle and nightshade, as well as volunteer tomato and potato plants.

Fig. 2 Symptoms of Fusarium wilt disease caused by Fusarium oxysporum. f sp. lycopersici. a Field view of infected tomato plants; note the yellowing of the oldest leaves. b Discolouration of vascular tissue in Fusarium infected tomato plants

Conditions that are warm and humid (24–29°C/75–84°F) are favorable for infection. Conidia will germinate in about 40 minutes at an ideal temperature of 28–30°C (82–86°F) with free moisture present. Because desiccated germ tubes can regrow when rewetted, infection may happen in environments with cyclical wet and dry spells.

The length of time between the first infection and the onset of foliar symptoms depends on the climate, the age of the leaves, and the susceptibility of the cultivar. The primary cause of early blight is a disease of aged plant tissue. Lesions typically show up on older foliage within 5-7 days of infection, especially in warm, humid conditions.

Sporangulation needs a prolonged wet period, although it can also happen when there are intermittent wet and dry periods. Wet nights result in the production of conidiophores, which are then stimulated by light and dryness the next day to create spores that emerge on the second wet night.

Conidia are mostly transported by wind, although they can also occasionally be dispersed by splashing rain or overhead irrigation, leading to secondary transmission of the disease.

Using effective cultural methods to keep tomato and potato plants healthy will often prevent early blight losses below commercially significant levels. Reducing the initial inoculum in future crops by in-field sanitation measures is important since the disease overwinters on infected crop debris. Removing potentially infectious materials from the area around producing fields, such as rotting fruits and vines, should be taken into consideration. The likelihood of disease transmission can be decreased by removing weeds and volunteers before planting the new crop, such as nightshade and horsenettle, which act as alternate hosts for the illness.

Fungicides that possess both curative and preventive qualities are authorized for use in the fight against tomato and potato early blight. The majority of early blight management regimens were built around the less expensive protectant fungicides like mancozeb and chlorothalonil. Reapplication of these fungicides is required every 7 to 10 days in order to preserve newly emerging growth and prevent weathering from gradually removing the chemical from the leaf surface. These compounds have the advantage of being both multi-site and efficacious, which lowers the possibility of resistance isolates forming in the pathogen population. As a result, they can be employed in rotation with other fungicides or as tank mix partners. The requirement for frequent applications and their comparatively high use rates are drawbacks.

When it comes to inhibiting fungal respiration, fungicides classified as Quinone Outside Inhibitors (QoI) (FRAC code #11) are quite effective against Alternaria species. This significant class of fungicides includes molecules such as azoxystrobin, pyraclostrobin, trifloxystrobin, fenamidone, and famoxidone that are registered for controlling Alternaria in potatoes and/or tomatoes. Generally speaking, QoIs are easily absorbed into plant tissue and function as a preventive measure to halt infection by preventing spore germination. Although the cost per acre is usually higher, they are not as effective as traditional protectant solutions and have far lower application rates.

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