

## First report of *Alternaria mali* causing apple leaf blotch disease in Iran

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**Abstract.** A severe foliar disease was observed on apple trees in the north-western part of Iran in 2006. Symptoms included black and dark brown leaf spots on leaves of apple trees. *Alternaria mali* was isolated from all diseased leaves. This is the first report of *Alternaria* leaf blotch on apple in Iran.

The most economically important apple production areas in Iran are the north-western and north-eastern Azarbaijan provinces. During 2006 surveys for apple disease, foliar disease symptoms were observed in several parts of these regions. The first symptoms of disease were usually found on the mature leaves in badly affected trees. Dark necrotic spots surrounded by chlorotic areas were observed on the leaves of apple (*Malus pumila*). Spots expanded over time and coalesced with other leaf blights. Spots reached 0.7 to 3 cm and appeared mainly on older leaves of Red and Golden Delicious cultivars of apple trees (Fig. 1). The number of spots could vary from very few to several per leaf. Severe infection of the leaves typically leads to a blight and necrosis of the infected leaf and eventual leaf drop.

To determine the causal agent of the leaf spot, small pieces of diseased tissue collected from seven different infected locations. The pieces of tissue were surface-sterilised for 2 min in 2% sodium hypochlorite, plated on potato dextrose agar and incubated at 25°C. Gray to almost black colonies developed within 3 to 4 days. Dark brown conidiophores, which formed singly or in small groups, were short, less than 95 µm long and 3 µm wide, sometimes flexuous and occasionally geniculate. The conidia were brown to black, obclavate, pyriform, 21.8–36.0 µm long and 8.55–17.0 µm wide, with three to four transverse septae and one to three longitudinal or oblique septae and a short conical beak (Fig. 2). Chains of conidia three to nine spores long were sometimes branched, appearing as bushy heads. Morphological characteristics of the cultures on potato carrot agar and V8 agar media after 7 days exhibited typical characteristics of *Alternaria mali* (Simmons 1999).

Pathogenicity of the isolates was tested on detached wounded apple (*cv.* Golden Delicious) leaves by using a conidial suspension at  $1.5 \times 10^5$  conidia/mL. The sprayed detached leaves were maintained at 22°C and 100% relative humidity under fluorescent light with a 12-h diurnal photoperiod, for 3 days in a moist chamber. Symptoms similar to those observed on infected apple leaves in the orchards appeared on the detached leaves. Control detached leaves, with injuries, and sprayed with distilled water remained symptomless. Koch's postulates were satisfied after reisolating the fungus from diseased tissues.

In addition, isolates were grown in liquid Czapek-Dox medium for 7 days at 22°C, without shaking. At the end of



Fig. 1. Symptoms of *A. mali* on apple leaves.



Fig. 2. Conidia and conidiophores of *A. mali* isolated from apple leaves.

this period a culture filtrate was obtained and applied to the underside of wounded leaves of apple, tomato, citrus and potato as described in Johnson *et al.* (2000). Necrotic spots were only observed on the apple leaves 24 h after the inoculation. These results supported the contention that *A. mali* causes disease by producing a specific toxin.

*Alternaria mali* has been found previously in the United States (Sawamura 1990), former Yugoslavia (Bulajic *et al.* 1996), China, India, Japan, Taiwan and Turkey (Sawamura 1990). While *A. alternata* is, in Europe, a very minor fruit-rotting fungus on apples, affecting only fruits which are already damaged, *A. mali* is important in the Far East because it causes both leaf and fruit disease. In the United States, the disease is only important in North Carolina where Asian *A. mali* has been introduced (Sawamura 1990).

This is the first report of *Alternaria* leaf blotch on apples caused by *A. mali* in Iran. This could be a damaging disease of apple orchards in the north-western area of Iran and potentially elsewhere. Control of *A. mali* is conferred through the use of resistant cultivars and fungicides. Chemical control of *A. mali* can be achieved through use of fungicides such as iprodion, mancozeb and captan. However, further studies are needed on the ecology and pathogenicity of *A. mali* to formulate steps for controlling of *Alternaria* leaf blotch on apples.

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