

Natural Occurrence of *Alternaria alternata* on *Agave americana*: a report from Himachal Pradesh, India

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ABSTRACT

Disease symptoms as round and golden brown spots to coloured longitudinal streaks were observed during two consecutive seasons (2011-12) on leaves of *Agave americana*. About 90-95% of plants were found affected with disease. On the basis of disease symptoms, morphological characters and dimensions of conidia, the pathogen was identified as *Alternaria alternata* (Fr.) Keissler.

Key Words: *Agave americana*, *Alternaria alternata*, Himachal Pradesh, India

INTRODUCTION

Agave is a plant genus having perennial succulent nature and forms rosettes of usually rigid, fleshy, spiny-edged leaves, with funnel-shaped flowers in racemes or panicles often much taller than the rosettes. Interestingly, each rosette flowers once in whole life and then dies. The genus is believed to the native of Mexico but also considered to the southern and western United States, central and tropical South America. The members of the genera are both wild as well as cultivated, used as ornamental and medicinal purposes (Kadam et al. 2012; Maroyi 2012). *Agave Americana*, one of the most familiar species of the group, is an evergreen medium shrub, 1 to 6 feet in height (up to 15 feet with flower), blooming in summer and are very high heat tolerant.

During regular observations from 2011-2012, severe infection was observed on *A. americana* leaves in all the plants growing at different sites in the campus of TR Abhilashi Memorial Institute of Engineering and Technology, Mandi Himachal Pradesh, India. Approximately 90-95% of plants were affected with disease. Therefore, the present study was carried out for isolation and identification of pathogen associated with diseased leaves of *A. americana*.

METHODOLOGY

Isolation and Identification of pathogen

Infected leaf samples of *A. americana* were collected and brought to the laboratory for further experimentations. The leaves showing the typical disease symptoms were cut into small pieces (approximately 5 mm²) aseptically, surface sterilized with 0.5% sodium hypochlorite (NaOCl) for one min and washed three to four times in sterile distilled water. The sterilized leaf segments were then aseptically plated on potato dextrose agar (PDA) media and incubated at 25±2 °C for 6–7 days. Hyphal tips from the margin of each developing colony were subculture on PDA. Microscopic examinations were carried out to study dimensions like conidiophore and conidia (50 each) from 7-day-old cultures.

Pathogenicity test

Healthy leaves from mature *A. americana* plants were surface sterilized and inoculated with isolated pathogen for pathogenicity test. Randomly selected healthy leaves were pin pricked, spray inoculated with spore suspension (10⁵ conidia/ ml) of the pathogen and incubated at mean temperature 25±2°C and relative humidity (90-95%). Leaves sprayed with sterile distilled water served as a control. Typical symptoms of pathogen observed on stems after artificial inoculation were consistently re-isolated and compared with original fungus.

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Fig. 1. Disease symptoms caused by *Alternaria alternata* on *Agave Americana* leaves (Upper and lower side)



Fig. 2. Conidiophores and conidia of *Alternaria alternata* on culture medium (PDA)

RESULTS AND DISCUSSION

Disease symptoms on the leaves were appeared as round and golden brown spots initially (0.7–6.5 mm). As the disease progressed, spots coalesced, enlarged and developed towards the tip of the leaf as grayish coloured longitudinal streaks. Tissue necrosis within these spots was observed which ultimately leads to drying and death of leaves (Fig. 1). Isolation of same fungus was observed after repeated isolations from the infected tissues.

The fungi grew profusely on PDA medium and showed very light pinkish to white coloured colonies initially, becoming olivaceous, and turning brown with age. Microscopic examination of the fungus revealed golden brown, branched, and septate mycelium and brown, short, simple, or sometimes branched conidiophores. Conidia were obclavate, obpyriform or ellipsoidal with a short conical beak, borne in long chains, branched or unbranched, pale brown to brown, with mean size 22.5 µm (10 to 35) long and 7.2 µm (8.5 to 12.5) wide at the broadest point. Conidia had three to five transverse septa and one to three longitudinal septa (Fig. 2). Typical spots similar to the original symptoms were produced on leaves inoculated artificially for pathogenicity tests and fungal pathogen was consistently reisolated from symptomatic leaf tissues on culture medium PDA. Control leaves inoculated with sterile distilled water remained asymptomatic. On the basis of disease symptoms, morphological characters and dimensions of conidia, the pathogen was identified as *Alternaria alternata* (Fr.) Keissler.

Alternaria alternata is ubiquitous fungal pathogen reported globally on different hosts. It was reported on *Vicia faba* (Gurha et al. 1981) in Japan, Syria and India, *Pelargonium domesticum* (Furukawa & Kishi 2001) and *Morinada citrifolia* (Taba et al. 2010) in Japan, *Punica granatum* (Tziros et al. 2007) and *Aloe vera* (da Silva & Singh 2012) in Louisiana. The fungus showed numerous host ranges in India. It has been reported on *Punica granatum* (Madhukar & Reddy 1976), *Vicia faba* (Gupta et al. 1992), *Stevia rebaudiana* (Maiti et al. 2000), *Pistia stratiotes* (Babu et al. 2004), *Gloriosa superba* (Maiti et al. 2007), *Aloe vera* (Kamalakaran et al. 2008), *Adhatoda vasica* (Singh & Verma 2009), *Calotropis gigantean* (Sain et al. 2009), *Basella alba* (Sankar & Sreeramulu 2011) and on *Rumex vesicarius* (Sankar et al. 2012). Recently the pathogen was reported to be associated with *Morinada citrifolia* (Hubballi et al. 2013) and *Withania coagulans* (Sharma et al. 2013).

Review of literature for diseases of *Agave americana* in India revealed only two names viz., leaf spot (Mukherji & Mukherji 1969) and rot (Kanaujia 1983) caused by *Alternaria tenuis* and *Penicillium* sp. respectively but no reports of *Alternaria alternata*.

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