



First Report of *Diplocarpon mali*, the Perfect State of Apple Blotch Fungus *Marssonina coronaria* from India

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ABSTRACT

Apple blotch caused by *Marssonina coronaria* is widespread in North Western Himalayas and is well known for causing economic losses to the apple growers since it was first reported from Himachal Pradesh in 1994 (Sharma, 1999). The disease is becoming a major bottleneck in successful cultivation of apple in the state. In the study, apothecia with asci and ascospores (sexual fruiting structures) produced on overwintered diseased leaves of apple were recorded, which are sources of the inoculum. The fungus primarily infects apple leaves, and conidia formed in acervuli causes infection of the leaves and fruits during the growing season. The presence of apothecia with asci and ascospores is the perfect state of the causal fungus of blotch, *Marssonina coronaria*, is first time being reported from India. The study will lead to an understanding about overwintering stage, variability in population and infection process of the fungus.

Key Words: *Diplocarpon Mali*, *Marssonina coronaria*, Perfect state, Apothecium, Apple.

INTRODUCTION

In Himachal Pradesh, apple cultivation has revolutionized the socio- economic conditions of farmers and it's a leading commercial crop being cultivated over 1,11,896 ha with annual production 4,68,134 MT (Anon, 2016). Apple blotch (*Marssonina coronaria*) causing premature leaf fall in apple is one of the major problems in successful cultivation of crop in the districts of HP. The fungus primarily infects apple leaves and conidia formed in acervuli cause secondary infection on leaves and fruits. The disease symptoms first appear as dark green circular patches on the upper surface of mature leaves in mid- summer. As the disease progresses, the leaf spot coalesce and black pin- head like asexual fruiting bodies (acervuli) develop on affected surface. In Himachal Pradesh, symptoms appear after rains in June- July as quick yellowing of leaves. Lower foliage of the tree is

first affected and severe infection of leaves result in premature leaf fall, hampering all developmental processes, thereby, reducing quality and quantity of apple produced. A good quantum of work has been done on diagnosis, epidemiology and management of disease from India (Sharma, 2001; Sharma *et al*, 2004), but the information on overwintering stage (perfect state) of the fungus was lacking. In the present study, microscopic examination of infected leaves was carried out during dormant season of 2016-17 to know about the perfect state of fungus, which will lead to an understanding about overwintering stage, variability in population and infection process of the fungus.

MATERIALS AND METHODS

A survey was conducted in Rohru and Karsog areas of districts Shimla and Mandi, Himachal Pradesh from June 2016 to April 2017, which

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are hot spots for the disease. Marssonina blotch/premature leaf fall affected orchards in these areas were selected and infected leaves showing characteristics symptoms of disease, fallen on the orchard floor were collected during the months of November 2016 to March, 2017 and kept in nylon mesh under orchard conditions in the same orchards as well as at Regional Horticultural Research and Training Station, Mashobra, Shimla for microscopic examinations. Initially, hand sectioned leaf samples were observed on weekly intervals (November and December months) and from January onward every third day. The microscopic observations were taken under the Olympus microscope CX 31. The measurements of morphological structures of the perfect stage were taken by using Magnus Pro software.

RESULTS AND DISCUSSION

During the studies, the spermatia were seen

in the acervuli (asexual fruiting body) during November 2016 to January 2017 but no apothecium, ascus and ascospores were seen until third week of December 2016. The initials of apothecium fruiting body were visible in the last week of December. The first apothecium with asci and paraphyses was observed in 3rd week of February 2017. However, fully developed apothecium with asci and ascospores were visible after 2nd week of March 2017. Apothecia were fleshy, cup shaped 123-177 μ m in diameter, 110-141 μ m in height (Fig. 1a & 1b); asci broad-clavate to oblong, 52-78 X 11-21 μ m, 8-spored (Fig. 2); ascospores oblong-elliptical, usually 1-septate, straight or somewhat curved, slightly constricted at the septum or not so, acute or rounded at the ends, hyaline, 20-31 X 6-7 μ m (Fig. 3); paraphyses filiform, 1-2 septate, almost the same height as the asci, 2-3 μ m in width, slightly broadened at the apex. The observations are in line with studies conducted by Harada and

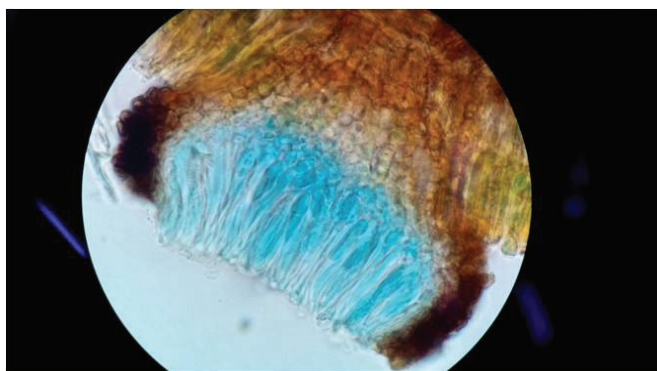


Fig. 1a. A cross section of mature apothecium with asci and ascospores (x40) of *Diplocarpon mali*

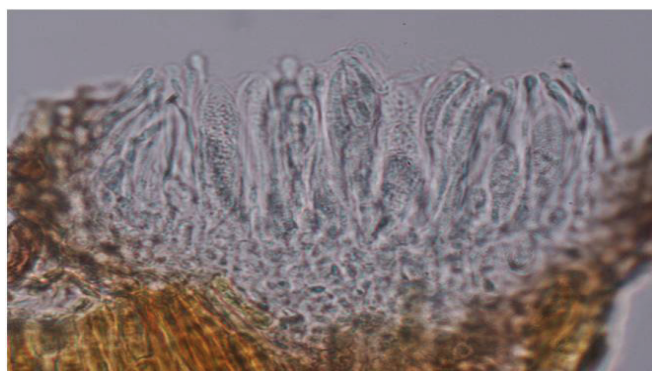


Fig. 1b. A cross section of mature apothecium with asci and ascospores (x100) of *Diplocarpon mali*



Fig. 2. Ascus with ascospores (x100) of *Diplocarpon mali*



Fig. 3. A ascospore (x100) of *Diplocarpon mali*

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co-workers (1974). The presence of apothecia with asci and ascospores, the perfect state of pathogen causing premature leaf fall in apple is first time being reported from India. Knowledge about the perfect state of fungus will lead to an understanding about overwintering stage, variability in population and infection process of the fungus. The study will ultimately help in development of effective management module against *Marssonina coronaria* with reduction of primary inoculum.

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