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# Understanding the Tolerance and Resistance to Plant Parasitic Nematodes in Coffee

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## Robusta coffee is susceptible to infection from root knot nematodes

Arabica (*Coffea arabica*) and Robusta (*C. canephora*) coffee are major crops that support the economy over 60 countries. A major detriment to coffee production is the damage caused by plant parasitic nematodes. Root-knot nematodes (*Meloidogyne* spp.) cause the induction of galls, or root knots, as they feed on modified living plant cells (Hoffmann and Grundler, 2007; Fig. 1). They are distributed worldwide, and cause approximately 15% yield losses in coffee (Wiryadiputra and Tran, 2008).

**Figure 1.** Roots of Arabica coffee which is heavily infected with root knot nematodes in the field, causing major galling (see arrows) in root tissue.

This project aims to explore the resistance and tolerance to root knot nematodes in varieties of Robusta coffee. Physiological and molecular traits identified which contribute to either resistance and or tolerance will be of interest in the development of coffee varieties which are protected from plant parasitic nematodes.

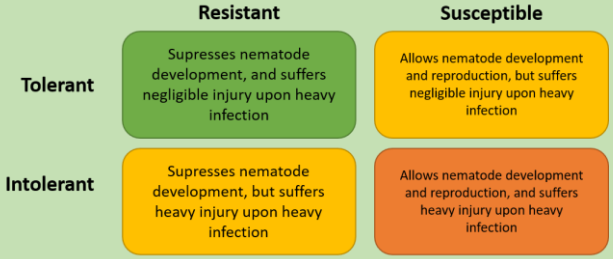


**Figure 2**. A plant can be described as resistant and/or tolerant to plant parasitic nematodes based upon the interaction between the parasite and host. Both tolerance and resistance are defined here in relation to each other, displaying the complexity of characterising the interaction.

## Varieties of Robusta coffee show a range in levels of tolerance against root knot nematodes

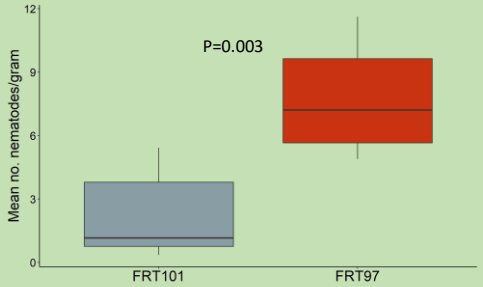


**Figure 3.** Mean number of *M. incognita* per gram of root of Robusta varieties FRT 97 (n=6) and FRT 101 (n=6), 18 weeks post inoculation with approx. 2000 juveniles. Roots of FRT 101 had significantly fewer nematodes which had developed, displaying less susceptibility to the parasite (F=14.88, p=0.003).

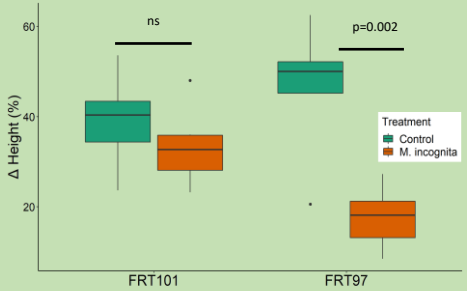


**Figure 4.** Percentage change, after 18 weeks, in the height of Robusta varieties FRT 97 (n=6) and FRT 101 (n=6) after infection with approx. 2000 juvenile *M. incognita*. While the growth of FRT 97 was significantly inhibited by *M. incognita* (F=16.75, p=0.00285), FRT 101 showed no inhibition of growth despite infection.

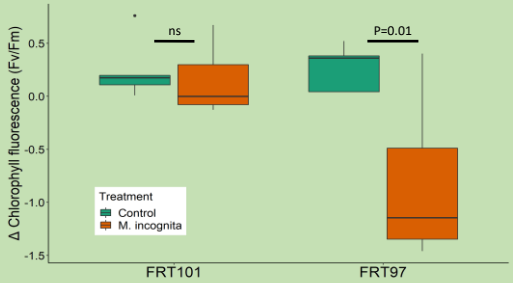


**Figure 5.** Change, after 18 weeks, in the mean chlorophyll fluorescence (Fv/Fm) of Robusta varieties FRT 97 (n=6) and FRT 101 (n=6) after infection with approx. 2000 juvenile *M. incognita*. Only FRT 97 inoculated with *M. incognita* shows a significant reduction in chlorophyll fluorescence compared to uninfected controls (F=10.44, p=0.0101).

FRT 101 shows traits suggesting partial tolerance to the root knot nematode *M. incognita*, as well as reduced susceptibility compared to FRT 97.

RNA-Sequencing is currently on-going, exploring the transcriptomes of both varieties of Robusta coffee, under long (12 weeks) and short (1 week) infection with *M. incognita*.

Genes that show differential expression across the two varieties could provide insight into the molecular mechanisms of both tolerance and resistance.

Hoffmann, J. and Grundler, F. (2007). How do nematodes get their sweets? Solute supply to sedentary plant-parasitic nematodes. Nematology, 9(4), 451-458.
Wiryadiputr, S and Tran, L. (2008). Indonesia and Vietnam. In: R. Souza, ed., Plant Parasitic Nematodes of Coffee. Dordrecht: Springer, 277-292