Robustodorus arachidis: A newly discovered seed-borne nematode on groundnut

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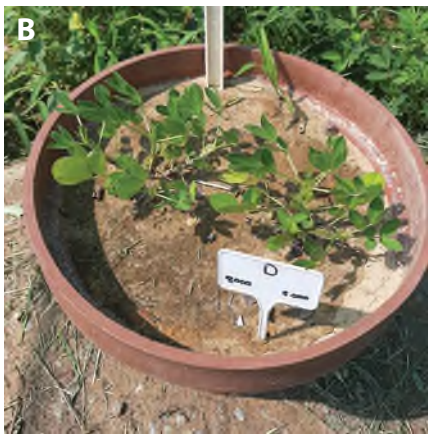
Our adventure with *Robustodorus arachidis* (*R. arachidis*) started with a photo and a book. The nematologists of the Nematological Society of Southern Africa had compiled a book about nematology in Southern Africa, to be used by scientists and scholars alike. In its chapters, it draws together our current knowledge on the plant-parasitic nematode species in the subregion.

An entire chapter is dedicated to oilseeds and legumes, which includes groundnut. Upon compilation of this chapter, an additional photo was required to illustrate the damage caused by the pod nematode on infested groundnut. For this purpose, Loureine Muller from TrioTrade in Gauteng collected badly damaged groundnut plants from a field at the Vaalharts Irrigation Scheme in the Northern Cape.

A strange-looking nematode emerges

Personnel of North-West University extracted nematodes from these pods, but the specimens found looked different. There was little sign of the expected pod nematode (*Ditylenchus africanus*, or *D. africanus*), while another strange-looking nematode occurred in its thousands within these damaged pods.

Figure 1: Similar to the plants inoculated with pod nematodes (A), those inoculated with *R. arachidis* (B) showed no above-ground symptoms.



A nematode that could apparently live with and seemingly compete against the aggressive pod nematode, instantly fascinated us. Taxonomists promptly identified this nematode as *R. arachidis*, previously known as *Aphelenchoides arachidis* (*A. arachidis*) or testa nematode, first found on groundnut in Northern Nigeria in the 1970s. Infestation of *A. arachidis* on groundnuts in Northern Nigeria devalued the quality of the crop as it caused shrivelled and discoloured kernels.

We assumed that the feeding habit of *R. arachidis* is similar to that of the pod nematode as they occur together in infested kernels. The pod nematode is seedborne and is one of the factors that limits groundnut production in South Africa, damaging kernels to such an extent that consignments can be downgraded.

The qualitative effect the additional testa nematode may have on groundnut consignments in South Africa and, consequently, the economic losses it translates to, prompted the present study on this species.

Effect of registered nematicides

Our first objective was to determine whether currently registered nematicides are efficient in keeping *R. arachidis* under control, as chemical control is not sufficient for pod nematodes. We evaluated the registered nematicides in the same field in which *R. arachidis* was originally identified.

The nematicides were applied at the time and dosage prescribed on the label and samples for nematode analysis were taken at harvesting. It was found that the trial-site maintained root-knot and lesion nematodes together with *R. arachidis* and pod nematodes. The root-knot and lesion nematodes occurred with the occasional pod nematode and *R. arachidis* in the soil and roots, while the pod nematodes and *R. arachidis* mainly resided in the pods (hulls and kernels).

Root-knot and lesion nematode numbers were significantly lower in

soil and root samples collected from plots treated with the nematicides, when compared to those collected from the untreated control plots.

In terms of *R. arachidis* and pod nematodes, however, we could see no significant differences between the various treatments and the untreated control. These results indicate that the nematicides are, similar to pod nematodes, not sufficient in keeping this nematode under control. This trial will be repeated during this season to confirm our observation.

Damage caused by *R. arachidis*

Our second objective was to determine whether the damage caused by *R. arachidis* is similar to pod nematode damage, so we can predict its potential impact on groundnut yields and consignments. It is also necessary to study the symptoms associated with *R. arachidis* so it can be recognised in the field.

In contrast to the other plant-parasitic nematodes that parasitise groundnut, pod nematodes show no above-ground symptoms. Plants inoculated with *R. arachidis* were similar in that no above-ground symptoms were visible (*Figure 1 A* and *B*).

Plants inoculated with *R. arachidis* in microplots in soil that were fumigated before planting showed similar symptoms on both the roots and the pods (*Figure 2*). Similar to pod-nematode infested seed, *R. arachidis* infested seed also germinated prematurely (*Figure 3*).

Figure 3: *R. arachidis* infested seed (left-hand side) germinate prematurely compared to the untreated control (right-hand side).

Survival of *R. arachidis*

We now know that *R. arachidis* enters into a resting phase called anhydrobiosis. In this anhydrobiotic state it can survive unfavourable conditions such as drought and low winter temperatures. Pod nematodes can survive in the hulls and seeds of groundnut throughout the cold winter months and are then able to reinfest the follow-up crop.

We wanted to determine whether *R. arachidis* has the same ability than that of pod nematodes. Harvesting of the field trials were done during May 2020. The samples were taken back to Potchefstroom and hung on a wire to dry out for at least six weeks, during which temperatures in Potchefstroom dropped to below freezing point. The pods were taken down after they had dried and were stored in a cool place until December.

Upon extraction, specimens of *R. arachidis* were found to have survived the six months. These specimens were used to inoculate groundnut to see if the nematodes were capable of causing damage to the plants and pods. The damaged plant seen on the right-hand side in *Figure 3* was inoculated with the surviving *R. arachidis*, which confirmed that this nematode could survive the cold, dry winter months, and subsequently damage the follow-up groundnut crop.

R. arachidis vs pod nematodes

At harvesting, the highest percentage of the pod nematode population will reside in the pods, and only a small portion will reside in the roots of the plant and in the soil. Interestingly, at harvesting of the field trials, pod nematode numbers in the roots were much higher than those of *R. arachidis*. However, *R. arachidis* dominated in the pods.

Another aspect where *R. arachidis* can be more aggressive or better adapted than pod nematodes is its ability to survive on other crops. In contrast, pod nematodes are able to survive only in small numbers on crops other than groundnut. Relatively high *R. arachidis* numbers were observed on maize planted in rotation with groundnuts. The effect of *R. arachidis* on maize in South Africa, however, is currently unknown. In the 1970s study in Nigeria of this nematode, it was suggested that there might be two biotypes of the nematode, one occurring on cereals and one occurring on both cereals and groundnut.

Figure 2: Below-ground symptoms of groundnut infested with *R. arachidis*.

This research raised a few interesting questions. Will *R. arachidis* damage crops other than groundnut? How widely does *R. arachidis* occur? Will current management tools other than chemical control be sufficient in keeping this nematode under control? Since this nematode is seedborne, it has the potential to spread throughout the groundnut production area. It also seems to be more aggressive than pod nematodes.

If this is true, *R. arachidis* indeed has the potential to be yet another pest South African producers have to reckon with.

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