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First report of *Colletotrichum falcatum* causing anthracnose in cardamom

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Abstract

The capsules of cardamom (*Elettaria cardamomum*) plants cultivated in Tamil Nadu and Kerala, India were found with black spots during June to August of 2015 and 2016. Nearly 40% crop loss was reported by farmers. The symptoms were characterized by watery, mucilaginous, yellow patches developing into sunken regions with black spots of 1–2 mm diam. On drying, the spots resembled the symptoms of anthracnose. These small spots coalesced to form lesions measuring 4–7 mm in length. The causal agent was identified as *Collectotrichum falcatum.* In culture, the pathogen developed as a greyish colony with sparse aerial mycelium and setae, possessing falcate, fusiform conidia with obtuse apices, and brown appressoria. Inoculating the isolated fungus onto healthy capsules resulted in recurrence of the disease symptoms after 4 days. The fungus was re-isolated and confirmed as *C. falcatum*. Previous reports of anthracnose in cardamom attribute the disease to *C. gloeosporioides*. This is the first report of *C. falcatum* causing anthracnose on cardamom.

Key words – anthracnose – cardamom – *Colletotrichum falcatum* – *Elettaria cardamomum* – pathogenicity

Introduction

Elettaria cardamomum (L.) Maton belonging to the family Zingiberaceae, considered as the Queen of Spices, is native to India, Bhutan and Nepal. In India, the estimated production of small cardamom is 22000 tonnes, spanning an area of 69,970 hectares across Kerala, Karnataka and Tamil Nadu, as of 2016 (Spices Board India 2016). Theni of Tamil Nadu, Idukki, Udumbanchola, Peeremadu and Devikulam of Kerala state are the major areas where cardamom is grown accounting for 78% of the total production in the country.

Development of plant diseases due to environmental factors or pathogens affects the production of crops and thus economy of the farmers. Cardamom is reported to be infected with several diseases of fungal origin, of which the major fungal pathogens are *Phytophthora meadii* (capsule rot), *Phythium vexans* (rhizome rot and seedling rot), *Phytophthora meadii* (leaf blight), *Phaeodactylium alpiniae* (leaf blotch), *Phakospora elettriae* (leaf rust) and *Colletotrichum*

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gloeosporioides (brown spot) (Thomas & Suseela 1995). Anthracnose in cardamom, caused by *C. gloeosporioides*, was reported by Suseela et al. (1988).

Examination of cardamom fields in Theni and Idukki districts in India showed the fruits of the plant were infected with_black spots during the period of June to August in 2015 and 2016. Nearly 40% crop loss was reported by the farmers. The disease symptoms are characterized as watery, mucilaginous, yellow patches developing into sunken regions with black spots of 1–2 mm. The current study reports isolation, identification and inoculation of the causal organism.

Materials and methods

Isolation and identification of the pathogen

Infected capsules of *E. cardamomum*, cultivated in Theni district of Tamil Nadu state and Idukki district of Kerala state in India were collected in June to July of the year 2016. The infection, resembling anthracnose was examined for the presence of causal organism. Sections of the infected capsules were placed onto potato dextrose agar (PDA) plates, under aseptic conditions and incubated at 28±2° C. The colonies developed were identified based on the morphology of the fungi and microscopic observation.

Pathogenicity test

The pathogenicity of the isolated fungi was evaluated. The conidia of the pathogen were harvested from 5-days-old pure culture. Healthy capsules of cardamom (25 in number) were surface sterilized with 1% sodium hypochlorite for 2 min and washed thrice with sterile water. The moistened capsules were sprayed with the spores of the pathogen (1×10^6 cfu/ml). As control, 25 capsules were immersed in sterile water. The capsules were incubated at room temperature in a moist chamber and periodically observed for the symptoms of infection. On development of symptoms, sections of the infected capsules were examined microscopically, and for confirmation of pathogenicity the fungus was re-isolated. The pathogenicity test was repeated thrice.

Results

The infection was widespread in both districts. Nearly 40% of plants were infected. Infected plants are shown (Fig 1A & B). The infected part of the capsules showed watery, mucilaginous patches with sunken regions of black spots of size range 2–7 mm (Fig 1C). On PDA the isolated pathogen grew as a greyish colony with sparse aerial mycelium (Fig 2A). The microscopic nature of the fungus showed the presence of circular or clavate appressoria of size 12.5–14.5 × 9.5–12 µm. The setae were falcate, and fusiform conidia with obtuse apices, measured 15.5–26.5 × 4–5 µm (Fig 3A-C).

Based on the cultural morphology and microscopic observation, the causal organism was identified as *Colletotrichum falcatum* Went. (Sutton 1980). The pathogenicity of *C. falcatum* was confirmed by inoculating the conidia of the pathogen onto healthy capsules of cardamom. The symptoms showed watery, mucilaginous, yellow spots on the fourth day of inoculation, followed by sunken surface and black spots in the following days (Fig 2B). The pathogenicity of *C. falcatum* was confirmed by re-isolating and identifying the fungus again.

Discussion

The causative agent of anthracnose in infected capsules of cardamom in India was identified as *C. falcatum* based on the morphology and microscopic observation. Evaluation of the pathogenicity of *C. falcatum* by re-infecting healthy capsules affirmed the fungus as the causative agent of anthracnose in cardamom.

Filamentous fungi of the genus *Colletotrichum* are considered as major plant pathogens worldwide, causing significant damage to crops and the economy. Gautam (2014) reported the pathogenesis of different species of *Colletotrichum* viz., *C. gloeosporioides*, *C. capsici*, *C. falcatum*, *C. truncatum*, *C. sansevieriae*, *C. acutatum* and *C. coccodes* on different plant species in

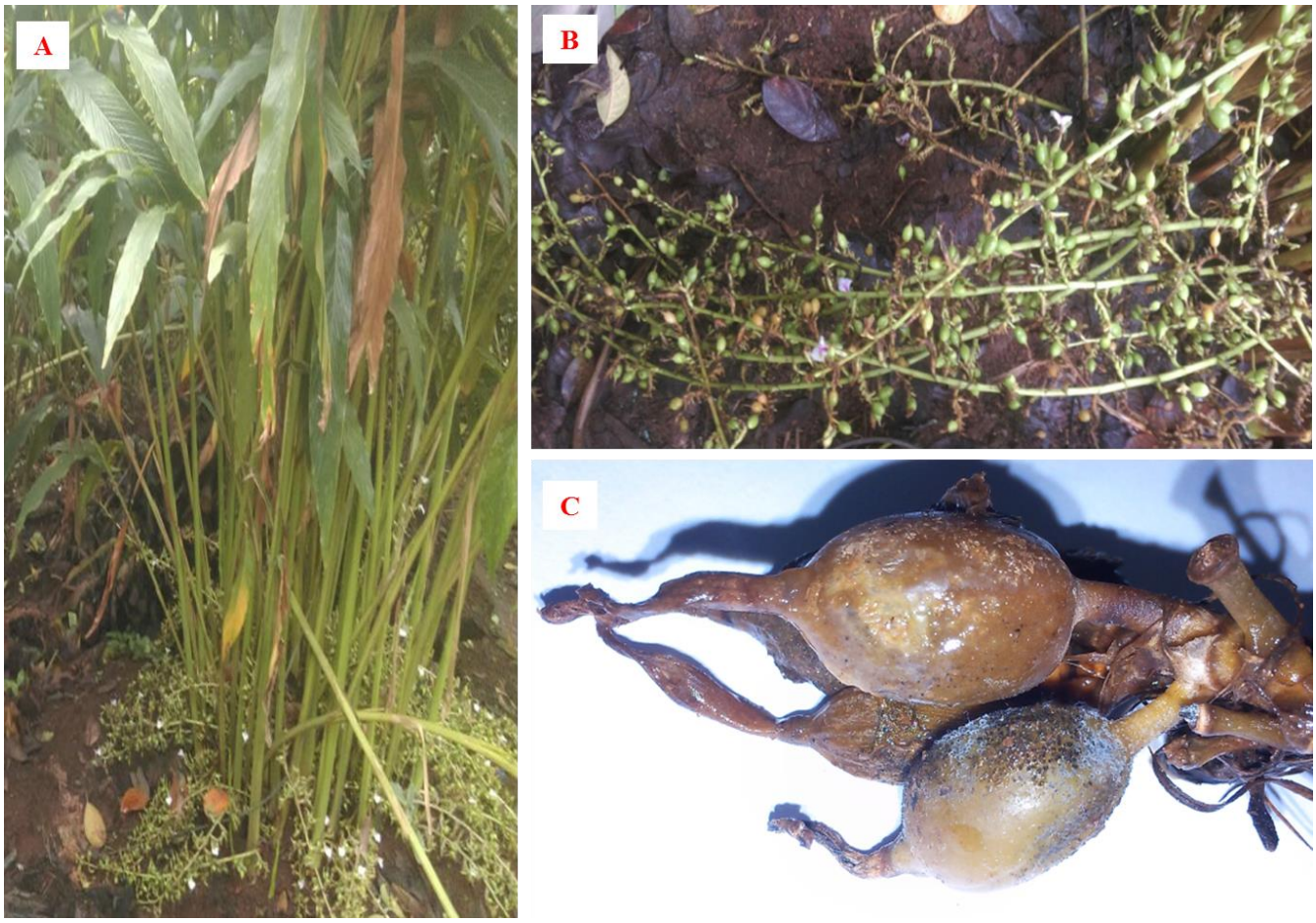

Fig 1 – A Habit of cardamom plant. B & C Infected cardamom.

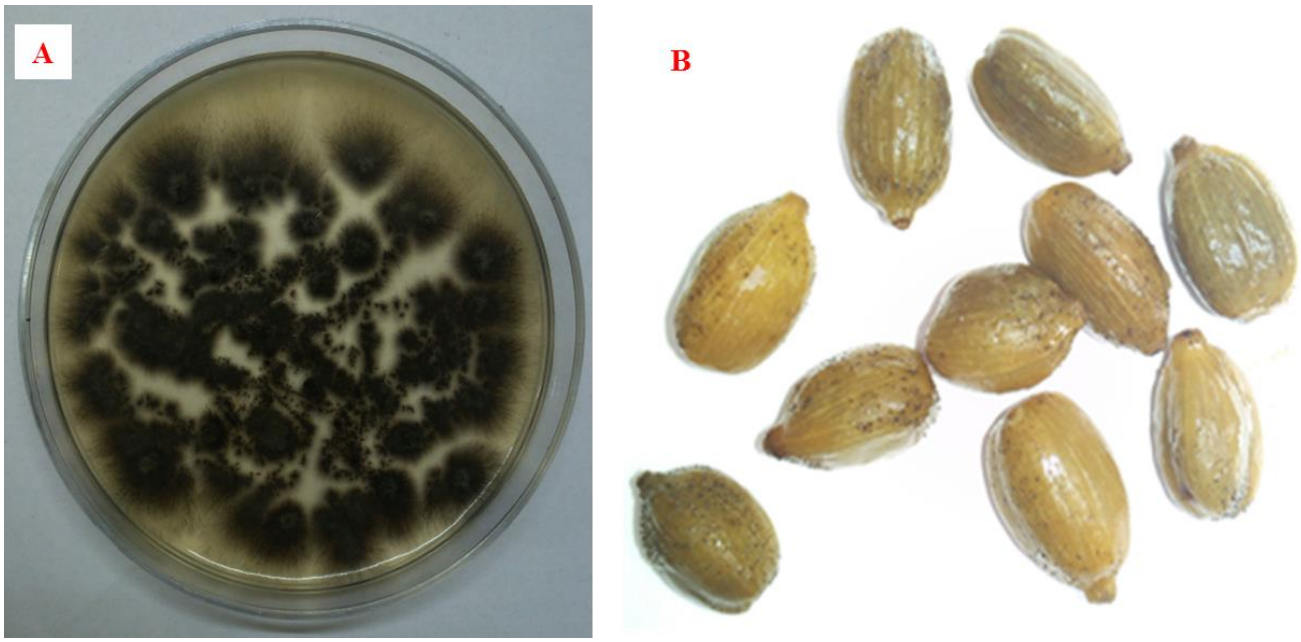

Fig 2 – A *Colletotrichum falcatum* on PDA. B Recurrence of symptoms on healthy capsules

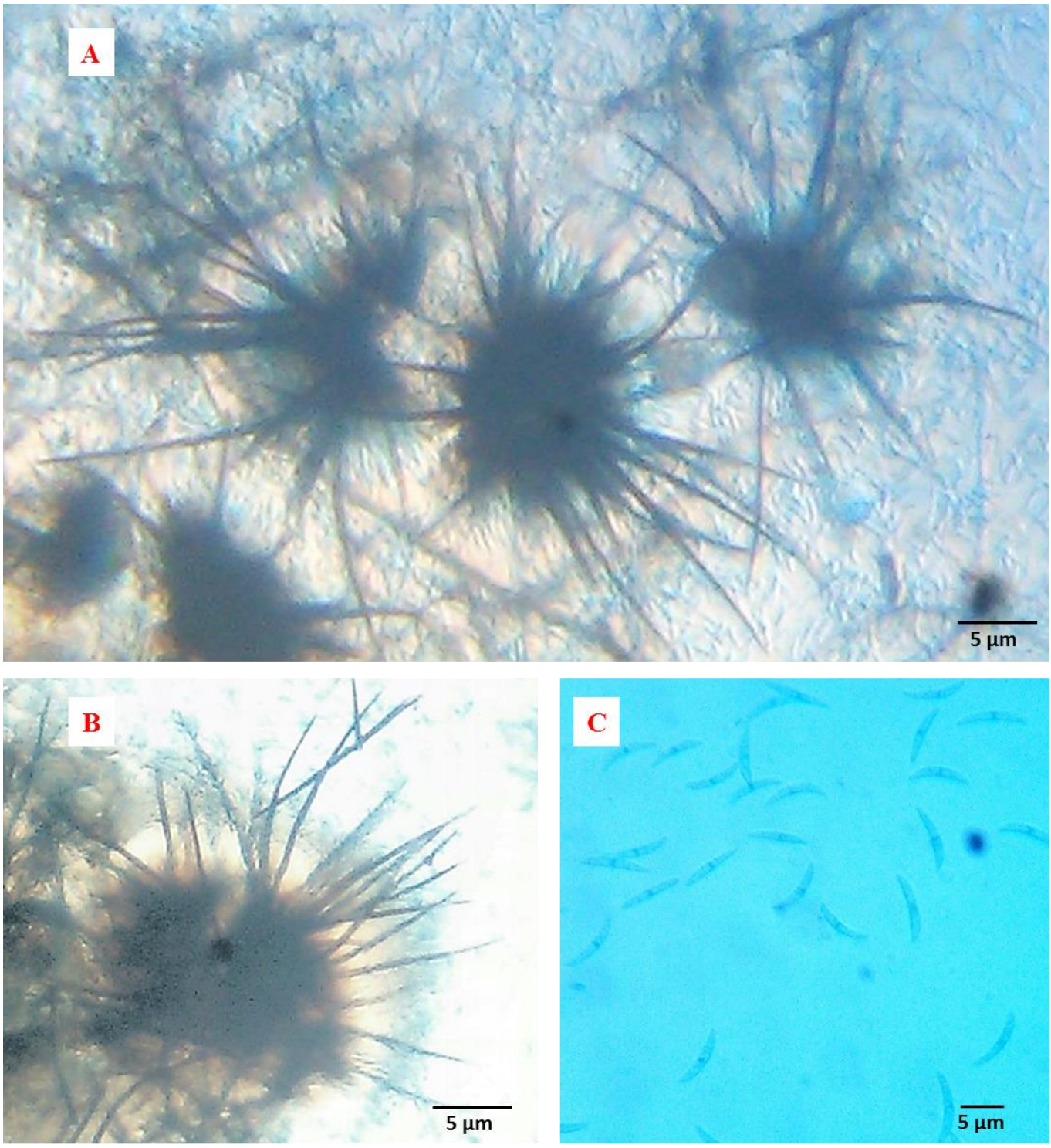

Fig 3 – Conidia. A Setae. B, C Conidiospores of *C. falcatum*

India. Species of *Colletotrichum* have the potency to infect diverse hosts as they can easily adapt to new environmental conditions (Yan et al. 2015). Though *C. falcatum* is reported to cause red rot in *Saccharum officinarum* (Barber 1901), there are no reports on the pathogenicity of *C. falcatum* on any other plant. It is alarming to note that the spread of *C. falcatum* on other hosts may give rise to further damage of crops. Previously, C. *gloeosporioides* was reported to cause anthracnose in cardamom (Suseela 1988). This is the first report of *C. falcatum* causing anthracnose on cardamom, suggesting the inclusion of *C. falcatum* as one of the pathogens on cardamom.

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