REPRODUCTION OF POPULATIONS OF MELOIDOGYNE SPECIES ON IN VITRO PRODUCED BANANA PLANTLETS

by

G. Grammatikaki and E. A. Tzortzakakis

Summary. Reproduction of two populations of Meloidogyne javanica and one of M. incognita, from Crete, did not differ on Goldfinger (FHIA 01) and Dwarf Cavendish banana plantlets produced in vitro. However, the intensity of root gall ing differed significantly, being higher on Goldfinger than on Dwarf Cavendish at both the two initial (1000 or 5000 eggs/pot) population densities tested.

Banana (Musa AAA cavendish subgroup: Dwarf Cavendish) is the most important subtropical crop in Crete where it is grown in plastic houses along the coastal areas of the island. A survey on 28 locations in the most representative banana growing areas during 1990-91 indicated the presence of M. javanica in nearly 95% of the sampled sites (Vovlas et al., 1994).

Goldfinger is a banana cultivar developed by the Queensland Department of Primary Industries for subtropical cultivation. It has exceptional cold tolerance, is highly resistant to Black Sigatoka (Mycosphaerella fijiensis), Panama disease races 1 and 4 (Fusarium oxysporum f.sp. cubense) and the burrowing nematode (Radopholus similis) (Information Bulletin, Department of Primary Industries, Queensland). The exceptional cold tolerance and resistance to Black Sigatoka may offer advantages for Cretan conditions and the FHIA lines could replace the traditionally grown clones of cv. Dwarf Cavendish. For this reason in vitro plants of the Goldfinger line (FHIA 01) were imported from Tropical Technologies Pty Limited, Tzaneen, Republic of South Africa, for multiplication and agronomic investigation. One line of investigation was an assessment of the reproduction of Cretan populations of root-knot nematode (Meloidogyne spp.) on Goldfinger FHIA 01 and the Dwarf Cavendish, the results of which are presented here.

Materials and methods

Both banana cvs were micromultiplied in vitro using vegetative shoot apices and the MS culture medium (Murashige and Skoog, 1962) containing myo-inositol (100 mg/l), thiamine HCl (2 mg/l), 6-benzylaminopurine (BAP) (5 mg/l) and sucrose (30 gr/l). The pH was adjusted to 5.8 and the medium was solidified with agar (8 gr/l). Cultures were maintained at 26 °C and 16 h photoperiod with fluorescent light of 3500 Lux. For bud proliferation of cv. Dwarf Cavendish the above mentioned medium was used, while for the Goldfinger line (FHIA 01)
multiple shoots and buds were found to be better stimulated by supplementing the medium with 6 mg/l of BAP. Repetitive dissection of the aggregated adventitious buds and new placement in the media was made until a sufficient population of buds was obtained. Buds were then transferred to the rooting medium (MS medium containing 100 mg/l myo-inositol, thiamine HCl 2 mg/l, indole-3-butyric acid 4 mg/l and sucrose 30 gr/l). After incubation for four weeks (26 °C, 16 h photoperiod and 3500 Lux) plantlets exhibited numerous roots. Acclimatization in an insect-proof conditioned glasshouse was carried out for about 20 days and then plants were individually transplanted into 0.6 l pots filled with steam sterilized soil (72% sand, 9% clay, 19% loam, EC=3.75, pH=7.183) and distributed on a glasshouse bench.

After 3 weeks (28 July) each pot was inoculated with egg masses of root-knot nematode populations which were buried in 4-5 cm deep depressions around the stem and covered with soil. The egg masses had been picked from infested roots of tomato plants maintained in pots in a growth room. The average number of eggs/egg mass was estimated by dissolving several egg masses in 1% NaOCl (Hussey and Baker, 1973). Two rates of inoculum were applied for each banana variety X nematode combination, namely c. 1,000 (low) or 5,000 (high) eggs per pot. Both inoculation levels were higher than the tolerance limit for height (0.32 eggs and J2/cm³) and relative weight (0.146 eggs and J2/cm³) defined for *M. javanica* on Dwarf Cavendish (Vovlas et al., 1993).

The nematode populations used were *M. javanica* (Treub) Chitw. (populations 1 and 2) and *M. incognita* (Kofoid et White) Chitw. collected from vegetable crops of different areas of Crete. One population (2) of *M. javanica* was highly pathogenic to nematode resistant tomatoes (Tzortzakakis and Gowen, 1996).

Pots were randomized in a glasshouse without supplementary light or heat for 14 weeks after inoculation (air temperature ranged from 18-28 °C) with each treatment replicated five times. Then the plants were uprooted, roots washed free from soil, weighed, rated for root-gallng intensity from 0 to 10 (Bridge and Page, 1980) and chopped into 1-2 cm pieces. Each root was individually comminuted in a kitchen blender (for three periods of 10-15 seconds separated by two intervals of 10 seconds) and eggs were collected after washing the slurry on a 38 μm sieve. A 150 μm sieve was used to collect coarse root material. The eggs collected on the sieve were washed in a beaker and the concentration was estimated in representative samples of 2 ml under a stereoscope (X 25).

Data on egg production were transformed to square roots before analysis to standardize the variances (Mead and Curnow, 1990). Effects were assessed by ANOVA following the design of a two factor experiment.

**Results and discussion**

The roots of control plants of Golfgfinger (FHIA 01) were longer and heavier (9.1 g) than Dwarf Cavendish (6.5 g). Nematodes caused galls and reproduced in both cultivars. The intensity of root-galling differed significantly between the two cultivars being higher in Golfgfinger than in Dwarf Cavendish at both nematode densities. Low nematode density galling was dependent on nematode population (Table I).

Nematode reproduction (number of eggs/g of root) did not differ between the cvs at both densities but was different between populations (Table II). This may be explained by inter or intraspecies differences on reproduction of *Meloidogyne* on a susceptible host (Khan and Haider, 1991).

Our results confirm that the banana cv. Goldfinger (FHIA 01) can be severely damaged and support high reproduction rates of *M. javanica* and *M. incognita*. Nevertheless, of particular interest would be a study on the effect of nematode damage on yield and other agronom-
TABLE I - Root galling intensity of two banana cvs grown in soil infested by Meloidogyne spp.

<table>
<thead>
<tr>
<th></th>
<th>1000 eggs/pot</th>
<th>5000 eggs/pot</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Goldfinger</td>
<td>Dwarf Cavendish</td>
</tr>
<tr>
<td>M. javanica 1</td>
<td>5.2</td>
<td>5.4</td>
</tr>
<tr>
<td>M. javanica 2</td>
<td>4.8</td>
<td>4.0</td>
</tr>
<tr>
<td>M. incognita</td>
<td>5.6</td>
<td>4.0</td>
</tr>
</tbody>
</table>

SE = 0.48
Cv. effect P < 0.01
Nematode effect P < 0.05
Interaction P > 0.05

TABLE II - Egg mass production (eggs/g root) on two banana cvs grown in soil infested by Meloidogyne spp.

<table>
<thead>
<tr>
<th></th>
<th>1000 eggs/pot</th>
<th>5000 eggs/pot</th>
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<tbody>
<tr>
<td></td>
<td>Goldfinger</td>
<td>Dwarf Cavendish</td>
</tr>
<tr>
<td>M. javanica 1</td>
<td>620 (24.9)</td>
<td>1681 (41.0)</td>
</tr>
<tr>
<td>M. javanica 2</td>
<td>2180 (46.7)</td>
<td>2079 (45.6)</td>
</tr>
<tr>
<td>M. incognita</td>
<td>2421 (49.2)</td>
<td>5640 (75.1)</td>
</tr>
</tbody>
</table>

SE = 13.47
Cv. effect P > 0.05
Nematode effect P < 0.05
Interaction P > 0.05

ANOVA on square root transformed data ( ).

...ical characteristics of both cultivars, as root-knot nematodes are widely distributed and abundant in Crete.

Literature cited


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