# RESISTANCE OF FIFTY-TWO SWEET POTATO [*Ipomoea batatas* (L.) LAM.] CULTIVARS TO *Meloidogyne incognita* AND *M. javanica*

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## ABSTRACT

Of the 52 sweet potato cultivars screened, 13, 4, 7 and 28 were susceptible, moderately susceptible, moderately resistant and resistant, respectively, to *Meloidogyne incognita*. With *M. javanica*, only one cultivar was found susceptible, one was moderately susceptible, three were moderately resistant and 47 were resistant.

Based on egg mass rating index, the most resistant cultivar to *M. incognita* was W-86 followed by L4-89, BPA-4 and Sinibastian whereas Gold Rush, Binicol, C1596-9, Catanduanes and BNAS – 51 were most susceptible. UPR was the only cultivar found susceptible to *M. javanica*.

Highly significant positive linear correlation was observed between resistance rating and the parameters used, viz., number of egg masses and root galls, nematode population in roots, egg mass and gall indices. Egg mass index was the main criterion used in assessing resistance since galling index was inadequate because galls produced in sweet potato were small and indistinct.

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**KEY WORDS:** Sweet potato *(Ipomoea batatas)*. *Meloidogyne incognita*. *M. javanica*. Resistance rating. Egg mass index. Galling index.

## INTRODUCTION

The root-knot nematodes of the genus *Meloidogyne* are among the important pests of sweet potato (Elliot, 1918; Poole and Schmidt, 1927; Nielsen and Sasser, 1959; Gapasin and Valdez, 1979). These nematodes cause galling on the feeder roots, roughening and frequent cracking of tubers, and generalized decay of the entire fibrous root system, thus reducing the yield and quality of tubers. In Asia alone, an estimated yield loss of 6% due to *Meloidogyne* spp. has been recorded (Sasser, 1979).

Several control strategies have been employed against root-knot nematodes in sweet potato and the most popular is the use of chemicals (Averre et al., 1974; Brathwaite, 1974). Although chemicals are effective, their high cost is prohibitive among small-scale growers because sweet potato has low market value. Also, the persistence of nematicides in the soil creates an imbalance in the agroecosystem.

A control method which can be effective, economical and environmentally safe is the use of resistant varieties. Studies on the resistance of vegetable crops like beans, tomato and white potato to root-knot nematodes are many and well documented. However, studies on the resistance of sweet potato to *Meloidogyne* spp. are very limited. This study was thus conducted to evaluate the resistance of sweet potato cultivars to *M. incognita* and *M. javanica*.

## MATERIALS AND METHODS

To obtain pure cultures of *Meloidogyne incognita* and *M. javanica*, identification based on the perennial patterns of adult females was carried out following the method of Taylor and Netscher (1974). After identification of the species, the single egg mass culture was maintained in susceptible tomato (VC-11) plants for 45 days. The nematode cultures were increased and maintained in susceptible tomato plants for several generations as source of inocula.

Eggs were used as inocula in this study. Infected VC-11 tomato plants were uprooted and washed free of soil with tap water. Egg masses of light brown color were usually ready for use at least 45 days from inoculation. Eggs were obtained following the procedure described by Hussey and Barker (1973.).

Cuttings of 52 sweet potato cultivars used in the screening tests were collected from the Philippine Root Crop Research and Training Center (PRCRTC) in ViSCA, Baybay, Leyte and from the Institute of Plant Breeding (IPB) in UPLB, College, Laguna. Each cutting was about 30 cm in length. The cuttings were planted separately in 10-cm diameter clay pots filled with baked sandy loam soil. After 10 days, each plant was inoculated with 5,000 eggs of each nematode species following the method of Hussey and Barker (1973). All plants were maintained and arranged in a complete randomized design in beds outside the greenhouse. There were five replicate plants for each cultivar.

The test plants were allowed to grow for 45 days after which they were removed from the pots by carefully separating the soil to avoid dismembering of the root system. The roots were washed with water, placed separately in plastic bags and labelled correspondingly. These were brought to the laboratory where egg masses and galls were counted.

A 5-gram root sample obtained from each plant was used to determine the nematode population. Roots were cut into pieces and mixed thoroughly to get a composite sample. Root samples were wrapped in a piece of cotton gauze, tied separately and stained in boiling acid fuchsin lactophenol for 5 minutes. The stained roots were removed from the gauze and placed in vials until ready for counting. Roots were then teased on a petri plate with a dissecting needle and the number of nematodes was determined with the aid of a stereomicroscope and a hand tally counter.

Egg mass and gall ratings per plant were determined using the Taylor and Sasser's (1978) index, namely, 0 = no gall or egg mass; 1 = 1-2 galls or egg masses; 2 = 3-10 galls or egg masses; 3 = 11-30 galls or egg masses; 4 = 31-100 galls or egg masses; and 5 = more than 100 galls or egg masses. Based on egg mass index, the resistance rating of the different cultivars was determined as follows: 0-1.9 = resistant (R); 2.0-2.9 = moderately resistant (MR); 3.0-3.9 = moderately susceptible (MS); and 4.0-5.0 = susceptible (S).

## RESULTS AND DISCUSSION

The number of egg masses, root galls per plant and nematodes in the roots varied significantly among the sweet potato cultivars screened for resistance to *M. incognita* and *M. javanica* (Tables 1 and 2).

Cultivars Gold Rush, Binicol, C 1596-9, Catanduanes and BNAS – 51 were the most susceptible to *M. incognita*. All of these cultivars showed significantly higher number of egg masses, galls and nematodes in the roots than the other cultivars. On the other hand, the most resistant cultivar was W-86 followed by Miracle, Sinibastian, BPA-4 and L4-89. No egg masses, galls and nematodes were found in cultivar W-86. Most of the cultivars screened had low mean counts of egg masses which ranged from 0.8 to 19.4 (Table 1).

With *M. javanica,* the different sweet potato cultivars also differed significantly in the number of egg masses, galls and nematodes recovered from the roots (Table 2), with UPR giving the highest mean counts of 77.4, 31.2 and 75.4, respectively.

These data show that some cultivars support large populations of *M. incognita* and *M. javanica* as indicated by the number of egg masses produced and are, therefore, good hosts. The other cultivars were considered poor hosts as indicated by the low number of egg masses produced in their roots.

Rohde (1965) suggested that the primary basis for parasitism is nutritional and that resistance in many cases is related to the failure of the host to supply some of the nutrients needed for the survival of the parasite. For example, lesion nematodes survived in Havana tobacco roots but failed to lay eggs. It appeared that some elements necessary for oogenesis were missing. Likewise, Webster (1967) stated that indole acetic acid and its precursor, tryptophan, were necessary for the reproduction of *Aphelenchoides ritzemabosi.*

The data in Table 2 seem to suggest that most of the sweet potato cultivars tested were either poor hosts of *M. javanica* or this particular nematode isolate was less virulent. Martin and Birchfield (1973) found that a population of *M. incognita* that was severely

**Table 1.** Number of egg masses and root galls produced by *Meloidogyne incognita* on fibrous roots, egg mass and gall indices, nematode counts and resistance rating on different sweet potato cultivars 45 days after inoculation.[1]

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| W-86 | 0.0 t | 0.0 | 0.0 r | 0.0 | 0.0 u | R |
| L4-89 | 0.8 st | 0.6 | 0.8 qr | 0.6 | 0.4 stu | R |
| BPA-4 | 1.2 rst | 0.8 | 0.6 qr | 0.4 | 0.2 tu | R |
| Sinibastian | 1.8 q-t | 1.0 | 1.2 o-r | 0.6 | 0.2 tu | R |
| Miracle | 1.8 q-t | 1.2 | 1.0 pqr | 0.8 | 1.6 p-u | R |
| Travis | 2.0 p-t | 1.2 | 0.4 qr | 0.4 | 1.6 p-u | R |
| UPLB 67 | 2.0 p-t | 1.2 | 1.0 pqr | 0.8 | 1.0 p-u | R |
| Tor Poak x Centennial | 2.0 p-t | 1.2 | 0.8 qr | 0.6 | 1.4 p-u | R |
| LO-323 | 2.4 o-t | 1.2 | 0.6 qr | 0.4 | 0.6 r-u | R |
| Georgia Red | 2.6 o-t | 1.4 | 0.6 qr | 0.6 | 2.0 o-u | R |
| UPLB 55 | 2.6 o-t | 1.4 | 0.6 qr | 0.6 | 2.0 o-u | R |
| UPLB 316 | 2.6 o-t | 1.4 | 0.8 qr | 0.6 | 2.0 o-u | R |
| Maligaya | 3.0 o-s | 1.6 | 0.8 qr | 0.6 | 2.8 n-u | R |

**Table 1.** Number of egg masses and root galls produced by ***Meloidogyne incognita*** on fibrous roots, egg mass and gall indices, nematode counts and resistance rating on different sweet potato cultivars 45 days after inoculation.[1]

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| W-86 | 0.0 t | 0.0 | 0.0 r | 0.0 | 0.0 u | R |
| L4-89 | 0.8 st | 0.6 | 0.8 qr | 0.6 | 0.4 stu | R |
| BPA-4 | 1.2 rst | 0.8 | 0.6 qr | 0.4 | 0.2 tu | R |
| Sinibastian | 1.8 q-t | 1.0 | 1.2 o-r | 0.6 | 0.2 tu | R |
| Miracle | 1.8 q-t | 1.2 | 1.0 pqr | 0.8 | 1.6 p-u | R |
| Travis | 2.0 p-t | 1.2 | 0.4 qr | 0.4 | 1.6 p-u | R |
| UPLB 67 | 2.0 p-t | 1.2 | 1.0 pqr | 0.8 | 1.0 p-u | R |
| Tor Poak x Centennial | 2.0 p-t | 1.2 | 0.8 qr | 0.6 | 1.4 p-u | R |
| LO-323 | 2.4 o-t | 1.2 | 0.6 qr | 0.4 | 0.6 r-u | R |
| Georgia Red | 2.6 o-t | 1.4 | 0.6 qr | 0.6 | 2.0 o-u | R |
| UPLB 55 | 2.6 o-t | 1.4 | 0.6 qr | 0.6 | 2.0 o-u | R |
| UPLB 316 | 2.6 o-t | 1.4 | 0.8 qr | 0.6 | 2.0 o-u | R |
| Maligaya | 3.0 o-s | 1.6 | 0.8 qr | 0.6 | 2.8 n-u | R |

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|---|---|---|---|---|---|---|
| W-86 | 0.0 t | 0.0 | 0.0 r | 0.0 | 0.0 u | R |
| L4-89 | 0.8 st | 0.6 | 0.8 qr | 0.6 | 0.4 stu | R |
| BPA-4 | 1.2 rst | 0.8 | 0.6 qr | 0.4 | 0.2 tu | R |
| Sinibastian | 1.8 q-t | 1.0 | 1.2 o-r | 0.6 | 0.2 tu | R |
| Miracle | 1.8 q-t | 1.2 | 1.0 pqr | 0.8 | 1.6 p-u | R |
| Travis | 2.0 p-t | 1.2 | 0.4 qr | 0.4 | 1.6 p-u | R |
| UPLB 67 | 2.0 p-t | 1.2 | 1.0 pqr | 0.8 | 1.0 p-u | R |
| Tor Poak x Centennial | 2.0 p-t | 1.2 | 0.8 qr | 0.6 | 1.4 p-u | R |
| LO-323 | 2.4 o-t | 1.2 | 0.6 qr | 0.4 | 0.6 r-u | R |
| Georgia Red | 2.6 o-t | 1.4 | 0.6 qr | 0.6 | 2.0 o-u | R |
| UPLB 55 | 2.6 o-t | 1.4 | 0.6 qr | 0.6 | 2.0 o-u | R |
| UPLB 316 | 2.6 o-t | 1.4 | 0.8 qr | 0.6 | 2.0 o-u | R |
| Maligaya | 3.0 o-s | 1.6 | 0.8 qr | 0.6 | 2.8 n-u | R |

**Table 1**. Continued . . . .

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| UPLB 90 | 3.0 o-s | 1.6 | 2.0 m-r | 1.2 | 1.0 q-u | R |
| UPLB 88 | 3.2 o-s | 1.6 | 1.4 n-r | 1.0 | 5.0 k-p | R |
| Karja | 3.2 o-s | 1.6 | 1.6 n-r | 0.8 | 2.0 o-u | R |
| Lubang | 3.4 o-s | 1.4 | 2.0 m-r | 1.4 | 1.2 p-u | R |
| Jewel | 3.4 o-s | 1.4 | 2.0 m-r | 1.0 | 4.2 1-q | R |
| Madregor | 3.6 n-s | 1.2 | 2.2 m-r | 1.4 | 3.0 m-u | R |
| Jasper | 3.6 n-s | 1.4 | 3.4 m-q | 1.6 | 2.0 o-u | R |
| UPLB 247 | 3.6 n-s | 1.8 | 0.8 qr | 0.6 | 3.4 m-s | R |
| 13-30 | 3.8 n-s | 1.6 | 0.6 qr | 0.4 | 6.0 k-o | R |
| UPLB 239 | 4.0 n-s | 1.6 | 1.8 m-r | 1.4 | 2.6 m-t | R |
| UPLB 57 | 4.4 m-s | 1.6 | 2.2 m-r | 1.2 | 3.2 m-s | R |
| PI 286621 | 4.6 l-s | 1.6 | 2.0 m-r | 1.2 | 6.6 k-n | R |
| UPLB 252 | 4.6 l-s | 1.8 | 1.4 n-r | 1.0 | 3.4 m-s | R |
| Garcia Yellow | 5.6 l-r | 1.8 | 2.6 m-r | 1.2 | 3.8 l-r | R |
| Caragold | 6.0 k-q | 1.8 | 0.8 qr | 0.4 | 3.0 m-t | R |

Table 1. Continued . . . .

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| UPLB 131 | 6.8 k-p | 2.0 | 2.6 m-r | 1.6 | 1.6 p-u | MR |
| Centennial | 7.2 j-o | 2.0 | 3.0 m-r | 1.2 | 6.6 j-n | MR |
| UPLB 243 | 8.6 i-l | 2.0 | 4.6 l-o | 1.8 | 12.2 i | MR |
| VSP 1 | 9.0 i-n | 2.2 | 4.2 l-p | 1.8 | 1.4 p-u | MR |
| VSP 3 | 10.0 i-n | 2.6 | 5.0 lmn | 1.6 | 2.0 o-u | MR |
| Binulakan | 12.0 h-k | 2.6 | 5.8 lm | 1.8 | 3.8 l-r | MR |
| San Isidro | 14.0 hij | 2.8 | 9.2 kl | 2.2 | 10.4 ijk | MR |
| Hsinchu | 15.8 hi | 3.0 | 8.0 kl | 2.2 | 8.0 i-l | MS |
| Ifugao 25 | 19.4 gh | 3.2 | 13.6 jk | 2.4 | 12.4 i | MS |
| UPR | 25.6 g | 3.2 | 19.2 ij | 3.0 | 25.6 h | MS |
| Calibre | 28.6 g | 3.2 | 18.6 ij | 3.0 | 22.4 h | MS |
| Davao 1 | 41.4 f | 4.0 | 36.4 gh | 3.6 | 28.8 gh | S |
| GAT | 49.2 ef | 4.0 | 27.4 hi | 3.4 | 36.4 fg | S |
| Kinabakab | 51.2 ef | 4.0 | 41.8 fg | 3.8 | 49.6 e | S |
| Tres Colores | 58.2 de | 4.0 | 44.2 fg | 3.6 | 75.2 d | S |

**Table 1.** Continued . . . .

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| UPLB 143 | 59.0 de | 4.0 | 46.4 efg | 3.8 | 47.0 ef | S |
| VSP 2 | 66.4 d | 4.0 | 52.6 ef | 4.0 | 30.0 gh | S |
| AIS-209-3 | 69.2 d | 4.0 | 45.2 efg | 4.0 | 68.4 d | S |
| High Yielding Yellow | 71.2 d | 4.0 | 59.2 d | 4.0 | 71.4 d | S |
| BNAS – 51 | 150.4 c | 5.0 | 68.4 cd | 4.0 | 123.2 c | S |
| Catanduanes | 156.0 c | 5.0 | 80.8 cd | 4.0 | 133.8 c | S |
| C 1596-9 | 308.8 b | 5.0 | 137.8 b | 5.0 | 187.8 b | S |
| Binicol | 343.2 ab | 5.0 | 170.2 a | 5.0 | 238.2 a | S |
| Gold Rush | 367.2 a | 5.0 | 173.0 a | 5.0 | 256.0 a | S |

[1] Data are means of 5 replicates. Means with different letters are significantly different at 5% DMRT. Data were transformed to $\sqrt{X + ½}$ for statistical analysis.

**Table 2.** Number of egg masses and root galls produced by ***Meloidogyne javanica*** on fibrous roots, egg mass and gall indices, nematode counts and resistance rating of different sweet potato cultivars 45 days after inoculation.[1]

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| W-86 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| VSP 3 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.4 fg | R |
| UPLB 55 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.6 fg | R |
| VSP 1 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.6 fg | R |
| Sinibastian | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| San Isidro | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Maligaya | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Madregor | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.6 fg | R |
| Miracle | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.6 fg | R |
| UPLB 131 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Karja | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Tres Colores | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| 13-30 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |

**Table 2**. Continued . . . .

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| UPLB 143 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Tor Poak x Centennial | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.6 fg | R |
| UPLB 316 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| UPLB 90 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.8 fg | R |
| C 1596-9 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| UPLB 57 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| PI 286621 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Kinabakab | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Centennial | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| UPLB 88 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| UPLB 67 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| UPLB 252 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.2 g | R |
| UPLB 248 | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |
| Georgia Red | 0.0 h | 0.0 | 0.0 f | 0.0 | 0.0 g | R |

**Table 2**. Continued . . . .

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| Hsinchu | 0.2 gh | 0.2 | 0.0 f | 0.0 | 0.0 g | R |
| Binulakan | 0.2 gh | 0.2 | 0.0 f | 0.0 | 0.0 g | R |
| Lubang | 0.2 gh | 0.2 | 0.0 f | 0.0 | 1.0 fg | R |
| Binicol | 0.2 gh | 0.2 | 0.2 ef | 0.2 | 0.6 fg | R |
| Ifugao 25 | 0.2 gh | 0.2 | 0.0 f | 0.0 | 3.6 de | R |
| Catanduanes | 0.2 gh | 0.2 | 0.0 f | 0.0 | 0.2 g | R |
| UPLB 239 | 0.4 fgh | 0.2 | 0.0 f | 0.0 | 0.0 g | R |
| LO-323 | 0.4 fgh | 0.2 | 0.0 f | 0.0 | 0.0 g | R |
| BNAS – 51 | 0.4 fgh | 0.2 | 0.2 ef | 0.2 | 1.2 fg | R |
| VSP 2 | 0.4 fgh | 0.4 | 0.0 f | 0.0 | 0.0 g | R |
| L4-89 | 0.6 fgh | 0.6 | 0.0 f | 0.0 | 0.6 fg | R |
| Jasper | 0.8 fgh | 0.6 | 0.2 ef | 0.0 | 0.8 fg | R |
| High Yielding Yellow | 1.0 fgh | 0.1 | 0.2 ef | 0.0 | 1.4 fg | R |
| Calibre | 1.6 fg | 0.8 | 0.4 def | 0.4 | 0.0 g | R |

**Table 2**. Continued . . . .

| Cultivar | Number of Egg Masses per Plant | Egg Mass Index | Number of Root Galls per Plant | Gall Index | Number of Nematodes/ 5-g roots | Resistance Rating |
|---|---|---|---|---|---|---|
| Travis | 1.6 fg | 1.0 | 0.2 ef | 0.2 | 1.2 fg | R |
| Caragold | 1.6 fg | 1.0 | 0.2 ef | 0.2 | 0.8 fg | R |
| AIS-209-3 | 1.8 fg | 0.8 | 0.6 def | 0.4 | 1.4 fg | R |
| Gold Rush | 2.0 f | 1.0 | 0.4 def | 0.4 | 1.0 fg | R |
| GAT | 4.0 e | 1.4 | 0.8 def | 0.4 | 4.8 de | R |
| Jewel | 5.4 de | 1.8 | 1.4 cd | 0.8 | 7.0 c | R |
| UPLB 247 | 6.0 d | 2.0 | 1.2 cde | 0.6 | 2.0 ef | MR |
| BPA-4 | 7.6 d | 2.0 | 2.0 c | 1.2 | 7.0 c | MR |
| Davao 1 | 12.2 c | 2.8 | 2.0 c | 1.0 | 19.0 b | MR |
| Garcia Yellow | 41.4 b | 3.8 | 10.6 b | 2.4 | 17.0 b | MS |
| UPR | 77.4 a | 4.0 | 31.2 a | 3.4 | 75.4 a | S |

[1] Data are means of 5 replicates. Means with different letters are significantly different at 5% DMRT. Data were transformed to $\sqrt{X + ½}$ for statistical analysis.

pathogenic on soybean failed to mature on 'Centennial' sweet potato, a very susceptible cultivar. On the other hand, sweet potato cultivar La4-73 which was resistant to Louisiana populations of ***M. incognita*** was severely attacked by a population from Maryland. Nishizawa (1974) reported similar variability in Japanese populations of ***M. incognita*** in sweet potato. Since only one isolate of ***M. javanica*** was used in this study, it appears that this isolate was less pathogenic against the sweet potato cultivars tested. Variability in host response within the root-knot nematodes collected from different parts of the world was reported by Sasser (1972).

The number of root galls was lower compared to the number of egg masses produced among the different sweet potato cultivars. For example, Gold Rush and BNAS – 51 which yielded mean egg mass counts of 367.2 and 150.4, respectively, produced corresponding mean root gall counts of 173.0 and 68.4. Some cultivars gave significantly low mean counts of galls which ranged from 0.8 to 4.2. Other cultivars had mean gall counts that ranged from 13.6 to 59.2 (Table 1). A few cultivars produced numerous small, indistinct root galls and egg masses (Figs. 1 and 2). These data suggest that galls produced by ***M. incognita*** and ***M. javanica*** on the roots of sweet potato were much smaller compared with those on other crops such as tomato and beans.

According to Golden and Shaffer (1958), galling can occur in some host plants in the absence of nematode growth and reproduction. On the other hand, Bird (1974) and Fassuliotis et al. (1970) found that galling scarcely occurred in some hosts despite the growth and normal reproduction of causal nematodes. Reyes (1979) reported that galls produced by ***M. incognita*** and ***M. javanica*** on sugarcane roots were small and indistinct. Because of these conflicting reports, the use of gall rating in determining resistance may pose some difficulties since low gall counts may not imply failure of the namatodes to develop or reproduce, or that the plant is resistant.

The data also show that a significantly low recovery of nematodes occurred in the roots of some sweet potato cultivars 45 days after inoculation with ***M. incognita*** and ***M. javanica*** (Table 1 and 2). This may be attributed to either the failure of the nematodes to penetrate the roots or to their moving out sometime after penetration. Morphological or biophysical resistance factors such as thick outer root epidermis, rapid proliferation of injured tissues and thickening of cell walls could be important barriers to penetration. Reynolds et al. (1970) reported that ***M. incognita*** larvae readily penetrated roots of resistant alfalfa but returned to the soil in a few days without inciting suitable giant cells. It is also possible that nematodes have penetrated the roots but died before reaching maturity. Dean and Struble (1953) found that few nematodes developed to egg-laying stage in resistant sweet potatoes. They concluded that most larvae either died and disappeared before reaching that stage.

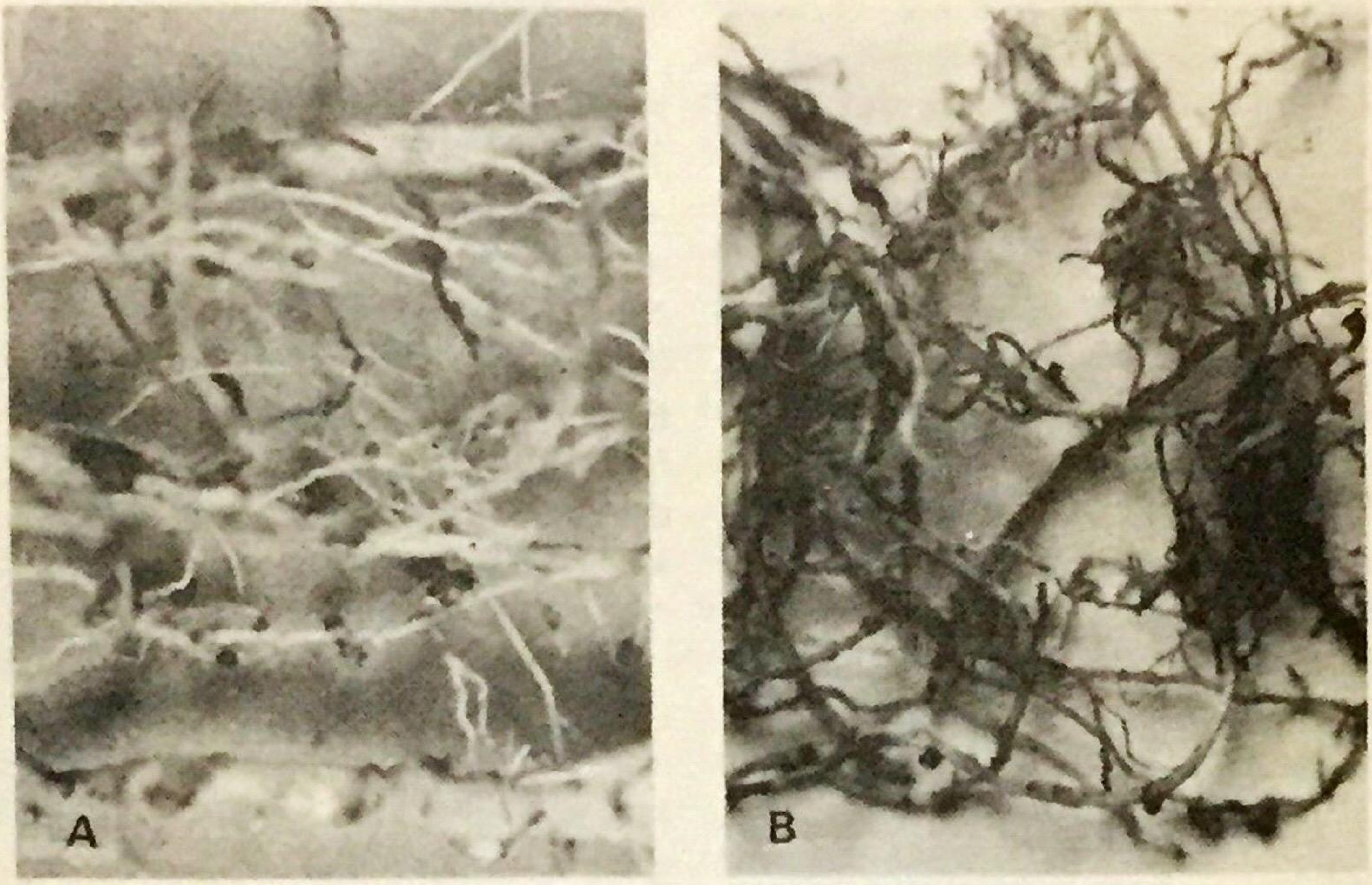


Figure 1. Roots of susceptible sweet potato cultivars Binicol infected with *Meloidogyne incognita* (A), and UPR infected with *M. javanica* (B). Note that galls are small and indistinct even with several egg masses.

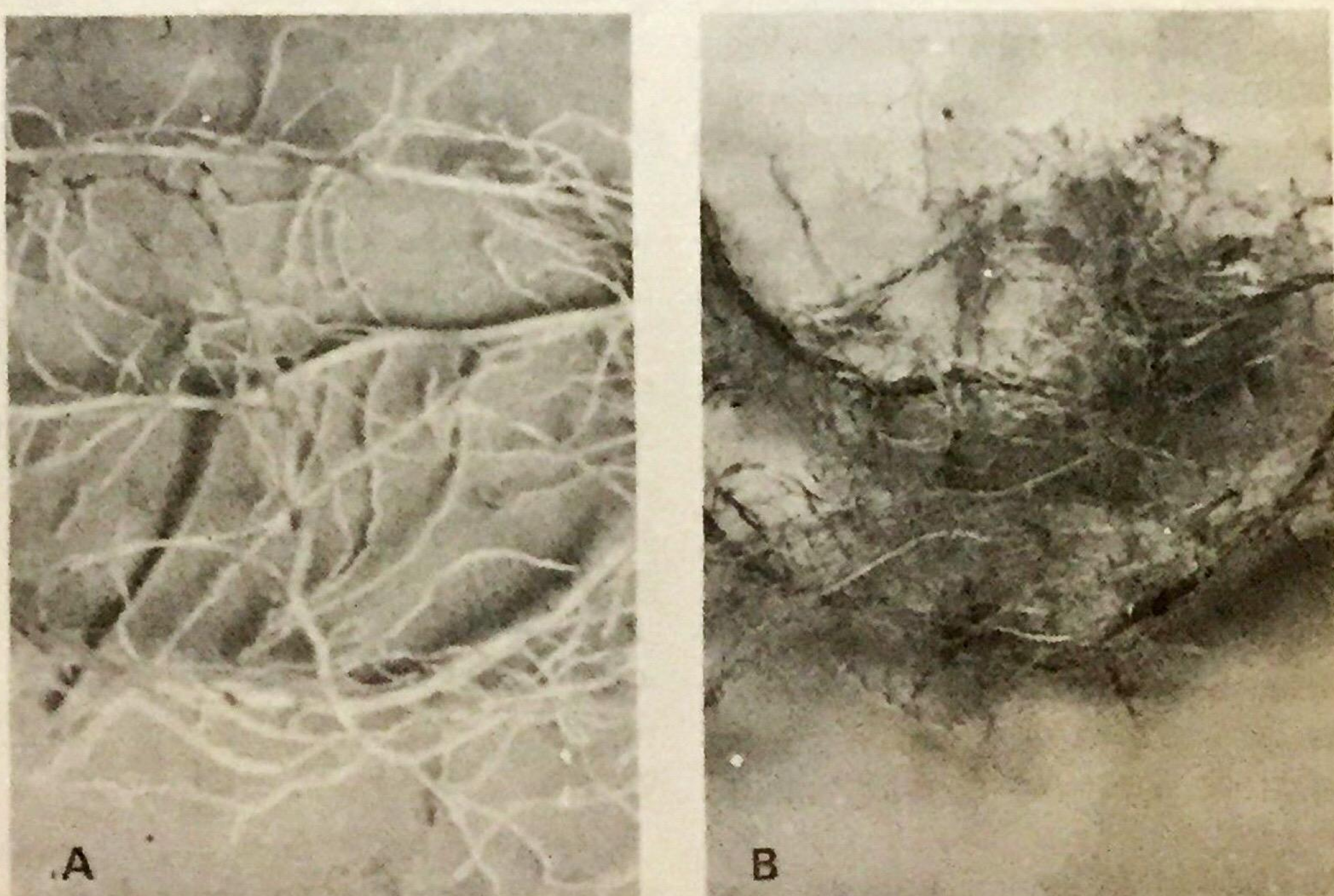


Figure 2. Roots of sweet potato cultivars Jasper (A) and W-86 (B) resistant to both *Meloidogyne incognita* and *M. javanica*. Note the few egg masses and indistinct galls in A and the absence of galls and egg masses in B.

The 52 sweet potato cultivars screened showed varying degrees of resistance to each of the test nematodes. Thirteen cultivars were found susceptible, four moderately susceptible, seven moderately resistant and 28 resistant to *M. incognita.* One cultivar was found susceptible to *M. javanica,* one moderately susceptible, three moderately resistant and 47 resistant. The different degrees of resistance exhibited by the cultivars screened against *M. incognita* and *M. javanica* could be attributed to the differences in genes for resistance possessed by the different cultivars.

The results clearly show that resistance to nematodes varies among sweet potato cultivars. For example, most of the cultivars susceptible to *M. incognita,* viz., Binicol, Gold Rush, AIS-209-3, BNAS – 51, Catanduanes, High Yielding Yellow, Tres Colores, Kinabakab and GAT, were resistant to *M. javanica.* Miracle, L4-89, Travis, Jasper, Jewel, Lubang, Karja, Caragold and W-86 were resistant to both nematode species. On the other hand, Garcia Yellow which was resistant to *M. incognita* was found to be moderately susceptible to *M. javanica.* UPR was susceptible to both nematode species. These results are similar to the findings of Giamalva et al. (1960) where two of eight sweet potato varieties were highly resistant to a population of *M. incognita, M. incognita acrita, M. hapla, M. javanica* and *M. arenaria.* Moreover, findings in this experiment further confirmed the results of similar studies conducted by Sasser (1954), Gentile et al. (1962), Weimer and Harter (1925) and Cordner et al. (1951).

It has been postulated that growth regulators are involved in the susceptibility or resistance of the hosts to nematodes (Veech, 1981). The high levels of growth hormones, e.g. IAA, cytokinins, kinetin and other compounds that induce synthesis or serve as precursor in hormone biosynthesis favor susceptibility. Higher levels of endogenous cytokinins were found in susceptible than in resistant tomato roots and nematode infection increased cytokinin levels in these roots (Van Standen and Dimalla, 1977). A relatively high level of endogenous auxins or kinins or both was demonstrated in the roots of susceptible plants infected with root-knot nematodes as compared to that occurring in the uninfected or infected resistant plants (Cutter and Krusberg, 1968; Setty and Wheeler, 1968; Kruspagar and Barker, 1966; Kochba and Sanish, 1972).

Although growth hormone levels of susceptible and resistant sweet potato cultivars were not determined in this experiment, the varying number of galls and gall index as shown in Tables 1 and 2 suggest that growth regulators play an important role. Jones (1981) emphasized that plant growth regulators rarely act independently and that it is the overall balance which must be determined to interpret their involvement in different infections.

The use of resistance ratings based on more than one assessment parameter is more reliable than using only one. In this experiment, analysis indicated highly significant ($P<0.01$)

positive linear correlation between resistance rating and the parameters used, viz., number of egg masses and galls, nematode population in the roots, egg mass index and gall index (Table 3). This implies that any of the parameters could be used to determine host resistance. Resistance rating in this particular study was based mainly on the egg mass index since root galling was not so pronounced in sweet potato. Although root galling has been used more often as the sole method of measuring resistance in screening experiments, it does not indicate the degree of nematode reproduction. For example, the root gall index ratings of cultivars Ifugao 25 and Hsinchu show that they are moderately resistant to *M. incognita* but based on egg mass index ratings, these cultivars are moderately susceptible. Likewise, Garcia Yellow which is moderately susceptible to *M. javanica* based on egg mass index, is moderately resistant when gall index was used as the criterion. Therefore in sweet potato, egg mass index would be a better and more reliable criterion for the assessment of resistance. Resistance of plants to nematodes should be based on the inhibition of nematode reproduction as pointed out by Fassuliotis (1979), Rohde (1972), and Taylor and Sasser (1978). Moreover, egg mass count is easier to determine than the other parameters used.

**Table 3.** Correlation of the number of egg masses (NEM), number of galls (NG), nematode population in roots (PR), egg mass index (EMI) and root gall index (GI) in sweet potato cultivars screened for resistance to *Meloidogyne incognita* and *M. javanica.*

| Species | Correlation Coefficient |
|---|---|
| *M. incognita* | |
| NEM vs NG | 0.97277** |
| NEM vs PR | 0.98179** |
| NG vs PR | 0.96706** |
| EMI vs GI | 0.91673** |
| *M. javanica* | |
| NEM vs NG | 0.95261** |
| NEM vs PR | 0.91093** |
| NG vs PR | 0.86703** |
| EMI vs GI | 0.86374** |

**Highly significant

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