



Article

Diversity and Pathogenicity of *Colletotrichum* Species Causing Coffee Anthracnose in China

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Abstract: Coffee is a significant traded commodity for developing countries. Among the various diseases affecting coffee, anthracnose caused by *Colletotrichum* spp. has re-emerged as a major constraint on global coffee production. To better understand the *Colletotrichum* species complex associated with coffee anthracnose, we characterized *Colletotrichum* spp. using a combination of phenotypic traits, MAT1-2 (ApMat) gene analysis, multi-locus phylogenetic (ITS, ACT, CHS-1, and GAPDH), and pathogenicity assays. A total of 74 *Colletotrichum* isolates were collected from coffee plants exhibiting anthracnose symptoms across nine coffee plantations in China. Among these, 55 isolates were identified as the *C. gloeosporioides* species complex using the ApMat locus, while the remaining 19 isolates were identified through multi-locus phylogenetic analyses. The isolates represented seven *Colletotrichum* species from five species complexes: *C. gloeosporioides* (including *C. siameuse*, *C. nupharicola*, and *C. theobromicola*), *C. boninensis* (*C. karstii*), *C. gigasporum* (*C. gigasporum*), *C. orchidearum* (*C. effusicola*), and *C. magnum* (*C. brevissporum*). This is the first report of *C. nupharicola* and *C. effusicola* causing coffee anthracnose worldwide, and the first report of *C. nupharicola* in China. Pathogenicity tests confirmed that all seven species were capable of infecting coffee leaves. This research enhances our understanding of the *Colletotrichum* species responsible for coffee anthracnose, and provides valuable insights for developing effective disease management strategies.

Keywords: coffee anthracnose; *Colletotrichum* spp.; pathogenicity tests; diagnosis; taxonomy



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1. Introduction

Coffee is a major traded commodity in the developing world [1]. Three primary commercial varieties are cultivated globally: *Coffea arabica* (*arabica*), *C. canephora* var. *robusta* (*robusta*), and *C. liberica* (*liberica*) [2]. Among these, *arabica* and *robusta* are the dominant species, accounting for over 99% of global exports. Coffee was introduced to China more than a century ago, and has since become a significant cash crop in Yunnan and Hainan provinces. *Arabica* coffee is predominantly cultivated in Yunnan, while *robusta* coffee is mainly grown in Hainan [1,3].

Diseases are among the most critical factors limiting coffee production. The most prevalent and economically significant diseases include coffee rust (*Hemileia vastatrix*),

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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

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

Traditional and Molecular Characterization of Variability in Colletotrichum Lindemuthianum Ricardo Silveiro Balardin, 1997

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 *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 Plant-fungal interactions Dong-Qin Dai,Samantha Chandranath Karunarathna,Nakarin 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 **Characterization of Colletotrichum Species Causing Bitter Rot of Apples in Kentucky Orchards** Misbakhul Munir,2015 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

The Indian Journal of Agricultural Sciences ,2015 **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 *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 **Genetic Diversity of *Colletotrichum Gloeosporioides* Penz. Causing Anthracnose Disease of Yam (*Dioscorea* Spp.) in Nigeria** Mathew Musumbale Abang,2003 **Proceedings of the VIIIth International Protea Research Symposium** A. I. Gerber,2006 *ACIAR Technical Reports* ,2006

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