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Effects of two Meloidogyne spp. on growth and reproduction of Bambara groundnut (Voandzeia subterranea) in Nigeria

Einfluß von zwei Meloidogyne spp. auf Wachstum und Reproduktion von Erderbse (Voandzeia subterranen) in Nigeria

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1. Introduction

Sellschop (1962) indicated that the most important leguminous crops in terms of production and consumption in Africa are groundnut, cowpea, and Bambara groundnut. Unlike groundnut and cowpea, little is known about Bambara groundnut as regards disease factors affecting its growth, reproduction and yield in the humid forest belt of West Africa. Stanton (1966) noted that Bambara groundnut has great advantage of tolerance to poor soils and drought. Nutritionally it appears to be one of the better crops and no record has appeared of toxicity due to its consumption. The pod develops under the soil surface and grows into an oblong or rounded structure and with a wrinkled surface when mature (Cobley 1956). The seeds, unlike those of groundnut cannot be eaten raw.

Hepper (1963), Cobley (1956), Oyenuga (1968), Purseglove (1968) and Tindall (1968) have reported that it is native to Central and West Africa where wild prototypes have been found. Morphologically, Bambara groundnut is very similar to the ordinary groundnut, but botanically they are not related. The plant is a bunched herbaceous annual with almost submerged trailing stems formed by downward compression of a much branched plant (Doku 1968, Irvine 1969). The plant grows to a height of about 30 cm with trifoliate leaves which are carried on long stiff, erect, grooved and stipellate petioles (Irvine 1969). This paper discusses the effects of two species of the root-knot nematodes on the growth and reproduction of seven cultivars of Bambara groundnut, *Voandzeia subterranea* Thours.

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2. Materials and Method

Two filter papers each were placed in three clean petridishes and moistened with distilled water. Seeds of seven cultivars of Bambara groundnut were surface sterilized separately in 0,5% clorox for five minutes and washed three times in tap water. The seeds were placed in the petridishes which were labelled for each cultivar. Germinating seeds were placed singly in steamed soil contained in 10 cm plastic pots and inoculated with nematode larvae extracted by the Baermann funnel method.

A germinating seed of each cultivar was inoculated with 1000 larvae of *Meloidogyne incognita* and replicated three times. This procedure was repeated for *M. javanica*. The non-inoculated seeds (control) of each cultivar were also planted in three replicates. Thus a total of 84 pots were used in the experiment. Plants were placed in the greenhouse in randomized fashion for 65 days at the average recorded temperatures of 25°C (day) and 21.5°C (night). Plant roots were washed and examined for infection and pod production. Leaves on each plant were counted; dry matter accumulation by shoot was determined by placing shoots in the drying chamber and drying to constant weights at 80°C for 48 hours.

Fig. 1. Bambara groundnut — Ivory Eyeless cultivar.
M. javanica infected plant (Left); Non-inoculated (Control) plant (Right)
(Tiny nodules are discernible on roots of control plants)

3. Results

The results of this study are summarized in Table 1. All the cultivars of Bambara groundnut were susceptible to the two *meloidogyne* spp., although *M. javanica* was more severe on Black Seed and Ivory Purple cultivars than *M. incognita.* Severely infected plants had heavily galled roots and were stunted in growth. Pod production in the infected plants was very poor or in most cases totally absent (Fig. 1). At the flowering stage more flowers aborted from the infected plants. Stunting in growth of infected plants reflected in the generally low averages in the leaf number and dry matter accumulation of shoots when compared with the non-inoculated controls.

4. Discussion

M. incognita and *M. javanica* are widespread in Nigeria, the former predominating in the Southern States (Caveness 1976) and the latter in the Northern States of the country (Wilson 1962). The severity of damage of these two *Meloidogyne* spp. on Bambara groundnut is high and this is a serious limiting factor in its production. Results in Table 1 show that the uninoculated plants (control) produced more than eight times as many pods as were produced by plants inoculated with either *M. incognita* or *M. javanica.* Besides the stunting effect on the infected plants, root knot disease had adverse effect on flower production as well as increasing its rate of abortion when produced. Dry matter accumulation by shoot was also low in diseased plants.

Galls are usually produced in plants inoculated with the root-knot nematodes (Fig. 1), in much the same way as tumours are produced in plants inoculated with tumour bacteria, *Agrobacterium tumefaciens.* Galston (1961) observed that tumour competes effectively with the rest of the plant for growth promoting materials, and as a result normal vegetative growth would be reduced tremendously. This study contends that the reduced growth in the infected cultivars of Bambare groundnut and other related effects resulted from the depredations of *Meloidogyne* spp. in a manner similar to the effects of *A. tumefaciens* on a host plant.

5. Summary

Seven cultivars of Bambara groundnut were susceptible to Nsukka population of *Meloidogyne incognita* and *M. javanica.* Stunted growth, reduced dry matter accumulation by shoot and more frequent flower abortions characterized the infected plants.

Zusammenfassung

Die vorliegende Arbeit berichtet über Untersuchungen des Einflusses von Meloidogyne incognita und Meloidogyne javanica auf das Wachstum der

Table 1: Leaf, dry matter and pod production in Bambara groundnut cultivars inoculated with two *Meloidogyne* spp. and the non-inoculated controls, after 65 days.

B. groundnut Cultivar	Average infection rating *	Average number of leaves	Average dry matter of shoots (gm)	Pods/ plant	Total pods
		M. incognita			
Black Seed	3.3	78	7.60	2, 1, 0	3
Ivory Mottled	3.7	63	3.63	0, 2, 1	3
Ivory Eyeless	4.0	75	6.81	0, 1, 1	2
Ivory Brown	3.7	90	9.26	0, 0, 0	0
Mottled Steak Eye	4.0	75	3.81	0, 0, 0	0
Ivory Purple	3.3	63	3.69	0, 2, 1	3
Ivory Black	4.0	69	4.90	0, 1, 0	1
					12
		M. javanica			
Black Seed	4.0	42	3.14	2, 0, 0	2
Ivory Mottled	4.0	90	9.38	0, 0, 0	0
Ivory Eyeless	4.0	63	4.62	1, 2, 1	4
Ivory Brown	4.0	84	8.84	0, 0, 0	0
Mottled Steak Eye	4.0	58	4.45	0, 0, 0	0
Ivory Purple	4.0	63	4.03	0, 1, 1	2
Ivory Black	4.0	72	4.95	0, 1, 1	2
					10
		Non-inoculated Controls			
Black Seed	—	87	8.44	1, 4, 1	6
Ivory Mottled	—	90	11.78	2, 4, 2	8
Ivory Eyeless	—	84	12.64	14,21,16	51
Ivory Brown	—	93	11.64	3, 4, 6	13
Mottled Steak Eye	—	84	11.34	4, 2, 2	8
Ivory Purple	—	60	8.04	4, 3, 1	8
Ivory Black	—	87	5.33	3, 2, 4	9
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* Root Indexing:
0 = no root galls; roots are clean
1 = very light galling; no mature females observed
2 = light galling; mature females and egg masses rare
3 = moderate galling; mature females and egg masses common
4 = severe galling; mature females and egg masses abundan

Erderbse auch Bambara groundnut (Voandzeia subterranea (L.) Thou. ex DC) genannt. Sieben der untersuchten Sorten zeigten sich anfällig gegenüber Meloidogyne spp. Reduziertes Wachstum, geringere Trockenmassebildung der oberirdischen Teile und ein häufigeres Verkümmern der Blüten ist charakteristisch für die infizierten Pflanzen.

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