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ROOT KNOT NEMATODES ON UPLAND RICE (*ORYZA SATIVA* & *O. GLABERRIMA*) AND CASSAVA (*MANIHOT ESCULENTA*) IN IVORY COAST

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Root knot nematodes on upland rice (*Oryza sativa* & *O. glaberrima*) and cassava (*Manihot esculenta*) in Ivory Coast

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After reading the reports of Merny (1976) and Foturner (1981), one gets a good general idea of the *Meloidogyne* problems in the Ivory Coast. Most crops extensively grown in the country (food, fruit, fiber, vegetable and commercial crops) have their associated Meloidogyne population, although the corresponding potential damage is certainly very variable. Fortuner (1981) indicates that Meloidogyne is the second important genus after *Helicotylenchus* on upland rice in the country in terms of abundance and frequency whereas Merny (1976) states that this nematode is a minor parasite of cassava. Rice and cassava being two of our major food crops, we have conducted some research work on them with regard to their relationships to *Meloidogyne* spp.

I. MELOIDOGYNE ON UPLAND RICE

Meloidogyne is associated with upland rice in most countries where this crop is grown (Fortuner & Merny, 1979). Upland rice cultivars have been recently screened for resistance to *Meloidogyne* spp. by Babatola (1980) here in Nigeria and Sharma in Brazil (1981). Results indicate that most cultivars are susceptible to this nematode although few cultivars show some interesting levels of resistance. In Ivory Coast, we have screened 41 upland rice cultivars for resistance to *M. incognita*. We have also performed some microplot inoculations with and without fertilizers in order to roughly evaluate the damage done by *M. incognita* to a popular upland rice cultivars, IRAT 13.

A - Screening upland rice cultivars. 41 upland rice cultivars including 21 cultivars of *Oryza sativa* and 20 of *O.glaberrima* were screened for resistance to *M. incognita*. 20 replicates of each cultivar were transplanted in PVC tubes (3 cm diam. by 28 cm long) at the rate of one plant/tube. Each tube was inoculated with 1050 larvae of a mixture of 3 *M. incognita* populations. The data obtained 2 months later included count of characteristic roots (roots with apical swellings) and final populations in roots. Penetration and development were subsequently studied on 6 selected cultivars including 3 of each Oryza species using the technique described by Cadet & Merny (1977).

The results indicated that : (i) *M. incognita* reproduces generally better on *O. sativa* roots than on *O. glaberrima* roots. (ii) *O. sativa* cultivars have significantly more characteristic roots than *O. glaberrima* cultivars (table 1). It is concluded that *O. sativa* cultivars are more susceptible to *M. incognita* than *O. glaberrima* cultivars. It must be noticed however that few sativ cultivars (e. g., IS 335 and IS 358) show some interesting level of resistance. (iii) penetration into roots is not different between the two rice species whereas development into adult females is better on *O. sativa* cultivars (table 2). It seems that the more suscep tible in the terms defined here, the more adult females are obtaine Resistance is therefore related to the development rather than to the penetration.

The rice breeding team at IRAT in Bouaké has successfully made several interspecific crosses between *O. sativa* and *O. glaberrima* but the progeny is always sterile. Breeding efforts are being pursued along this line.

B - Microplot inoculations. *M. incognita* eggs were inoculated tc IRAT 13 growing in microplot with or without fertilizer at the rate of 100 000 eggs/microplot (≃ 300 eggs/dm3 of soil). The following treatments were used in a factorial set up with 6 repetitions :

- OO : No nematode no fertilizer
- ON : Nematode alone
- EO : Fertilizer alone
- EN : Fertilizer and nematode

Results can be found in table 3 and figure 1. *M. incognita* does significantly decrease the number of tillers, the number of panicles, the plant height and the yield of IRAT 13. All these characteristics can be improved by fertilization. These improvements, although at their best in the absence of *M. incognita*, are significant in the presence of the nematode. It is concluded that under certain circumstances, fertilization can largely compensate the effects of *M. incognita* on upland rice. In the light of new findings, we have observed that this nematode may prevent rice cultivars from responding to fertilization.

One can conclude that resistance germplasm to *M. incognit* exists in upland rice cultivars and that fertilization may help aleviate Meloidogyne problems under certain circumstances.

II. MELOIDOGYNE ON CASSAVA

The role played by cassava (*Manihot esculenta*) in solving the food problem in the Ivory Coast has always been significant and is actually increasing with large scale projects such as that of SODEPALM in Toumodi. More scientific attention is needed for this crop. From the paper of Dickson (1977), it is apparent that nematodes have not been adequately studied on cassava on a worldwide scale. The work of Caveness (1979) appears to be one of the major contributions in this area. We undertook this study in order to get an idea of the population dynamics of *Meloidogyne* spp on two cassava cultivars. For this purpose, a test was setup on *M. javanica* infested plots on the ORSTOM farm and an inoculation test was conducted in the greenhouse. In the inoculation test, 7060 juveniles of *M. incognita* and 7000 *Pratylenchus brachyurus* were simultaneously inoculated to cutting-seedlings of the two most commonly used cassava clones (CB and Bonoua) in buckets. Non inoculated controls were included in the test. Every 15 days, 2 buckets of each treatment were emptied and the roots of the plants put in the mist chamber. The field test involved a DBCP treatment of a plot with a non treated control. Cuttings of CB and Bonoua were planted on both and every 15 days, 5 plants were uprooted in each treatment (removing as much of the root system as possible) and the roots put in the mist chamber.

Results can be seen in table 4 and figure 2. These 2 cassava cultivars are not good hosts for *Meloidogyne incognita* and *M. javanica* since these nematodes do not reproduce well on them. No difference was found in the tuber yield between DBCP-treated and non treated plots. Plant hights seemed better in treated than non treated plots however. In the inoculation test, only the root weight of Bonoua decreased significantly, probably due to Pratylenchus rather than Meloidogyne. Since cassava is commonly associated with many other crops in traditionnal farming, the 2 cultivars tested here could be useful in Keeping Meloidogyne populations down. Since Saka & Makina (1981) have shown that bitter cassava extract has some nematicidal property in Malawi, we are looking into such possibilities with these two cassava cultivars.

Table 1 - Final populations of *Meloidogyne incognita* and number of characteristic roots on *glaberrima* and *sativa* cultivars of upland rice in 2 months.

Glaberrima varieties	Nematode population (J_2/g)	Characteristic roots (per plant)	*Sativa* varieties	Nematode population (J_2 /g)	Characteristic roots (per plant)
CA V6	156	0,3	ACC-10-18-55*	12 647	6,9
CG 11*	60	0,5	IGUAPE CATETO	6 840	6,3
CG 13	981	1,0	IRAT 13	6 607	5,4
CG 18	305	0,6	MOROBEREKAN	1 614	2,5
CG 24	464	0,6	IS 126	4 700	3,3
CG 45	247	0,7	IS 168	4 812	3,2
CG 67	114	0,3	IS 173*	14 372	11,8
CG 74	62	0,3	IS 220	5 357	4,2
CG 84*	1 930	0,5	IS 251	4 309	5,9
DG 15	1 109	0,5	IS 254	3 954	5,0
LG 009	489	0,3	IS 276	1 800	1,8
LG 052	138	0,7	IS 283	9 055	7,4
LG 061	293	0,4	IS 289	3 712	2,4
MG 007	134	0,3	IS 300	1 658	1,6
MG 021	511	0,3	IS 302	2 619	2,0
MG 029	844	0,9	IS 328	1 757	1,6
OG 1	347	0,8	IS 335	783	1,4
OG 008*	0	0	IS 337	1 053	1,6
OG 15	568	0,3	IS 338	2 102	3,3
TO 580	77	0,6	IS 340	2 386	1,8
			IS 358*	703	1,3
LSD 0,05	-	-		-	1,8
Means	441,45	0,5		4 421	3,8

* Varieties selected for penetration and development studies.

Table 2 - Penetration and development of *Meloidogyne incognita* juveniles in the roots of few upland rice varieties.

Rice varieties	% (1) penetration	% (2) males	% (2) females
OG - 008	10,1 d	2,1	0 i
CG 11	16,3 c	3,0	4,3 h
CG 84	20,3 b	1,9	7,9 g
ACC 10-18-55	14,4 c	0	25 f
IS 358	20,2 b	6,9	3,4 h
IS 173	23,3 a	3,0	70,4 e

(1) average percentage of the 50 juveniles initially inoculated

(2) average percentage of the penetrated juveniles.

numbers followed by different letters are significantly different at 5%.

Table 3 - Effects of *Meloidogyne incognita* on some characteristics of IRAT 13 with and/or without fertilization.

	Mean plant height (cm)		Mean panicle length (cm)		Panicle fresh weight (g/microplot)		Effective yield(1) (g/microplot)		Percentages (2)
ON(3)	94,9	a	22,2	d	124	f	84,7	j	100
OO	107,6	b	23,3	d	220	g	160,2	k	189
EN	115,1	bc	26,2	e	300,7	hi	194,8	kl	229,9
EO	124,9	c	27,8	e	338,4	i	235,5	l	278

(1) grain yield obtained after gravity separation of floating grains.

(2) The effective yield of treatment ON is taken as 100.

(3) OO = NO nematode no fertilizer - ON = nematode alone - EO = fertilizer alone - EN = fertilizer and nematode.
Numbers followed by different letters are significantly different at the 5% level.

Table 4 - Populations of *Meloidogyne javanica* and *Pratylenchus brachyurus* on CB and Bonoua roots 3 months after inoculation.

Cassava cultivars		final populations		roots dry weight (g)
		M. javanica (J_2/g of root)	*P. brachyurus* (nemas/g of root)	
CB	NON INOCULATED	0	0	7.25 a
	inoculated	242	4 394	6 a
BONOUA	non inoculated	0	0	6.5 a
	inoculated	357	12 683	3.2 b

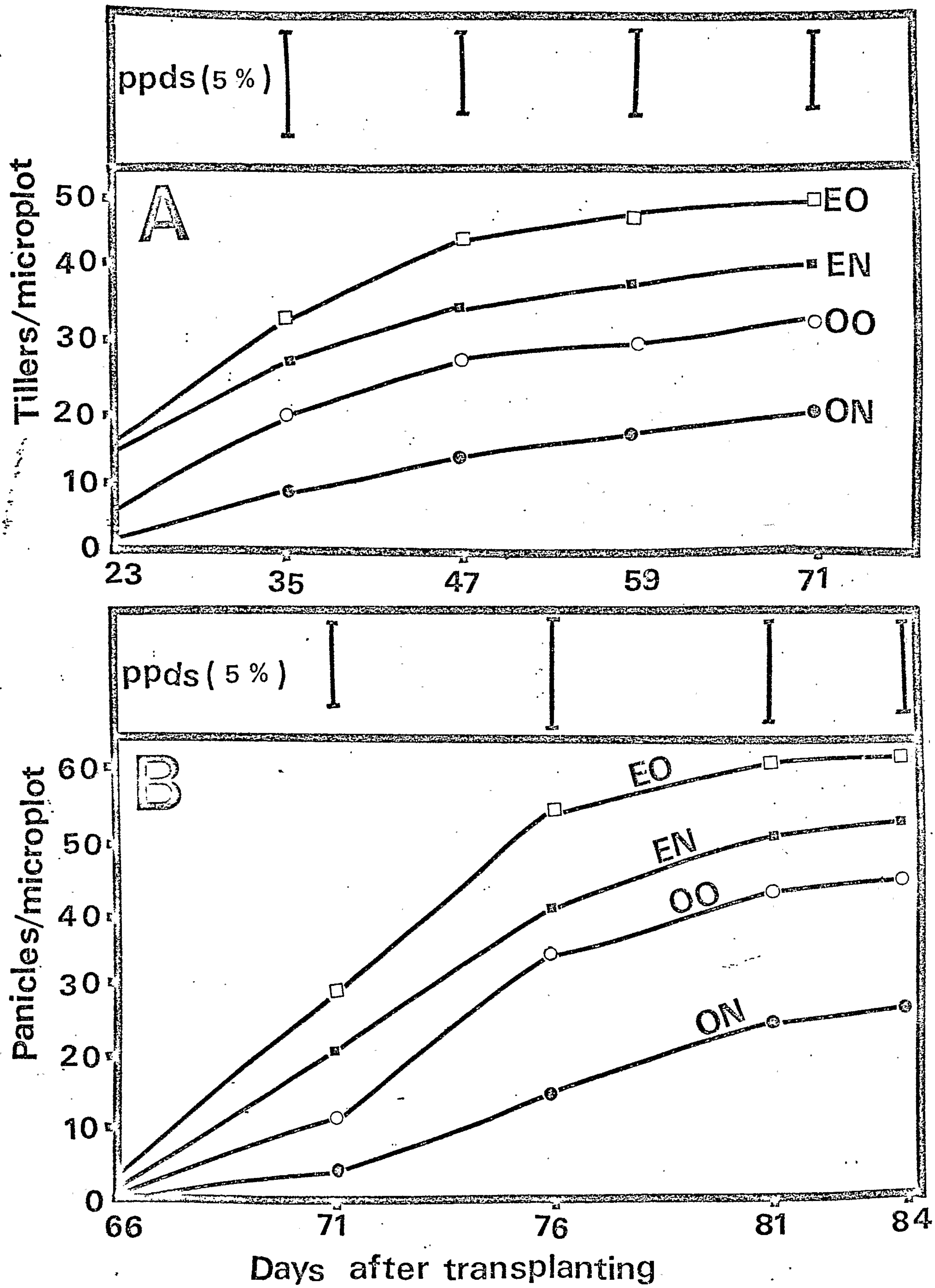

Fig. 1 (A - B) - Effects of *Meloidogyne incognita* and/or fertilization on tillering (A) and panicle setting (B) of IRAT 13. OO = NO nematode no fertilizer - ON = Nematode alone EO = Fertilizer alone - EN = Fertilizer and nematode.

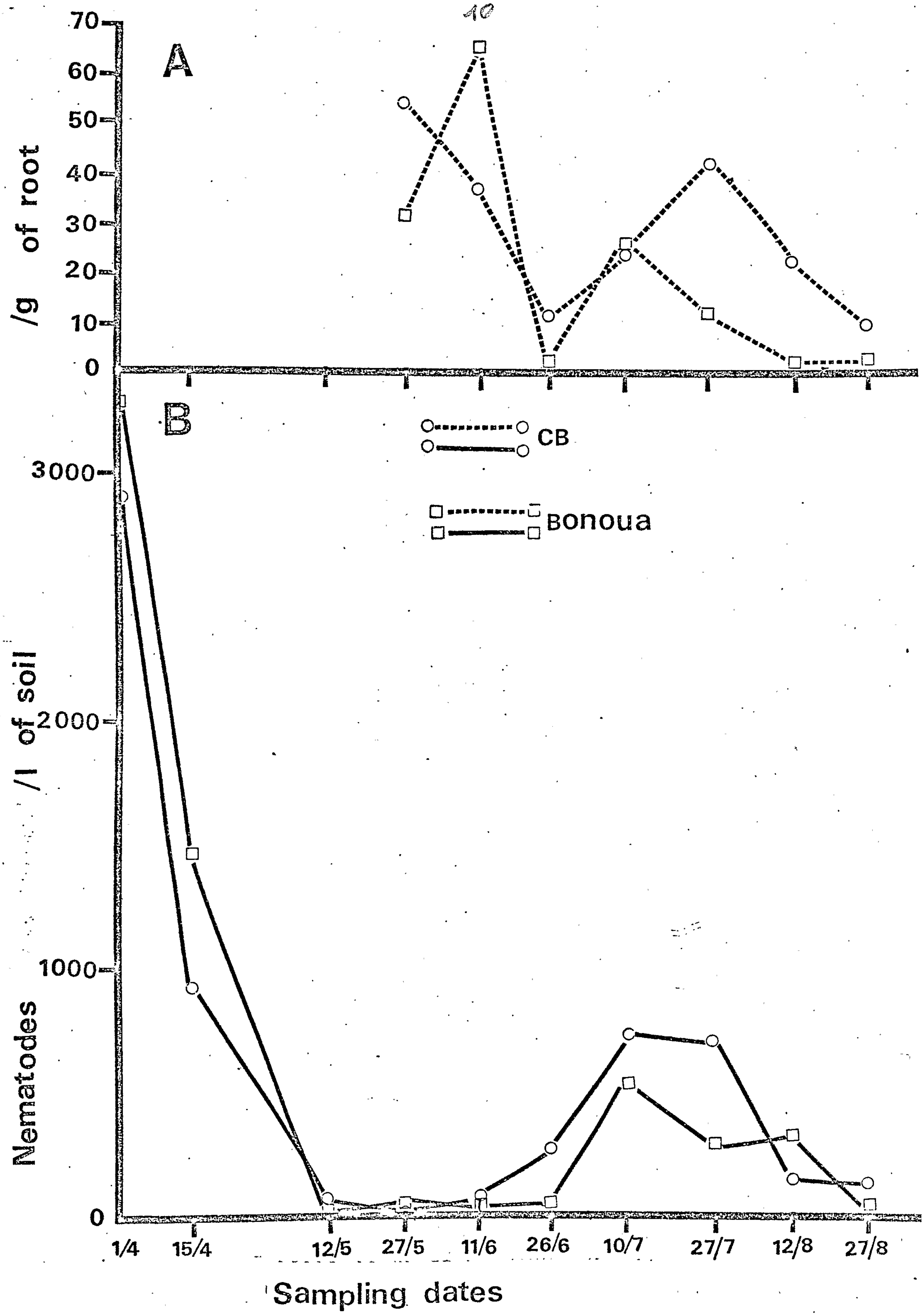

Fig. 2 (A–B) – Populations of *Meloidogyne javanica* in the roots of CB and Bonoua (A) and in the soil (B) in 4 months.

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