PATHOGENICITY OF *Meloidogyne* spp. AND *Rotylenchulus reniformis* ON SWEET POTATO

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ABSTRACT

The reaction of sweet potato to *Meloidogyne incognita*, *M. javanica* and *Rotylenchulus reniformis* at varying levels of inoculum showed that as population increases there was a corresponding decrease in root, tuber and top weights. Tuber reduction in pots at initial populations of 20,000 eggs and 5,000 larvae of *Meloidogyne* spp. *and R. reniformis* were 47.7, 50.6 and 60.6%, respectively, 4 months after inoculation. Plants were stunted and roots were galled with several egg masses on the surface. Lesions, necroses and rotting were observed. Tubers were cracked, deformed and smaller in size.

INTRODUCTION

Sweet potato (*Ipomoea batatas* Poir) is one of the major root crops grown in the Philippines. It is regarded as an important source of feeds and industrial products. However, damage by nematodes is a threat to the maximum production of this crop.

The study of nematode injury to sweet potato was first reported by

Elliot in 1918. In North Carolina, Poole and Schmidt (1927) associated the cause of heavy losses of sweet potato to the root-knot nematode, then known as *Heterodera radicicola* (Greeff) Muller. Root cracking of sweet potato, var. *Porto Rico* was attributed to *Meloidogyne incognita acrita* (Krusberg & Nielsen, 1959; Nielsen & Sasser, 1959). In the United States, Martin (1967) reported that *Meloidogyne incognita, M. hapla* and *M. javanica* caused distinct damage to sweet potatoes. In Louisiana, Martin (1960) reported a severe damage to sweet potato by *Rotylenchulus reniformis*. He found that plants inoculated with the nematode had sparse, necrotic and discolored roots with very few feeder roots.

Although studies on the association of plant parasitic nematodes in the Philippines are available (Castillo & Maranan, 1974; Gapasin, 1978), inoculation experiments are lacking. This paper reports the effect of certain species of nematodes on the yield of sweet potato var. BNAS 51.

MATERIALS AND METHODS

Sweet potato (var. BNAS 51) top cuttings obtained from the Department of Agronomy, University of the Philippines at Los Baños in Laguna were planted in sterilized sandy loam soil using 20-cm diameter clay pots.

Inoculum. -- *Meloidogyne incognita, M. javanica* and *Rotylenchulus reniformis* were used for the inoculation experiments. Single egg mass cultures of *Meloidogyne* spp. were prepared and maintained on susceptible tomato while *R. reniformis* was multiplied on siratro. For inoculation, eggs of *Meloidogyne* spp. and larvae of *R. reniformis* were used. Eggs of *Meloidogyne* were obtained from the cultures following the procedure of Sasser (1976). The inoculum levels used were 0, 1000, 5000, 10000 and 20000 eggs per pot. Larvae of *R. reniformis* were obtained from cultures using the Baermann funnel method (Goodey, 1963). Inoculum levels used were 0, 500, 1000, 3000 and 5000 larvae per pots. Plants were inoculated two weeks after planting by pipetting the desired number of egg larvae in water into several holes in the soil around the base of the plant. All treatments were replicated three times in a completely randomized design.

Routine cultural practices were provided during the experimental period. At the end of the experiment, fresh weight of roots, tubers and tops were recorded. The severity of infection was determined using galling and egg mass indices (Sasser & Taylor, 1976). Populations of *R. reniformis* in the soil and in the roots were determined by getting 300 ml soil and 5 g root samples from each pot. Soils were processed using the Baermann funnel method and nematodes were counted after 48 hr in suspension with the aid of a

stereomicroscope and a hand tally counter. The roots were first stained with acid fuchsin lactophenol before the nematodes were counted.

RESULTS AND DISCUSSION

Reaction of sweet potato to Meloidogyne incognita and M. javanica.

Only trace to slight galling on the roots of inoculated plants were observed (Table 1). However, an egg mass index of 5 was obtained in the 10,000 and 20,000 inoculum levels on both species, indicating that abundant egg masses may be formed even with very slight galling on this variety. Plants were stunted and roots were galled with several egg masses protruding on the root surfaces and tubers (Figures 1 A, B and C). Although both species produced galls, bigger galls were observed in plants inoculated with *M. incognita*. Similar observations were reported by Cortado and Davide (1968) on tobacco. The possibility of different species causing different responses in the same plant has already been noted by other workers (Krusberg, 1963).

Tuber yield was reduced and cracking was distinct as a response to the nematode (Figs. 1 D and E). Similar reactions were observed by Elliot (1918) and Poole and Schmidt (1927). From these observations, it is evident that the cracking of sweet potato tubers is caused by *Meloidogyne* and not a physiological response.

Increase of inoculum levels of the nematodes from 10,000 to 20,000 resulted in a significant decrease in root, tuber and top weights. Although there was a reduction of 10.2 and 26.9% in tuber weights at the 1,000 and 5,000 inoculum levels, respectively, this was not significantly different from the uninoculated control. Likewise, reduction in tuber weight of 14.6 and 17.5% by *M. javanica* at the 1,000 and 5,000 inoculum levels, respectively, are not significantly different from the control.

This result shows that the initial population of 5,000 per pot of *M. incognita* and *M. javanica* which increased to 12,244 and 11,227 larvae from soil, respectively, after four months failed to disrupt the normal growth of the plants. The plants were still supporting these nematode populations without causing economic loss to the crop. These nematode densities, therefore, have not exceeded the tolerance density limit of sweet potato. However, at final densities of 16,285 and 16,047, larvae reduction in tuber weight is very significant. This seems to suggest that the tolerance limit of sweet potato to the nematodes is about 16,000 larvae per pot. Furthermore, these results indicate that the nematodes tested are pathogenic and potential pests of sweet potato.

Table 1. Reaction of sweet potato, var. BNAS 51, to inoculation with *Meloidogyne incognita* and *M. javanica* from single egg mass culture.[1]

Inoculum level (egg)	Galling index	Egg mass index	Fresh weight (g [2]			% Tuber reduction
			Roots	Tubers	Tops	
Meloidogyne incognita						
0 (control)	1.0	0	16.0a	85.3a	120.0a	-
1000	1.3	3.6	14.0a	76.6a	119.0a	10.2
5000	2.0	4.6	11.6ab	62.3ab	111.0ab	26.9
10000	2.6	5.0	10.0b	52.3b	104bc	38.7
20000	3.0	5.0	9.0b	44.6b	97.3c	47.7
M. javanica						
0 (control)	1.0	0	16.3a	104.6a	166.6a	-
1000	1.0	3.6	13.0a	89.3a	165.0a	14.6
5000	2.3	4.6	11.3a	86.3a	125.3a	17.5
10000	2.3	5.0	10.0a	62.3ab	101.6ab	40.4
20000	3.0	5.0	9.3a	51.6b	94.0b	50.6

[1] Mean of 3 replications.
[2] Means followed by the same letter are not significantly different at 5% level according to Duncan's Multiple Range Test.

Reaction of sweet potato to Rotylenchulus reniformis.

Pathogenicity test of *R. reniformis* on sweet potato showed that the different inoculum levels affected plant growth resulting in decreased root, tuber and top weights (Table 2). Tubers were deformed, cracked, and smaller compared to the uninoculated control (Fig. 1 F).

Reduction in tuber weight was significant at initial populations of 3,000 and 5,000 per pot which increased to 22,255 and 29,257 after 4 months, respectively. This indicates that a population density of 22,000 and more could reduce tuber weight from 44% to as much as 60%. The population increase was based on nematodes recovered from the soil and roots. However, at an initial inoculum level of 5,000 population in roots decreased by 13.7%. It seems that at the 500 initial inoculum level, the nematodes multiplied faster because there were more feeding sites and, hence, less competition. Nevertheless, at the

5,000 inoculum level, it appears that most of the roots, as a result of severe feeding, rotted before the nematode could increase, hence, the low population.

This study has shown that *R. reniformis,* under the conditions of the experiment, could be a threat to the production of sweet potato. It may be useful to study the interaction of *Meloidogyne* spp. *and* R. *reniformis* on the yield of sweet potato since, according to surveys, these three nematodes are always present in soil samples.

Table 2. Reaction of sweet potato, var. BNAS 51, to inoculation with *Rotylenchulus reniformis*.[1]

Inoculum level (larvae)	Fresh weight (g)[2]			% Tuber reduction	Recovery		% Increase
	Roots	Tubers	Tops		Soil	Roots	
0 (control)	34.0a	109.3a	158.3a	-	0	0	-
500	30.6a	94.6a	138.6a	13.4	12,060	2,980.4	96.6
1000	24.3a	73.6b	120.6ab	32.6	12,879	2,940.3	93.6
3000	29.3a	61.0b	107.6b	44.2	17,064	5,191.9	95.5
5000	20.3a	43.0c	89.6b	60.6	25,758	3,499.7	82.9

[1] Mean of 3 replications.

[2] Means followed by the same letter are not significantly different at 5% according to Duncan's Multiple Range Test.

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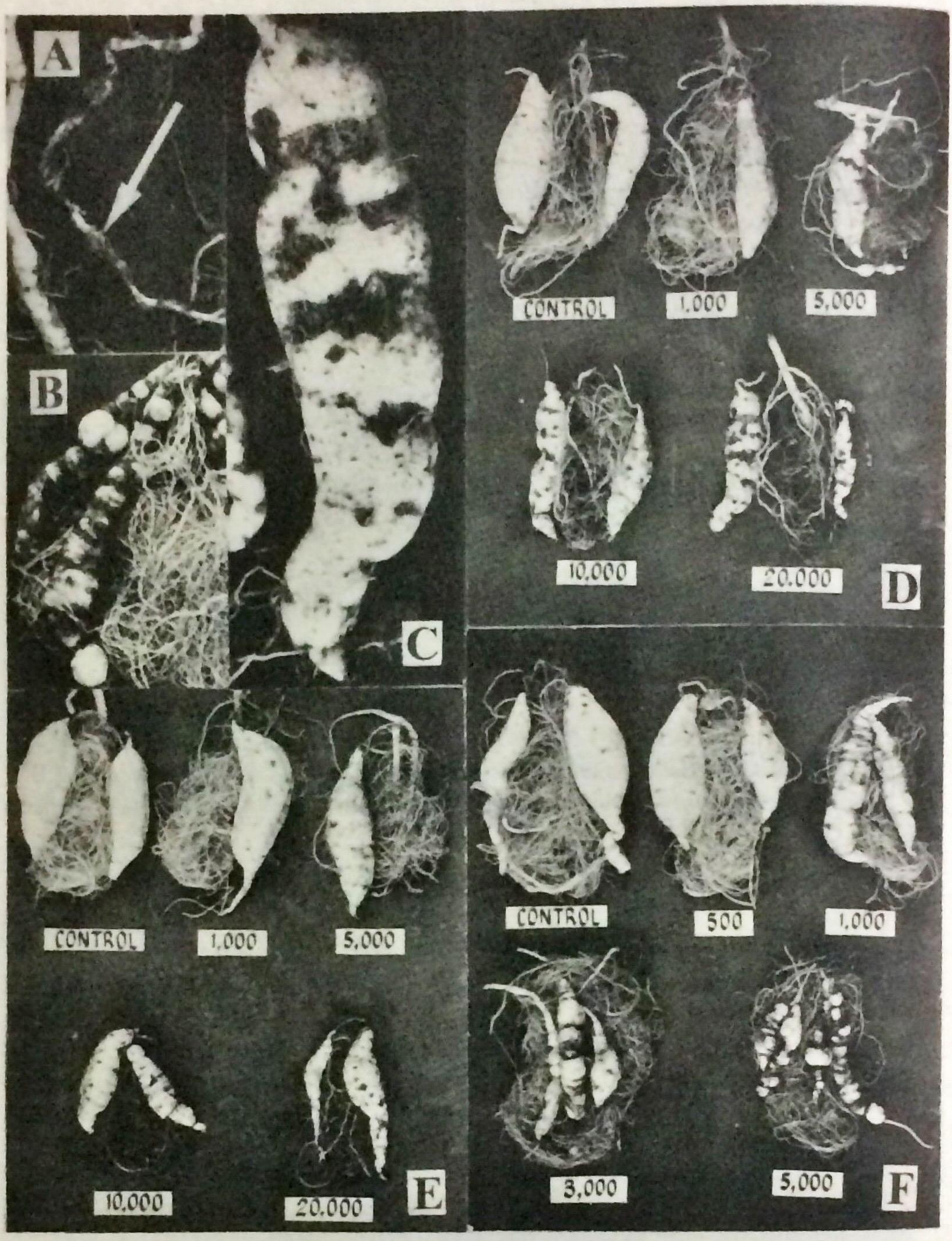

Fig. 1. Effects of different nematode species on the roots and tubers of sweet potato var. BNAS 51. (A) galled and rotted roots showing egg masses on surface (arrow); (B) lesions on shrivelled tubers; (C) damaged tuber showing cracks; (D) effects of varying levels of *M. incognita*; (E) effects of varying levels of *M. javanica*; (F) effects of varying levels of *Rotylenchulus reniformis*.