Root-lesion nematodes of the genus *Pratylenchus* are recognised worldwide as one of the major constraints of crops of primary economic importance, including banana, cereals, coffee, corn, legumes, peanut, potato and many fruit trees. *Pratylenchus* spp. rank second behind root-knot and cyst nematodes as causing greatest economic damage to crops worldwide. This is not only due to their wide host range, but also because of their distribution in almost every temperate and tropical environment. They are migratory endoparasites feeding primarily in the cortical parenchyma of roots and thereby causing severe damage on a wide range of crops. This book comprises ten chapters and presents summarised and specialised information on various aspects of the root-lesion nematodes belonging to the genus *Pratylenchus*. Chapter 1 describes the importance of *Pratylenchus* species in agricultural crops and their world distribution. Chapter 2 presents general morphology and diagnostic traits of *Pratylenchus* spp. and their usefulness in taxonomy. This chapter also includes morphometric and cluster analyses in order to separate groups of species so as to facilitate identification. Chapter 3 analyses the taxonomy and systematics of *Pratylenchus* and includes a list of nominal species. Chapter 4 provides descriptions and complete measurements of all populations characterised for each species, as well as data on their world distribution. Chapter 5 includes comprehensive tabular and dichotomous keys for species identification. Whilst recognising the complexity of creating a system to identify such a large number of species, we are nevertheless confident that, by using both systems, the reader has the necessary information to identify the species of *Pratylenchus* with which they are dealing. Chapter 6 summarises new diagnostic technologies based on biochemical and molecular analyses, which are becoming increasingly important for practical identifications. Chapter 7 includes numerous aspects of the biology of *Pratylenchus* spp., life cycle, epidemiology and ecology. Chapter 8 is a complete revision of the host-parasite relationships between *Pratylenchus* spp. and herbaceous and woody plants. Chapter 9 presents the pathogenicity and damage caused by *Pratylenchus* spp. to crops, as well as their interactions with beneficial and pathogenic fungi and other nematodes. Finally, Chapter 10 summarises various management strategies for *Pratylenchus*, including crop rotation, host-plant resistance, chemical control, soil solarisation and biological control by means of nematophagous fungi, entomopathogenic nematodes, the hyperparasitic bacteria *Pasteuria penetrans* and nematicidal plants.

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Dedication

The authors dedicate this book to our parents, *José M^a* and *Gregoria* and *Athanasio* and *Polixena*, as a way to express our innermost gratitude for their efforts and sacrifices during their lives and the permanent support they demonstrated for us.

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About the authors

Pablo Castillo was born in Castillo de Locubín, province of Jaén, southern Spain, in June 1960. He received his B.Sc. in Biology at the University of Granada, Spain, in June 1984 and his Ph.D. in Nematology at the University of Granada in December 1988. He joined the Department of Crop Protection at the Centre for Agricultural Research and Formation in Granada from the regional government of Andalusia in 1989. In 1990 he was recipient of the Phytopathological Research Award 'Antonio Ciccarrone', from the Mediterranean Phytopathological Union, and in 1992 moved to Córdoba (Spain) to the Department of Crop Protection at the Institute of Sustainable Agriculture belonging to the Spanish Council for Scientific Research, where he is now a research scientist.

Castillo's research has focused primarily on plant-nematode and nematode-soil-borne fungi interactions, as well as diagnosis of nematode diseases, host-parasite relationships and nematode control by means of strategies compatible with sustainable agriculture. He has produced more than 65 peer-reviewed research articles and recently co-authored a comprehensive monograph of the plant-parasitic nematode genus *Rotylenchus*.

Nicola Vovlas was born in Distraton-Arta, Greece, in October, 1944. He received his university degree in Agricultural Sciences in Italy from the University of Naples in 1968. From 1977 to 1991 he held the position of researcher at the Istituto di Nematologia Agraria di Bari where he currently serves as a research leader. His research interests include nematode taxonomy, biology and host-parasite relationships. Currently his responsibilities include teaching nematology, taxonomy, biology and nematode interactions. He is an active member of the Society of Nematologists, the Organisation of Tropical American Nematologists and the European Society of Nematologists (he also served for 4 years as active member of the governing board of this society) and currently is on the editorial board of the *International Journal of Nematology and Helminthologia*. His research activities have resulted in nine contributions to national and 30 to international meetings, and 95 national journal and 116 international journal articles. He contributed to the CABI Publishing Crop Protection Compendium and recently co-authored a comprehensive monograph of the plant-parasitic nematode genus *Rotylenchus*.

Preface

It is a pleasure for us, as Series Editors, to introduce the second monograph on plant-parasitic nematodes by Pablo Castillo and Nicola Vovlas, the first being on the genus *Rotylenchus*. This volume, the sixth in the *Nematology Monographs and Perspectives* series, follows the same, highly successful pattern as its predecessor and, in dealing with *Pratylenchus*, a genus of such worldwide economic importance, will be of great assistance to nematologists, agronomists and plant pathologists. This volume covers the morphology and systematics of the genus and provides full descriptions of all 68 species considered to be valid by the authors. All species are illustrated by line drawings and, in some cases, light micrographs. In addition, distribution data and associated hosts are also provided together with a comprehensive bibliography. Dichotomous and tabular keys to the valid species are provided. Management options for these nematodes are discussed in detail and include biological methods as well as rotation strategies, resistant/tolerant varieties and chemical control.

In the Preface to the authors' previous monograph on *Rotylenchus*, Michel Luc commented: "It is to be hoped that the present work will serve as a model for future monographs on other genera of plant-parasitic nematodes". That hope has now been fulfilled.

David J. Hunt and Roland N. Perry
Harpenden, UK
March 2007

Foreword

Root-lesion nematodes of the genus *Pratylenchus* are recognised worldwide as one of the major constraints of crops of primary economic importance, including banana, cereals, coffee, corn, legumes, peanut, potato and many fruits. *Pratylenchus* species rank second only to root-knot and cyst nematodes as having greatest economic impact on crops worldwide. This is not only due to their wide host range, but also to their distribution in almost every cool, temperate and tropical environment. They are migratory endoparasites that cause severe root damage on a wide range of crops whilst feeding primarily in the cortical parenchyma.

The genus *Pratylenchus* comprises 68 nominal species of worldwide distribution that parasitise a wide variety of plants. Nevertheless, the majority of economic damage to herbaceous, vegetables and fruit crops throughout the world is attributable to a dozen of the most common species, including *P. brachyurus* in corn, cotton, peanut, pineapple, potato and tobacco; *P. coffeae* in coffee, citrus, sugarcane and tea; *P. goodeyi* in banana; *P. neglectus* in cereals and legumes; *P. penetrans* in grasses, forages, fruit trees and strawberries; *P. pratensis* in cereals, grasses, ornamentals and strawberries; *P. scribneri* in potato, soybean and strawberries; *P. thornei* in cereals and legumes; *P. vulnus* in pome and stone fruit trees, ornamentals and roses; and *P. zae* which parasitises corn, rice, sugarcane and wheat.

The book comprises ten chapters and presents summarised and specialised information on various aspects of the root-lesion nematodes belonging to the genus *Pratylenchus*. Chapter 1 describes the importance of *Pratylenchus* species in agricultural crops and their world distribution. Chapter 2 presents general morphology and diagnostic traits of *Pratylenchus* spp. and their usefulness in taxonomy. This chapter also includes morphometric and cluster analyses to separate groups of species in order to facilitate identification. Chapter 3 analyses the taxonomy and systematic position of *Pratylenchus* and related genera, including a list of nominal species. Chapter 4 provides complete descriptions and morphometrics of all populations characterised for each species, as well as their world distribution. Chapter 5 includes comprehensive tabular and dichotomous keys for species identification. Whilst recognising the com-

plexity of creating a system to identify such a large number of species, we are nevertheless confident that, by using both systems, the reader has the necessary information to identify the species of *Pratylenchus* with which they are dealing. Chapter 6 summarises new diagnostic technologies based on biochemical and molecular analyses, which are becoming increasingly important for practical identifications. Chapter 7 includes numerous aspects of the biology of *Pratylenchus* spp., life cycle, epidemiology and ecology. Chapter 8 comprises a complete revision of the host-parasite relationships between *Pratylenchus* spp. and herbaceous and woody plants. Chapter 9 presents the pathogenicity and damage of *Pratylenchus* spp. to crops, as well as their interactions with beneficial and pathogenic fungi and other nematodes. Finally, Chapter 10 illustrates different management strategies for *Pratylenchus* species, including crop rotation, host-plant resistance, chemical control, soil solarisation and biological control by means of nematophagous fungi, entomopathogenic nematodes, the hyperparasitic bacterium *Pasteuria penetrans* and nematocidal plants.

Pablo Castillo and Nicola Vovlas
Córdoba, Spain
November, 2006

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Since the major portion of this book was completed at home, we would like to express our deep gratitude and indebtedness to our wives and the rest of our families for the neglect and loss they endured during the preparation of this second book in the last 3 years and for all the support they provided. We know that words are not enough to make up for this loss, but it is the only thing that we can do here and now. Likewise, we thank our colleagues and friends from the Institute of Sustainable Agriculture, Consejo Superior de Investigaciones Científicas (CSIC), Córdoba (Rafael M. Jiménez Díaz, Juan A. Navas Cortés and Blanca B. Landa del Castillo) and the Institute for Plant Protection, Nematology Section, Consiglio Nazionale delle Ricerche (CNR), Bari (Alberto Troccoli and Franco Elia), for their help, suggestions and interest in this book. We also thank Dr R.N. Inserra for his help and Dr Deliang Peng for his contribution to the translation of papers in the Chinese language.

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Finally, we are grateful to the journals for allowing reproduction of illustrations and to the many nematologists who, through their work on this genus, have contributed to a better knowledge of diagnosis, biology, parasitism, ecology and management of the many species included in the genus *Pratylenchus*.

Pablo Castillo¹ and Nicola Vovlas²

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