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Pathogenicity of Meloidogyne incognita Race 1 on Lima bean cultivars

Untersuchung des Befalls von Meloidogyne incognito Stamm 1 an Lima-Bohnen-Sorten

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Among the different sources of marketable food proteins currently available in Nigeria, beans are the least expensive on a protein unit basis compared with rice, fish, meat and cassava (Aykroyd & Doughty 1964). Apart from being good and cheap protein sources, beans and other legumes have other beneficial effects in agriculture. They are symbionts of bacteria that form nodules in roots. Consequently these legumes indirectly increase the level of soil nitrogen and this in turn increases the yields of other non-legume cereals that my follow legumes in plant rotation.

Legume foods are consumed in a variety of forms in the tropical world. When bean intake is high it provides significant amounts of protein calories and other nutrients. Legume grain protein is high in lysine. Protein content of beans is twice the level in other grains and more than that in root crops (Aykroyd & Doughty 1964).

In Eastern Nigeria decreased yield in lima beans often results from root-knot nematode attacks and the problem posed is significant in terms of losses in food and revenue. Much work has been done on screening and breeding for resistance in common beans (Phaseolus vulgaris L.) for root-knot nematodes (Barrons 1940; Blazey et al. 1964; Hartmann 1971). It is known too that some cultivars of lime beans resist attacks of Meloidogyne incognita (Western et al. 1958; Allard 1954). In this study seven lima bean cultivars commonly grown in Nigeria were screened for resistance/suspectibility to a Meloidogyne incognita pathotype.

2. Materials and Methods

A root-knot nematode population was collected from Celosia argentia (‚Soko') grown in the University of Nigeria farm at Nsukka. The population was identified Meloidogyne incognita by cutting and examining the perineal patterns of ten ma-

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ture females from the population. The nematode was cultured in a shadehouse on tomato (Lycopersicon esculentum cv. Bonny Best) for six weeks at an average recorded temperature of 27.64 (day). Galled tomato roots were excised and washed in tap water to obtain eggs. Galled roots were placed in a jar containing 200 ml of 10% clorox solution. The lid of the jar was closed tightly, the jar was shaken vigorously for 4 min, and the egg suspension was quickly passed through a 200-mesh sieve nested in a 500-mesh sieve (Int. Mel. Project 1978). The 500-mesh sieve containing eggs was held under a slow stream of cold tap water to remove residual clorox. The eggs were then rinsed into a 2-L flask. By repeating this procedure, eggs were concentrated in a flask, and the number of eggs was counted in 1 ml of the suspension. Seeds of the following seven lima bean cultivars were procured from the departmental seed store: Acc 2021, Acc 6405, Acc 2419 A, Ex-Ibadan, 3166 Early, Acc 2425 A and Acc 2405 C. Respective seeds were surface sterilized in 10% clorox for 2 min and placed in sterile petridishes containing moistened filter paper. In 48 hrs the seeds had germinated. Clorox functionally sterizes seeds but would also help in softening seed coats thereby hastening germination. Germinated seeds of each cultivar were placed one each in steam sterilized sandy loam soil contained in 20-cm diameter plastic pots and replicated five times. Germinated seeds were inoculated with 5000 eggs per pot by adding the inoculum in depressions made in the soil. Uninoculated control for each cultivar was provided for purposes of comparing growths.

To establish the race of the Meloidogyne spp, seedlings (7—10 cm tall) of tobacco (Nicotiana tabacum 'NC 95'), and cotton (Gossypium hirstum 'Deltapine 16') which were raised in sterilized soil were also inoculated at the time of transplanting with 5000 eggs per plant and replicated five times. All plants were grown at temperatures between 26 and 30 C for 50 days. Egg masses and galls were rated according to the following scale: 0 = 0, 1 = 1 or 2, 2 = 3—10, 3 = 11—30, 4 = 31—100, and 5 = more than 100 galls or egg masses per root system (Int. Mel. Project 1978).

3. Results and Discussion

The M. incognita population failed to attack both tobacco and cotton. These plants appeared immune to the nematode. Table 1 shows results of the differential tests

Table 1. Root indices of lima bean cultivars inoculated with Meloidogyne incognita Race 1.

	Replications					
Cultivar	I	II	III	IV	V	$\bar{x}$
2425 A	2*	2	2	2	2	2
Acc 2405 C	1	1	2	1	2	1.4
Acc 2419 A	3	3	3	3	3	3
Acc 2021	4	4	4	4	4	4
3166 Early	3	2	2	2	2	2.2
Ex-Ibadan	3	3	3	2	3	2.8
6405	4	4	4	4	4	4

LSD 05 = 0.41

* Nos. in I—V represent mean of 5 replications.

with lima bean cultivars. The most susceptible cultivars were Acc 2021 and 6405. The most resistant cultivar was Acc 2405 C. Uninoculated controls (not shown in Table 1) had zero ratings. No susceptible cultivar had ratings > 4. Since tobacco 'NC 95' and cotton 'Deltapine 16' were virtually immune to attack by the M. incognita population its race identity was designated Race 1. According to J.N. Sasser (unpublished data), when tobacco (NC 95) and cotton (Deltapine 16) are resistant to a population of M. incognita, the population is Race 1. Designation of other races of M. incognita depends on whether a population is able to reproduce on tobacco, but not on cotton (Race 2), or is able to reproduce on cotton, but not on tobacco (Race 3), or is able to reproduce on both plants (Race 4). A lima bean cultivar with a mean index < 2 was considered resistant. Table 1 therefore indicates that Acc 2405 C was the only resistant cultivar. Fig. 1 provides an insight in the

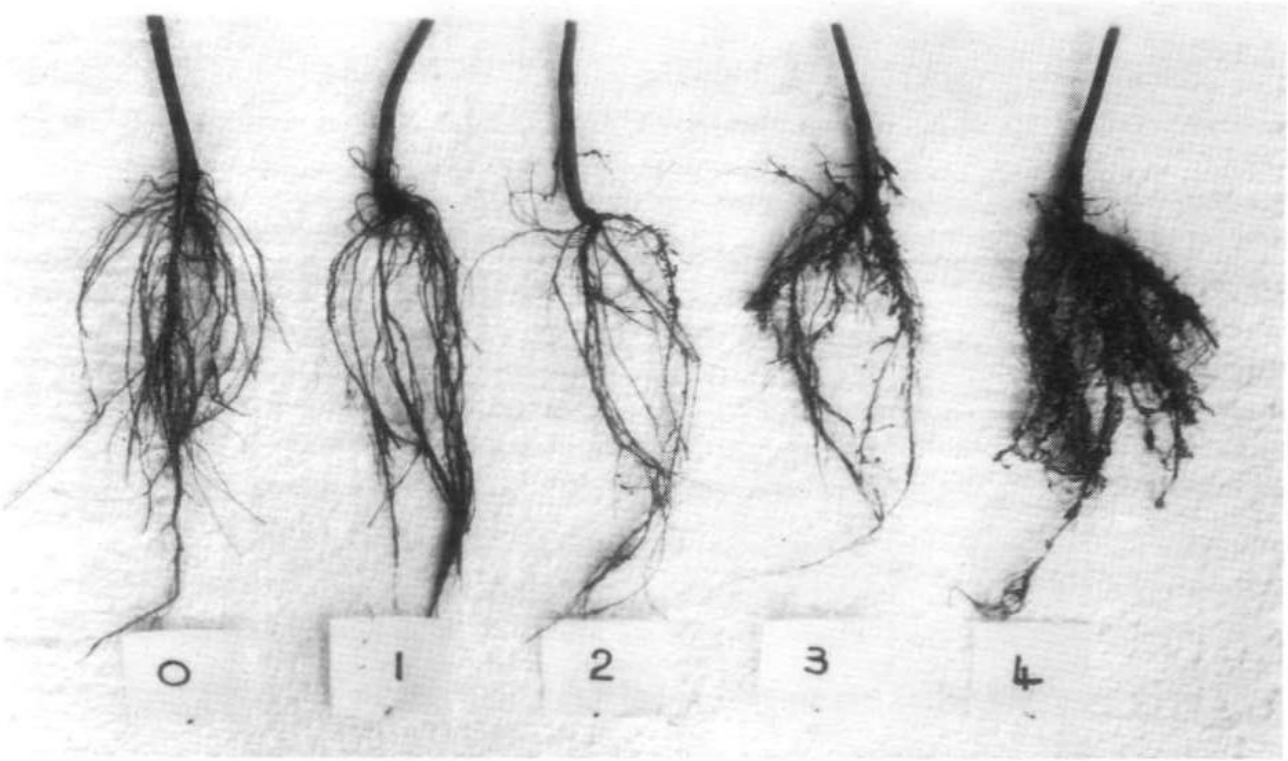

Fig. 1. Roots of lima bean cultivars showing degrees of infection by M. incognita pathotype. 0 (control) = 0 galls/egg masses (6405); 1 = 1 or 2 galls/egg masses (Acc 2405 C); 2 = 3–10 galls/egg masses (2425 A); 3 = 11–30 galls/egg masses (Acc 2419 A); 4 = 31–100 galls/egg masses (6405).

interplay between nematode pathogen and roots of the various host cultivars. The uninoculated controls had good, well formed root systems; the resistant cultivar Acc 2405 C also had good intact root system. Cultivars 2425 A and Acc 2419 A which showed degrees of susceptibility to M. incognita Race 1 had reduced root systems due largely to the depredations of the nematode pathogen. Roots of cultivar 6405 was one of the two most susceptible cultivars and yet had a sizeable root system comparable to the control. Its top growth also compared favourably with the control (Fig. 2). By this it would seem that the cultivar characteristic was to produce more roots as others were damaged by nematode pathogen. This made

Fig. 2. Top growth of cultivar 6405 inoculated with M. incognita pathotype (Left) and control (Right)

up for the impaired nutritional intake which the plant would have suffered as a result of infection. The cultivar (6405) was therefore considered tolerant to the M. incognita pathotype. And tolerance is a factor of resistance. While tolerant plants could give reasonable yields at harvests, they could also leave the soil highly infested after cultivation. The responses of these lima bean cultivars to M. incognita Race 1 could differ markedly if exposed to other races of this root-knot nematode species.

4. Summary

Seven cultivars of lima bean were screened for resistance/ susceptibility to Meloidogyne incognita Race 1 from Nsukka. Only one cultivar (Acc 2405 C) was resistant to the pathotype. Results with other races of M. incognita may not necessarily be identical.

Zusammenfassung

Sieben Sorten Lima-Bohnen wurden auf Resistenz/Verträglichkeit gegen Meloidogyne incognito Stamm 1 überprüft. Nur eine Sorte (Acc 2405 C) war resistent gegenüber diesem Stamm. Ergebnisse mit anderen Stämmen vom M. incognita müssen nicht identisch sein.

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