

1. Record Nr.	UNINA9910506381003321
Autore	Saharan G. S.
Titolo	Clubroot disease of crucifers : biology, ecology and disease management // Govind Singh Saharan, Naresh K. Mehta, Prabhu Dayal Meena
Pubbl/distr/stampa	Gateway East, Singapore : , : Springer, , [2021] ©2021
ISBN	981-16-2133-0
Descrizione fisica	1 online resource (778 pages)
Disciplina	632.3
Soggetti	Plant diseases Crucíferes Patologia vegetal Llibres electrònics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Intro -- Foreword -- Preface -- Acknowledgements -- Contents -- About the Authors -- Abbreviations -- Symbols -- 1: Clubroot Perspective -- 1.1 Introduction -- 1.2 Host Crops and Their Importance -- 1.3 The Disease and Pathogen -- 1.4 The Resting Spores -- 1.5 The Environmental Factors of the Soil -- 1.6 Soil Temperature and Other Biotic Interactions -- 1.7 Evolution of Host-Pathogen Interaction -- 1.8 The Plasmodiophora brassicae Genome -- 1.9 Historical Research Development -- 1.9.1 Studies on Clubroot Disease Discovery -- 1.9.2 Initial Scientific Studies Period (1830-1930) -- 1.9.3 Modern Era of the Twentieth Century -- i. Establishing Pathogen Biology, Host Responses, and Clubroot Management -- ii. Epidemiology, Biochemistry, and Physiology -- 1.9.4 Present Era of the Twenty-First Century -- i. Host Metabolism and Clubroot Development -- ii. Genetic of Host-Parasite Interaction -- Inheritance of Resistance -- iv. Pathotype Virulence Versus Host Resistance -- v. Molecular Mechanism of Pathogenicity -- vi. Induction of Gene in Brassica by P. brassicae -- 1.10 Challenging Aspects of Clubroot Disease Management -- 1.10.1 Interactions of Physical, Chemical, and Nutritional Factors -- 1.10.2 Interactions of

Biological Factors -- 1.10.3 Soil Suppressiveness and Conduciveness -- 1.10.4 Host Resistance -- 1.10.5 Use of Molecular Techniques -- 1.10.6 Complexities of Soil Environmental Factors -- 1.11 Pathogen Diagnosis and Quantification -- 1.12 Detection of Clubroot Pathogen -- 1.12.1 Bait Plants -- 1.12.2 Fluorescent Microscopy -- 1.12.3 Serology -- 1.12.4 Polymerase Chain Reaction (PCR) -- 1.13 Major Sources of Information on Clubroot -- References -- 2: The Disease: Clubroot -- 2.1 Introduction -- 2.2 Disease Synonymous -- 2.3 History of Clubroot Introduction and Distribution -- 2.4 Geographical Distribution.

2.4.1 Geographical Distribution of Clubroot in China -- 2.5 Economic Importance -- 2.6 Host Range -- 2.7 Symptomatology -- 2.7.1 Anatomical Symptoms -- 2.8 Disease Assessment -- 2.8.1 Disease Severity Index of Watson (1965) -- 2.8.2 Disease Assessment Scale of Ricarova et al. (2016b) -- 2.8.3 Disease Assessment scale of Linnasalmi and Toiviainen (1991) -- 2.8.4 Disease Assessment scale of Kim et al. (2016) -- 2.8.5 Disease Assessment scale of Porth et al. (2003) -- 2.8.6 Disease Assessment scale of Strelkov et al. (2018) -- 2.8.7 Disease Assessment scale in Relation to Virulence -- 2.8.8 Disease Assessment scale of Xue et al. (2008) -- 2.8.9 Scoring Scale of Wu et al. (2012) -- 2.8.10 Disease Assessment Scales of Deora et al. (2012) -- 2.8.11 Disease Assessment Scale for Root-Hair Infection of He et al. (2019) -- 2.8.12 Scoring Scale to Classify Genotypes for Resistance to *P. brassicae* (Liu et al. 2018) -- 2.9 Dissemination of Clubroot -- References -- 3: The Pathogen: *Plasmodiophora brassicae* -- 3.1 Introduction -- 3.2 Morphology of *Plasmodiophora brassicae* in Host-Pathogen Interface -- 3.2.1 Resting Spores -- 3.2.2 Zoospores -- 3.2.3 Plasmodium -- 3.2.4 Morphology of Pathogen into Host Cell -- 3.2.5 Chemical Composition of Resting Spore Wall -- 3.3 Classification and Taxonomy -- 3.3.1 Taxonomy -- 3.4 The Life Cycle of *Plasmodiophora brassicae* -- 3.5 Molecular Biology of *Plasmodiophora brassicae* -- 3.5.1 The Size of the *P. brassicae* Genome -- 3.5.2 Recombination in *P. brassicae* -- 3.5.3 Genes Discovery of *P. brassicae* -- 3.5.4 Evolutionary Position of *P. brassicae* and Other Plasmodiophorids -- 3.5.5 cDNA Cloning Approaches to Identify *P. brassicae* Genes -- 3.5.6 *Plasmodiophora brassicae* Gene Structure -- 3.5.7 Gene Functions at the Host-Pathogen Interaction -- 3.6 Molecular Biology of *Plasmodiophora brassicae* Pathogenesis.

3.7 The *Plasmodiophora brassicae* Genome and Life Stage-Specific Transcriptomics -- 3.8 Genome Characteristics of Pathotypes -- 3.9 Pathogen Dissemination -- 3.9.1 Seed -- 3.9.2 Infected Plant Material -- 3.9.3 Soil -- 3.9.4 Rain and Irrigation Water -- 3.9.5 Animal Fodder and Manure -- 3.10 In Vitro Growth of *Plasmodiophora brassicae* -- 3.11 Factor Affecting Host-Pathogen Interactions -- 3.11.1 Resting Spore Germination -- 3.11.2 Effects of Root Exudates on Resting Spore Germination -- 3.11.3 Effects of pH on Resting Spore Germination -- 3.11.4 Gall Formation -- References -- 4: Electron Microscopy and Ultra-Structures -- 4.1 Introduction -- 4.2 Electron Microscopy of Infection Process -- 4.2.1 Electron Microscopy of Hairy Root Infection -- 4.2.2 Microscopic Observations -- 4.3 Fine Structures of *Plasmodiophora brassicae* in Host Tissues -- 4.4 Symptoms of Anatomical Changes -- 4.5 Cellular Events During Gall Formation -- 4.5.1 *Plasmodiophora brassicae* Increases Cell Division within the Hypocotyl by Exploiting Existing Meristematic Activities -- 4.5.2 Changes in Vascular System Differentiation, and Implications of the Host-Pathogen Interaction -- 4.5.3 Implications of Reduced Gall Size on the Disease Progression -- 4.6 Scanning Electron Microscopy (SEM) of Clubroot Cells -- 4.6.1 Early Young Plasmodia -- 4.6.2 Young

Plasmodia -- 4.6.3 Vegetative Plasmodia -- 4.6.4 Resting Spores --
4.7 Electron Microscopy of Zoosporogenesis -- 4.8 The Ultra-Structure
of Mitosis in *Plasmodiophora brassicae* -- 4.9 Cytological Changes and
Ultra-Structures of *Plasmodiophora brassicae* in *Brassica napus*
Susceptible and Resistant Cultivars -- References -- 5: Pathogenic
Variability -- 5.1 Introduction -- 5.2 Occurrence, Distribution, and
Pattern of *Plasmodiophora brassicae* Virulence -- 5.2.1 Australia --
5.2.2 Canada -- 5.2.3 China -- 5.2.4 Czech Republic.
Czech Republic and Poland -- 5.2.5 Finland -- 5.2.6 France -- 5.2.7
Germany -- 5.2.8 India -- 5.2.9 Japan -- 5.2.10 Korea -- 5.2.11
Turkey -- 5.3 Identification and Characterization of *Plasmodiophora*
brassicae Pathotypes -- 5.3.1 Molecular Marker for Identification of *P.*
brassicae Pathotypes -- 5.3.2 Identification of Geographical Isolates of
P. brassicae by Ribosomal DNA Sequence Polymorphisms -- 5.3.3 Race
and Isolate-Specific Molecular Marker -- 5.3.4 Pathotype-Specific
Molecular Marker -- 5.4 Differential Sets -- 5.4.1 Validity of Clubroot
Differentials Sets and Isolates of Pathogen -- 5.4.2 Limitations of the
Current Host Differential Sets -- 5.4.3 Proposed Novel Clubroot
Differential Set -- 5.5 Nomenclature of Pathotypes -- 5.6 Proposed
Novel Nomenclature System of Pathotypes -- 5.7 Virulence Pattern of
Plasmodiophora brassicae Pathotypes -- 5.7.1 Virulence and Spread of
Plasmodiophora brassicae (Clubroot) in Alberta, Canada -- 5.8
Pathotype Variation Analysis Through Single Spore -- 5.9 Relationship
Between Pathogenic and Genetic Variation in *Plasmodiophora brassicae*
-- 5.10 Global Distribution of *Plasmodiophora brassicae* Pathotypes --
5.11 Analysis of *Plasmodiophora brassicae* Pathotypes Genome --
5.11.1 Genome Sequencing and Assembly -- 5.11.2 Genome
Comparison of *P. brassicae* Pathotypes -- 5.11.3 The *Plasmodiophora*
brassicae Pathotype 3 Proteome -- 5.12 Intraspecific Biodiversity of
Plasmodiophora brassicae -- 5.13 Phylogenetic Analysis of Pathotypes
-- 5.14 Polymorphisms in *Plasmodiophora brassicae* -- 5.15
Production of Pure Genotype Isolates of *Plasmodiophora brassicae* --
5.16 Virulence Pattern of *Plasmodiophora brassicae* Populations on
Cruciferous Weeds -- References -- 6: Perpetuation and Survival of the
Pathogen -- 6.1 Introduction -- 6.2 Factors Affecting Survival of
Pathogen -- 6.2.1 Effect on Resting Spores.
6.2.2 Effect on Zoospore -- 6.2.3 Effect of Soil Moisture -- 6.2.4 Effect
of Temperature -- 6.2.5 Effect of Light Intensity -- 6.2.6 Effect of Soil
Texture and Structure -- 6.2.7 Effect of Spore Load -- 6.2.8 Effect of
Pathogenic Variability -- 6.2.9 Effect of Host Resistance -- 6.2.10
Effect of pH, Calcium, and Magnesium -- 6.2.11 Effect of pH, Acidity,
and Alkalinity -- 6.2.12 Effect of Boron -- 6.2.13 Effect of Nitrogen,
Calcium Cyanamide, Molybdenum, Calcareous Seaweed, and Plant
Growth Regulators -- 6.2.14 Effect of Biological Soil Constituents --
6.2.15 Effect of Host and Non-host Plants -- 6.2.16 Effect of
Traditional and Modern Technology -- 6.2.17 An Over View --
References -- 7: Infection and Pathogenesis -- 7.1 Introduction -- 7.2
Process of Infection and Pathogenesis -- 7.2.1 Root-Hair Infection
Process -- 7.2.2 Cortical Infection Process -- 7.2.3 Symptom
Development and Clubroot Severity -- 7.2.4 Quantification of Resting
Spores -- 7.2.5 Effect of Temperature on Cortical Infection by *P.*
brassicae and Clubroot Severity -- 7.2.6 Effect of Host Resistance on
Cortical Infection -- 7.2.7 Induction and Role of Metabolites in
Clubroot Host-Parasite Interaction -- 7.2.8 Role of Host Hormone
Metabolism in Pathogenesis -- 7.2.8.1 Auxin Metabolism and Signaling
-- 7.2.8.2 Cytokinin Metabolism -- 7.2.8.3 Role of Other Plant
Hormones -- 7.2.8.4 Hormonal Responses to *P. brassicae* Infection in
Brassica Cultivars Differing in Resistance -- 7.2.9 Role of Nitrilase in

Clubroot Development -- 7.2.10 Transcriptome Analysis of Arabidopsis Clubroots Indicates a Key Role for Cytokinins in Disease Development During the P... -- 7.2.11 Role of Host Resistance in Modulating Colonization of *P. brassicae* -- 7.2.12 Role of a Serine Protease pro 1 in *P. brassicae* Pathogenesis -- 7.2.13 Role of Lipids in *P. brassicae* Pathogenesis.
7.2.14 Relationship of Endogenous Glucosinolate Content to *P. brassicae* Infection.
