

# Characterisation of *Colletotrichum siamense* TD1 causing anthracnose leaf spots of *Camellia tamdaoensis* Ninh et Hakoda at the Tam Dao National Park

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Received 29 December 2021; accepted 1 March 2022

## Abstract:

*Camellia* L. is a precious medicinal plant with 16 different species and high economic value. In Tam Dao National Park, Vinh Phuc, *Camellia* L. is rich in ingredients. Anthracnose is a severe disease caused by fungi on the leaves of *Camellia* L., however, research of the fungus causing anthracnose on leaves of *Camellia* L. in Vietnam remains limited. In this study, anthracnose-infected leaves of *Camellia tamdaoensis* Ninh et Hakoda in Tam Dao National Park were collected, and the causative agent was isolated. Eleven fungal strains that cause anthracnose were obtained through gene sequence identification of the internal transcribed spacer (*ITS*) region. One fungal strain was selected to isolate DNA and determine the gene sequence of the *ITS* region. Based on this *ITS* sequence, the causative agent on leaves of *C. tamdaoensis* Ninh et Hakoda was *Colletotrichum siamense* TD1. The *ITS* sequence was determined to be 522 bp in length, 52.30% of guanine-cytosine (GC) content, and was registered on GenBank with accession number OK560718. Pathogenicity tests were conducted to fulfill Koch's postulates. This is the first report of anthracnose leaf spots of *C. tamdaoensis* Ninh et Hakoda caused by *C. siamense* TD1 in Vietnam. The results of anthracnose fungi provide helpful information for disease management and are necessary for future studies on selecting disease-resistant varieties of *Camellia* L.

**Keywords:** anthracnose, *Camellia tamdaoensis* Ninh et Hakoda, *Colletotrichum siamense*, golden camellia, Tam Dao National Park.

**Classification numbers:** 3.1, 3.4

## 1. Introduction

Golden camellia belongs to the *Camellia* L. genus, Theaceae family. They are shrubs and small-sized trees that are naturally distributed in Vietnam. Its benefits are well-known in traditional medicine for improving human health. In Tam Dao, a large number of *Camellia* species were discovered in the National Park and natural zone [1]. Especially, *C. tamdaoensis* Ninh et Hakoda is one of the many unique plants scattered in the forest of this mountain. In recent years, anthracnose has become one of the most severe fungal diseases globally and severe anthracnose symptoms can be seen on the leaves of the *Camellia* genus. The first observed symptom appears as random chlorotic spots on leaves after which they coalesce and form large spots. The visual spots become dark brown or black depending on damage level [2]. In the past, morphological characters and host ranges were mainly used to classify the *Colletotrichum* species [3]. They were conidial, conidiophore, and acervuli morphology or sensitive to benomyl [4, 5]. However, it is challenging to identify taxonomies based on the morphological differences of *Colletotrichum* species because their morphological characteristics were strongly affected by both laboratory and

natural conditions. Currently, molecular tools give biologists many advantages to rapidly recognise *Colletotrichum* species at the genus level [3]. The nuclear *ITS* regions have been used to separate *Colletotrichum* species [4]. In this study, we aimed to collect a leaf with a disease related to anthracnose of *C. tamdaoensis* Ninh et Hakoda and describe the symptoms of this disease. Then, the fungal pathogen was isolated on a specific medium and molecular identification was performed based on sequencing the *ITS* sequence. Consequently, *C. tamdaoensis* Ninh et Hakoda was reinfected with the fungus to test pathogenicity ability.

## 2. Materials and methods

### 2.1. Collection of the disease leaf and describe the symptoms

*C. tamdaoensis* Ninh et Hakoda plant with anthracnose leaf spots were obtained from the Tam Dao National Park, Tam Dao district, Vinh Phuc province in May 2021. The symptoms of anthracnose disease were observed with an increase from small brown spots to black necrotic spots appearing on the leaf and stem. Diseased leaves of *C. tamdaoensis* Ninh et Hakoda were taken from these infected plants, packed in a

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# Characterisation Of Colletotrichum Species Causing

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## **Characterisation Of Colletotrichum Species Causing:**

Plant, Soil and Microbes in Tropical Ecosystems Suresh Kumar Dubey, Satish Kumar Verma, 2021-09-25 This book describes the multitude of interactions between plant soil and micro organisms It emphasizes on how growth and development in plants starting from seed germination is heavily influenced by the soil type It describes the interactions established by plants with soil and inhabitant microbial community The chapters describe how plants selectively promote certain microorganisms in the rhizospheric ecozone to derive multifarious benefits such as nutrient acquisition and protection from diseases The diversity of these rhizospheric microbes and their interactions with plants largely depend on plant genotype soils attributes and several abiotic and biotic factors Most of the studies concerned with plant microbe interaction are focused on temperate regions even though the tropical ecosystems are more diverse and need more attention Therefore it is crucial to understand how soil type and climatic conditions influence the plant soil microbes interaction in the tropics Considering the significance of the subject the present volume is designed to cover the most relevant aspects of rhizospheric microbial interactions in tropical ecosystems Chapters include aspects related to the diversity of rhizospheric microbes as well as modern tools and techniques to assess the rhizospheric microbiomes and their functional roles The book also covers applications of rhizospheric microbes and evaluation of prospects improving agricultural practice and productivity through the use of microbiome technologies This book will be extremely interesting to microbiologists plant biologists and ecologists

*Plant Pathogenic Fungi: Molecular Systematics, Genomics and Evolution* Sajeewa S. N. Maharachchikumbura, Chia-Lin Chung, Hyang Burm Lee, Hiran A. Ariyawansa, 2022-07-14

Community Series in Plants and Microbial Communities: Diversity, Pathogens and Biological Control, Volume II Yong Wang, Amin Uddin Mridha, 2023-12-18

Challenges in Plant Disease Detection and Recent Advancements Amar Bahadur, 2024-07-17

*Plant Relationships Part B* George C. Carroll, Paul Tudzynski, 2012-12-06 Part A and Part B of the fifth of twelve volumes of The Mycota deal with the mechanisms of interactions between fungi and plants and consider pathogenic as well as mutualistic associations Nobody involved in the manipulation of plant populations can afford to ignore the fungi so pervasive and important are fungus plant interactions for the well being of plant communities both managed and natural Consequently these volumes will be of interest to a broad range of professionals involved in agriculture forestry horticulture and conservation as well as plant pathology mycology ecology and evolution

*Capsicum* Orarat Mongkolporn, 2018-08-14 *Capsicum* more commonly as chili or chili pepper is an important global vegetable and spice crop Anthracnose disease caused by a complex of *Colletotrichum* species is the major biotic stress limiting chili production in tropical and subtropical countries Anthracnose disease mainly manifests itself as a post harvest disease resulting in large necrotic lesions on the fruit This disease is mainly controlled by the application of a cocktail of fungicides as commercial resistant cultivars are not available In recent years insights into the complexity of the pathogen and the genomics of the host have been accomplished using cutting edge molecular technologies

The author has been at the forefront of this technology revolution in Capsicum breeding through her research to understand the host and pathogen which has led to the development of new anthracnose resistant genotypes Capsicum Breeding Strategies for Anthracnose Resistance is structured based on a review of the origin and evolution of Capsicum Capsicum genetic diversity and germplasm resources the latest research in the biology and taxonomy of Colletotrichum pathogens of Capsicum and the classic and molecular breeding for resistance in Capsicum to the suite of Colletotrichum pathogens that infect Capsicum globally This book brings together knowledge on both the pathogen and the host which is often overlooked when reviewing the breeding and genetics of a crop plant It informs the facts behind breeding for resistance from both the host and pathogen perspectives **Australian Journal of Agricultural Research** ,1998 **Traditional and Molecular Characterization of Variability in Colletotrichum Lindemuthianum** Ricardo Silveiro Balardin,1997 **Plant-fungal interactions** Dong-Qin Dai,Samantha Chandranath Karunarathna,Nakaran Suwannarach,2023-08-16 **Capsicum** Aman Dekebo,2020-10-14 Capsicum also known as chili or bell pepper is one of the most economically important vegetable crops worldwide due to its antioxidant anti inflammatory and anticancer properties This book provides information on many aspects of this plant such as its botanical information nutritional values bioactive compounds pharmacology cultivation its use in treating diseases and its applications in the food and pharmaceutical industries *Phytopathology* ,1922 Some issues accompanied by lists of members of the society **The Identification and Characterization of Pest Organisms** D. L. Hawksworth,1994 The identification of and relationship among pest organisms and their natural enemies is an essential prerequisite for the development of sustainable methods for their control Biosystematics is the basis for management of biodiversity in sustainable agriculture There is a vast armory of techniques available to the biosystematist and this book is the first major review of the applications and potential of the methods now in use ranging from the morphometric and ultrastructural to isozymes and DNA sequencing This volume consists of 34 papers presented at the Third Workshop on the Ecological Foundations of Sustainable Agriculture WEFSA III organized by CAB INTERNATIONAL and the Systematics Association held in June 1993 The book is divided into four parts biosystematic services biosystematic information biosystematic characters and biochemical and molecular biosystematics It demonstrates how biosystematics can contribute to improved crop protection and which techniques are appropriate to address particular identification problems and makes recommendations for future actions *Colletotrichum* Dov Prusky,Stanley Freeman,Martin B. Dickman,2000 Linking the past present and future of Colletotrichum systematics The importance of phylogeny in understanding host relationships within Colletotrichum Genetic regulation of sexual compatibility in Glomerella graminicola Vegetative compatibility in Colletotrichum Dissecting the cell biology of Colletotrichum infection processes Early molecular communication between Colletotrichum gloeosporioides and its host Regulation of melanin biosynthesis genes during appressorium formation by Colletotrichum lagenarium Colletotrichum as a model system for defining the genetic basis of fungal symbiotic life styles

Genetic diversity and host specificity of Colletotrichum species on various fruits Inter and intra species variation in Colletotrichum and mechanism which affect population structure Gene transfer and expression in Colletotrichum gloeosporioides causing anthracnose on Stylosanthes The endopolygalacturonases of Colletotrichum lindemuthianum Molecular characterization gene expression and elicitor activity Signal exchange during Colletotrichum trifolii alfalfa interactions Resistance mechanisms of subtropical fruits to Colletotrichum gloeosporioides Colletotrichum strains for weed control Potential for biological control of diseases caused by Colletotrichum Colletotrichum diseases of strawberries in Florida Biology and control of anthracnose diseases of citrus Occurrence and management of anthracnose epidemics cause Colletotrichum species on tree fruit crops in California Recent advances in understanding Colletotrichum diseases of some tropical perennial crops Host pathogen interaction and viability of Colletotrichum lindemuthianum Colletotrichum coccodes on potato The biology of Colletotrichum graminicola and maize anthracnose

**Proceedings of the VIIth International Protea Research Symposium** A. I. Gerber,2006 **ACIAR Technical Reports** ,2006 *Plant Relationships Part B* George Carroll,Paul Tudzynski,1997-08-06 Part A and Part B of the fifth of twelve volumes of The Mycota deal with the mechanisms of interactions between fungi and plants and consider pathogenic as well as mutualistic associations Nobody involved in the manipulation of plant populations can afford to ignore the fungi so pervasive and important are fungus plant interactions for the well being of plant communities both managed and natural Consequently these volumes will be of interest to a broad range of professionals involved in agriculture forestry horticulture and conservation as well as plant pathology mycology ecology and evolution

**The Indian Journal of Agricultural Sciences** ,2015 *Genetic Diversity of Colletotrichum Gloeosporioides Penz. Causing Anthracnose Disease of Yam (Dioscorea Spp.) in Nigeria* Mathew Musumbale Abang,2003 Review of Applied Mycology ,1922 Vol 24 has a special part issued July 1946 issued as part 13 with sub title Common names of virus diseases used in the Review of applied mycology The pages are numbered 513 556 which duplicates the paging of the index to the same volume *Bulletin Organisation Internationale de Lutte Biologique Contre Les Animaux Et Les Plantes Nuisibles, Section Regionale Quest Paléarctique* ,2006

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