

Review Article

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Chemical Management of Alternaria leaf and fruit spot of apple

Altaf Ahmad Wani*, Raheeba Tun Nisa and Rameesa Rashid

Division of Plant Pathology, Sher-e-Kashmir University of Agricultural Sciences and
Technology of Kashmir, India

**Corresponding author*

ABSTRACT

In Jammu and Kashmir, a number of diseases like scab, Alternaria leaf blotch, Marsonena, sooty blotch, fly-speck and a number of post-harvest diseases pose a major threat to the apple industry. The occurrence of Alternaria leaf blotch in J&K was reported and the disease is prevalent in almost all the apple growing districts of Kashmir valley. Alternaria leaf blotch was considered a disease of minor importance in comparison to apple scab. However, the disease resulted in epidemic during summer of 2013, and about 40-60 per cent yield loss was reported. This epidemic was attributed to climate change (high temperature coupled with prolonged rains), absence of disease forecasting system in the valley and also to the fact that currently used fungicides do not provide satisfactory level of disease control. When overwintering mycelium forms conidia and infects fresh budding apple leaves in the spring, the infection begins. After 90 days after flowering, a rise in temperature combined with significant rainfall and relative humidity enhances secondary infection in leaves and fruits. For disease control, a variety of techniques are available, including cultural, chemical, resistance, and biological approaches. We'll go through the disease's cause, symptoms, and treatment options here.

Keywords

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Introduction

Apples are the most commercially grown and are produced in all temperate areas of the world, with an annual production of over 81 million tonnes and a yield of nearly 18 tonnes per hectare (FAOSTAT, 2018). More than 70 plant diseases affect them, the most majority

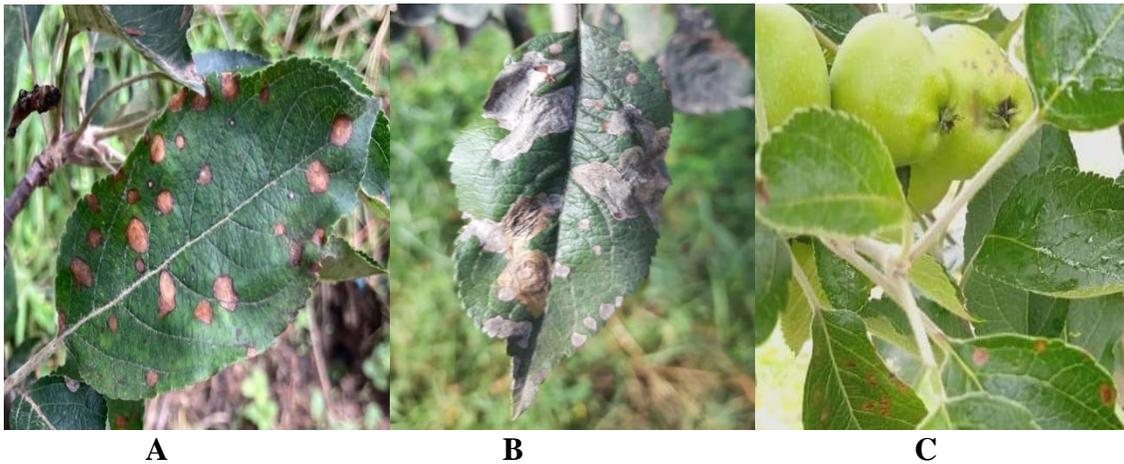
of which are caused by pathogenic fungus (Nabi et al., 2020). Various diseases, such as apple scab, Alternaria blotch, and cankers, are found all over the world (Muneer et al., 2017). The Alternaria leaf and fruit spot (ALFS) disease, caused by Alternaria spp., is a serious danger to apple production. Alternaria disease in apples has caused catastrophic losses to the

apple industry in most apple-growing countries throughout the world during the previous decade (Filajdic et al., 1991). Apples are mostly cultivated in India's Union territory of Jammu and Kashmir (J&K) and the states of Himachal Pradesh and Uttarakhand, which account for about 90% of the country's total output. *Alternaria* Leaf and Fruit Spot has arisen as a significant disease that has resulted in financial losses for producers and business. *Alternaria* leaf blotch was initially discovered in the United States in 1924 (Roberts, 1924), and is now seen in almost every apple-producing country. The disease (*Alternaria mali*) was first discovered in India in the Kashmir valley of J and K in 2002 (Shahzad et al., 2002). In comparison to apple scab, the ALFS is regarded a minimal disease. The ALFS has been found in most cultivars, although the Delicious group is particularly vulnerable (Bhat et al., 2015).

Symptoms of *Alternaria mali*

Small, round, purple or blackish spots emerge

on leaves in late spring or early summer, gradually expanding to 1/4 inch in diameter with a purplish border (Figure 1A). Most lesions expand and become irregular, darker, and resemble frog eye symptoms or crescent-shaped rings as a result of subsequent expansion (Figure 1B). Early in the season, frog eye leaf spot occurs and can be seen around fruit mummies or dead wood. When petioles get infected, the leaves become yellow and may defoliate prematurely. Premature fruit drop can be caused by severe defoliation. When a severe mite infestation is present, defoliation is more severe (Filajdic et al., 1995). Fruit symptoms include the following: Lenticels are small, black patches with a somewhat sunken appearance (Figure 1C). Twigs of susceptibility cultivars have round, depressed, blackish patches bordered by fractures. Under storage temperature, the presence of moisture promotes the growth of profuse light-grey mycelium on the exterior of apple fruit. Soft rot occurs when fungus enters damaged fruits (Peter, 2017).



Pathogen: *Alternaria mali*

Alternaria species are members of the Phylum Ascomycota, Subphylum Pezizomycotina, Class Dothideomycetes, Order Pleosporales, Family Pleosporaceae, and Genus *Alternaria*, which cause apple *Alternaria* Leaf and Fruit

Spot. Conidia morphology distinguishes *Alternaria* from other fungal genera; they are big and black, multi-celled, catenate or solitary, ovoid or obclavate, frequently beaked, brown, and have transverse and longitudinal septa (fig-2 A&B). *Alternaria mali* is the most commonly reported and

dangerous apple disease. It has been found in the United States, Canada, Chile, the Netherlands, France, Turkey, Serbia, Slovenia, Asia (India, China, Japan, Taiwan, Korea), and Australia (EPPO Global Database

2020). Different isolates, on the other hand, showed varying levels of pathogenicity and virulence (both within and within species complexes) (Harteveld *et al.*, 2014).



2A

2B

Management of Disease

The use of resistant cultivars allows for effective disease management. There has yet to be discovered a resistance gene. Only a few researches have looked at *Alternaria* leaf blotch resistance (Filajdic *et al.*, 1991; Abe *et al.*, 2010; Li *et al.*, 2011). A combination of fungicidal spray, mite treatments, and suitable cultural practices might be used to suppress the ALFS epidemic. Leaf debris on the orchard floor is the primary source of inoculums, and spores can be found on twigs and buds even during winter. As a result, reducing leaf litter on the orchard floor is critical. To prevent *Alternaria* leaf blotch fungus and mite eggs from overwintering in fallen apple leaves and other waste, maintain cleanliness in orchards and reduce or degrade fallen apple leaves and other trash. The use of urea on fallen leaves, mulching, weed control, removing fallen apple litter from orchards, using lime sulphur, covering the plastic foil, and manually removing leaf residues might all

help to limit the source of inoculums in orchards. During the winter, spores might be seen on twigs and buds. During the end of fall or early spring, a protective spray of copper-based fungicide is advised prior to the emergence of new leaves. In orchards, selective canopy trimming lowers inoculum contained in branches and buds. With the right application schedule, fungicide sprays might help to reduce infections. Leaf blotch incidence should be observed, and if it is greater than 15% by 70-90 DAB (2 months before harvest), fungicide spray may be required to avoid fruit spot infection (Gomez *et al.*, 2007). List of the chemicals (Table-1) used against *Alternaria mali* in vivo on Red Velox cultivar and three replications were maintained in each treatment. Disease incidence was calculated by using formula-

$$\text{Disease incidence} = \frac{\text{number of diseased leaves}}{\text{total no. of leaves observed}}$$

Table1: List of chemicals evaluated against *Alternaria* Leaf and Fruit spot of Apple

S.No.	Treatment	Dosage/L
1	Fluopyram+ Tebuconazole (Luna)	0.62ml
2	Tebuconazole+Trifloxystrobin (Nativo)	0.4g
3	Fluxapyroxad 250 G/L + Pyraclostrobin 250 G/L SC (Merivan)	0.2ml
4	Pyraclostrobin 12.8%+ Boscalid 25.2% (Visma)	0.25g
5	Metiram 55% + Pyraclostrobin 5% WG (Cabrio-top)	1g
6	Fluxapyroxad 75g/L + Difenconazole 50g/L SC (sercadisplus)	0.3ml

Table.2 Disease incidence of *Alternaria* Leaf and Fruit spot of Apple

S.No.	Treatment	Percent disease incidence
1	Fluopyram17.7%+ Tebuconazole17.17 WG (Luna)	12.12 (5.33)*
2	Fluxapyroxad 250 G/L + Pyraclostrobin 250 G/L SC (Merivon)	19.32 (9.45)
3	Tebuconazole50%+Trifloxystrobin25% SC (Nativo)	15.91 (8.32)
4	Pyraclostrobin 12.8%+ Boscalid 25.2% (Visma)	23.71 (12.98)
5	Metiram 55% + Pyraclostrobin 5% WG (cabrio-top)	27.88 (14.11)
6	Fluxapyroxad 75g/L + Difenconazole 50g/L SC (sercadisplus)	36.90 (16.11)

*Values in brackets are arc sine transformed values

The ALFS disease, which is caused by the *Alternaria* species complex, has spread around the world. Due to a lack of understanding of the timing and process of infection, as well as the epidemiological features of the diseases, control options are restricted. The occurrence of *Alternaria* leaf blotch in J&K was reported by Shahzad *et al.* (2002) and the disease is prevalent in almost all the apple growing districts of Kashmir valley (Sofi *et al.*, 2013). *Alternaria* leaf blotch was considered a disease of minor importance in comparison to apple scab. However, the disease resulted in

epidemic during summer of 2013, and about 40-60 per cent yield loss was reported (Anonymous, 2013). This epidemic was attributed to climate change (high temperature coupled with prolonged rains), absence of disease forecasting system in the valley and also to the fact that currently used fungicides do not provide satisfactory level of disease control (Bhat *et al.*, 2015). Lowest disease incidence was observed in fungicide Fluopyram17.7%+ Tebuconazole17.17 WG (Luna)- 12.12%, followed by Fluxapyroxad 250 G/L + Pyraclostrobin 250 G/L SC

(Merivon)-19.32% followed by Tebuconazole50%+Trifloxystrobin25% SC (Nativo). Our results suggests that fungicide Fluopyram17.7%+ Tebuconazole17.17 WG (Luna) effectively controls the Alternaria leaf and Fruit spot of Apple.

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