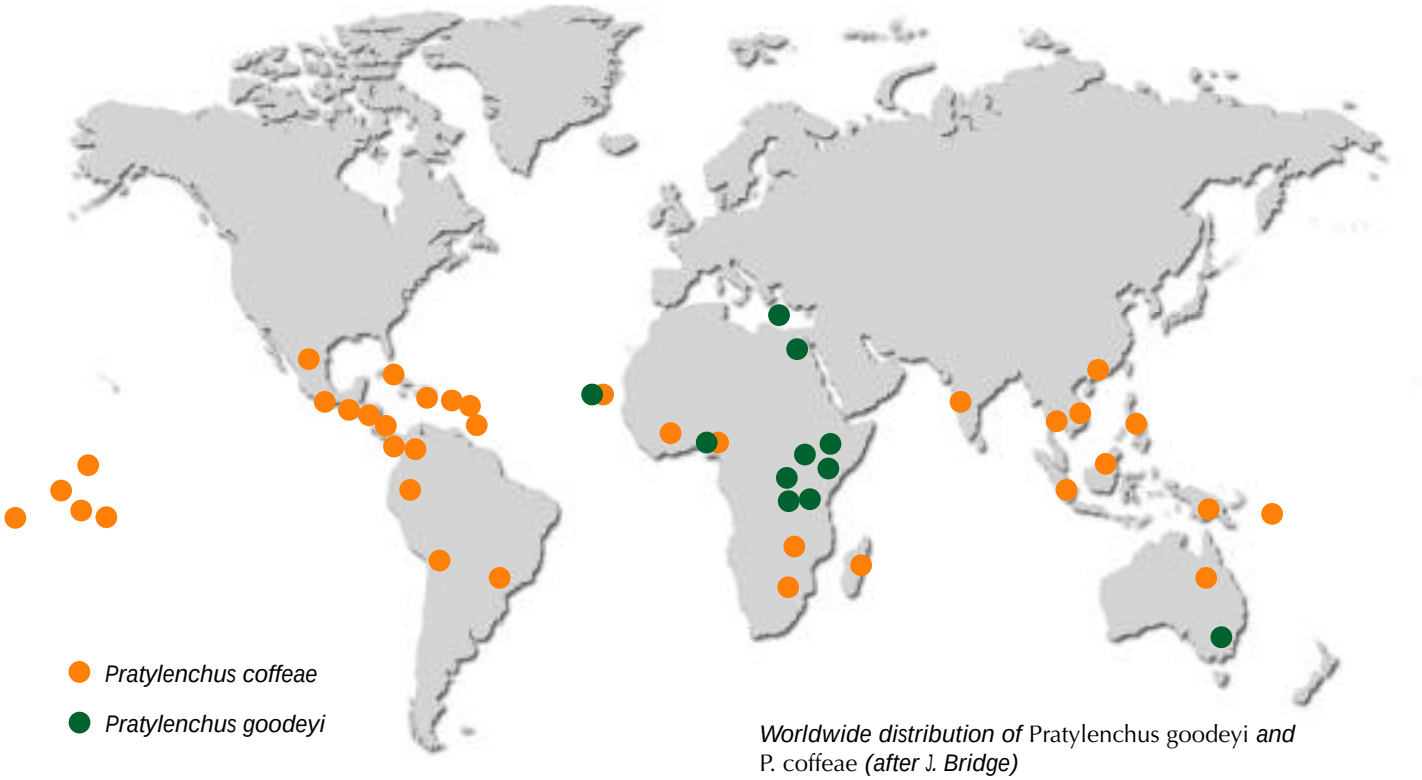
# THE ROOT LESION NEMATODES OF BANANA

## *Pratylenchus coffeae* (Zimmermann, 1898) Filip. & Schu. Stek., 1941

## *Pratylenchus goodeyi* Sher & Allen, 1953

John Bridge, Roger Fogain and Paul Speijer (November 1997)




*Worldwide distribution of* Pratylenchus goodeyi *and* P. coffeae *(after J. Bridge)*

The root lesion nematodes *Pratylenchus coffeae* and *Pratylenchus goodeyi* are both major pests of *Musa* wherever they occur. The damage they cause is very similar to that caused by the other important banana root nematode pest *Radopholus similis.*

## Distribution

*P. coffeae* is probably a native of the Pacific and Pacific Rim countries but now has a world wide distribution, almost equal to that of *R. similis* although more clustered (see map). It is most likely that it has been spread around the world on commercial banana planting material. In the Pacific Island countries, it is the most important nematode species affecting both diploid and triploid bananas. It is also a significant pest in parts of South East Asia, being the major nematode species affecting Pisang Awak (*Musa* ABB) in Thailand, while in Central and South America it is the most important nematode species affecting Cavendish cultivars (*Musa* AAA) in Honduras. In Africa, although it is widespread and important in South Africa and in Ghana, where it is reported to cause up to 60% production loss in the plant crop of plantains (*Musa* AAB), in other African countries its distribution is very localized indicating that it is probably a recent introduction here. In West Africa, *P. coffeae* generally occurs in mixed populations with *Helicotylenchus multicinctus*, *Radopholus similis* and *Meloidogyne* spp. This nematode species has an extremely wide host range and is also a major pest on other crops such as yams, ginger, turmeric, abaca and coffee.

*P. goodeyi*, in contrast to *P. coffeae*, has a much more restricted distribution. It is considered to be indigenous to Africa where it is limited to the higher elevation zones of Central, Eastern and West Africa. It is an

*Blackened and necrosed roots of banana caused by* Pratylenchus coffeae *in Papua New Guinea (photo J. Bridge)*

important pest of highland bananas (*Musa* AAA, Matooke and Mbidde groups) in Uganda, Tanzania, Kenya, Rwanda and Burundi; of both highland bananas and plantains in Cameroon, and of *Ensete* in Ethiopia. *P. goodeyi* is also the main nematode species affecting Cavendish bananas in the Canary Islands and it has been found on Madeira, in Egypt and in Crete. Elsewhere, it has been recorded from one site in Australia (New South Wales) only. *P. goodeyi* has a lower temperature preference than either *P. coffeae* or *R. similis* and its distribution is closely linked to altitude and the higher latitudes of the cooler banana growing areas. In Cameroon the lower altitudinal limit of *P. goodeyi* is 700 metres above sea level (masl), while in Uganda at elevations of 1500 masl and above it is often the only nematode species found in banana roots and its densities can easily exceed 100,000 per 100 g fresh roots. In East and West Africa, *P. goodeyi* represents a pest almost exclusively of small holder cultivation and it is generally absent from the commercial banana plantations of the lowland areas. This would explain why the species has not been widely disseminated, as have *R. similis* and *P. coffeae*, on commercial banana planting material. However, *P. goodeyi* has the potential to become an important pest of bananas where they are grown in the cooler climatic zones of the Mediterranean and Middle Eastern countries and it probably does occur at altitude in other countries of Africa.

*Poor growth and toppling of East African Highland bananas seriously infested with* Pratylenchus goodeyi *in Tanzania (photo J. Bridge)*

## Symptoms

*Pratylenchus coffeae* and *P. goodeyi* are both migratory endoparasites of the root cortex and corms of banana, plantain and abaca where they feed and multiply. All life stages and both sexes of the two species invade and feed in the root and corm tissues where the eggs are laid. The life cycle of *P. coffeae* is less than 30 days at 25o-30oC. Infection causes symptoms of damage similar to *Radopholus similis*: extensive black or purple necrosis of epidermal and cortical root tissues resulting in lesions and snapping of roots. Necrotic nematode lesions can also be found on the corm. The *Pratylenchus* spp. do not penetrate the root stele which normally remains white. This damage and reduction of the root system leads to stunting of plants, decreased bunch weight, lengthening of the production cycle, and toppling or uprooting. Plant toppling may considerably increase in poor soils with low nutritional content.

*Plantain planting sucker pared/cleaned to remove* Pratylenchus goodeyi *infestations prior to planting in Tanzania (photo J. Bridge)*

Reduced growth and thus soil coverage by banana plants can further reduce the soil organic matter by exposure to sunlight and an increase in soil temperature, and also result in nutrient leaching and erosion by direct rainfall, causing a declining production spiral. The presence of *P. coffeae* and *P. goodeyi* in banana root lesions is generally highly correlated with infection by fungi such as *Fusarium* spp., including *F. oxysporum*, *F. redolens*, *F. sambucium*; *Nigrospora musae* and *Rhizoctonia solani*. *P. goodeyi* is also associated with bacterial wilt of *Ensete*. This disease, caused by *Xanthomonas campestris*, is highly destructive as it kills plants of all growth stages. *P. goodeyi* may aggravate the disease expression and play a role in the spread of the disease.

## Pathogen diversity

*P. coffeae* appears to multiply freely on banana and plantain cultivars including those which show resistance to *R. similis*. Biological diversity is known to occur in this species as the nematode has been found as a pest of yams in Uganda and the Pacific, but has not invaded the surrounding banana plants, indicating the existence of different biological races. In contrast, in Ghana, the same isolate of *P. coffeae* was found to affect both yam and plantain. Diversity also occurs in *P. goodeyi*, with root populations and associated damage varying greatly between different *Musa* groups and cultivars. This may be high on genetic groups such as Pelipita (ABB), Bluggoe (ABB), and Plantains (AAB) but low on others. Differences also appear to occur between geographic isolates of *P. goodeyi*. In parts of the highlands of Uganda, for example, very high densities of *P. goodeyi* can be observed in old East African highland banana stands, some of which exceed 100 years in age and remain productive. On the other

*Female (left) and male (right) individuals of* Pratylenchus goodeyi *(photo R. Fogain)*

hand, in the neighbouring part of Tanzania, relatively lower *P. goodeyi* densities are associated with a high incidence of plant toppling.

## Control measures

Eliminating *P. coffeae* or *P. goodeyi* from field soil prior to planting is difficult as the nematode has a wide host range, including the common grasses, and crops such as groundnut and sweet potato. However, the nematode is generally found in low densities of around 1 per 100 ml of soil after a bush fallow period exceeding one year.

*P. coffeae* and *P. goodeyi* densities in planting material can be greatly reduced by removing the roots and superficially paring the corms to remove the lesions. Exposure of planting material to direct sunlight for a period of two weeks further reduces the nematode densities in the planting material. However, care must be taken using this methodology, as pared suckers act as a trap for banana weevils and they can be quickly infested with weevil eggs. Additional hot-water treatment for 20 minutes, using a warm-water bath of 53°C to 55°C, eradicates almost all nematodes from the planting material. The nematicides advised for the control of *R. similis* are expected to be equally effective in control of both *Pratylenchus* spp. However, the negative environmental side effects of nematicide use must be taken into account. In addition, as *P. goodeyi* represents a pest almost exclusively of small holder cultivation in the African highlands, the use of relatively costly nematicides may not be an option for nematode control in these farming systems.

Efforts to breed for resistance to *P. coffeae* have been initiated in Honduras (FHIA), and germplasm with sources of resistance to *P. coffeae* have been identified. Identification of sources of resistance to *P. goodeyi* is underway in Cameroon (CRBP), on Canary Islands (ICIA) and in Uganda (IITA-ESARC), and resistance breeding will be initiated in Uganda (IITA-ESARC).

**Your help is needed.** INIBAP is encouraging studies on genomic and pathogenic diversity of *P. coffeae* and *P. goodeyi* to improve integrated control strategies, including breeding for resistance and possibly the use of biological control agents. You can contribute by sending root samples infested with *P. coffeae* and/or *P. goodeyi* to John Bridge or Richard Plowright (International Institute of Parasitology, Bakeham Lane, Egham, Surrey TW20 9TY, UK. E-mail: j.Bridge@cabi.org or r.plowright@cabi.org). Root samples must be shaken to remove excess soil, but not washed, placed in plastic bags, closed and sent by express mail. Details on collection date, location, cultivar and cultural practices must be included with the sample.

*In Uganda, women learn to pare suckers (photo P. Speijer)*