The reproductive capacity and longevity of *Xiphinema index* (Nematoda : Dorylaimida) from three populations on selected host plants (1)

Derek J. F. BROWN and Maria I. COIRO


**Summary**

Under *Ficus carica* host plants, in a laboratory study done at 18°, longevity and the total reproductive capacity of female *Xiphinema index* from populations from Italy and the U.S.A. were the same. The nematodes survived for c 64 weeks, had a reproductive span of c 56 weeks and produced a total of c 150 progeny which was equivalent to an egg being produced every 25 day above a minimum daily threshold soil temperature of 10°. Under *Lycopersicon esculentum* cv. Moneymaker females from populations from Italy, Israel and the U.S.A. survived for c 40 weeks and their reproductive capacity was only 20% of that under *F. carica*, with 62 or 90 day required for individual egg production. In a second experiment done in larger pots (250 ml vs 25 ml) at 22° Italian female nematodes required 21 and 48 day for individual egg production under *F. carica* and *Vitis vinifera* host plants.

**Materials and methods**

Brown and Coiro (1983) reported the total reproductive capacity and longevity of female *Xiphinema diversicaudatum* (Micoletzky, 1927) Thorne, 1939 from a Scottish population. A similar study was done with female *X. index* Thorne & Allen, 1950 from Israel, Italy and the United States of America. The results from this study are presented here and are compared with those reported for *X. diversicaudatum*. Results from these two studies allow the longevity and total reproductive capacity of a thelytokous species, *X. index*, to be compared with that of an amphimictic species in the same genus, *X. diversicaudatum*. The reproductive capacity of female *X. index* from the Italian population on selected crop plants also was examined and the results are presented here.

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In an experiment done to examine the total reproductive capacity and longevity of individual female *X. index* the methods used were similar to those of Brown and Coiro (1983) and Coiro and Brown (1984). *X. index* from the three populations were extracted and individual fourth stage juveniles (J 4) or pre-adult females were hand-picked into a series of 25 ml plastic pots, without drainage holes. A plant seedling was added to each of the fifteen pots used for each plant species, for each population. The pots were maintained in a temperature controlled cabinet, similar to that of Taylor and Brown (1974), at 18° ± 1° with supplementary lights providing a minimum daylength of 16 h. After eight weeks nematodes were extracted from the pots, the juveniles counted and discarded and the female returned to a clean pot together with a new seedling. This procedure was repeated each eight weeks until the females were not recovered or were considered to have ceased feeding (translucent bodies) and were moving sluggishly.

A second experiment was done to examine the reproductive ability of female *X. index* on several crop plants. Five J 4 or pre-adult females from the Italian population were added to each of ten 250 ml plastic pots, without drainage holes, per plant species. The plants were allowed to grow in the pots in a glasshouse for sixteen weeks at 22°. Upon terminating the experiment the nematodes were extracted from all the soil contained in the pots, identified to developmental stage and counted.

### Results

#### Longevity and Total Reproductive Capacity

Under *F. carica* host plants longevity and the total reproductive capacity of female *X. index* from populations from Italy and the U.S.A. were similar. Juveniles were produced up to between 48 and 56 weeks. At 56 weeks the females remaining generally had translucent bodies and moved sluggishly, and, none were recovered at 64 weeks (Tab. 1). Differences between females in the numbers of juveniles which they produced were similar for both populations and the total mean numbers of juveniles produced had a coefficient of variation of c. 7 percent. Under *L. esculentum* cv. Moneymaker females from three populations of *X. index* produced fewer juveniles than under *F. carica* and reproduction ceased between 24 and 32 weeks although the females survived for another eight to sixteen weeks.

<table>
<thead>
<tr>
<th>Population</th>
<th>Ficus carica</th>
<th>Lycopersicon esculentum cv. Moneymaker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>0 16 52 58 83 111 133 133</td>
<td>9 14 50 63 112 112 120 120</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>5 10 19 20 20 - - - -</td>
<td>5 10 19 20 20 - - - -</td>
</tr>
<tr>
<td>Israel</td>
<td>0 5 16 16 - -</td>
<td>0 5 16 16 - -</td>
</tr>
</tbody>
</table>

#### Reproductive Ability Under Selected Crop Plants

Nematodes from the Italian population completed a life cycle (J 4 to J 4) in less than sixteen weeks on

<table>
<thead>
<tr>
<th>Plant</th>
<th>X. index juveniles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 2 3 4 ♀</td>
</tr>
<tr>
<td>Ficus carica</td>
<td>24 137 78 76 8</td>
</tr>
<tr>
<td>Vitis vinifera</td>
<td>23 70 28 18 6</td>
</tr>
<tr>
<td>Olea europaea</td>
<td>2 1 0 0 3</td>
</tr>
<tr>
<td>Citrus aurantium</td>
<td>6 2 0 0 2</td>
</tr>
<tr>
<td>Lycopersicon esculentum cv. Roma</td>
<td>1 2 0 0 2</td>
</tr>
<tr>
<td>cv Rossol</td>
<td>4 9 0 0 3</td>
</tr>
<tr>
<td>cv Nematex</td>
<td>0 8 1 0 3</td>
</tr>
<tr>
<td>cv Chico II × Rossol</td>
<td>5 6 0 0 2</td>
</tr>
<tr>
<td>cv Haubners Vollendung</td>
<td>3 3 0 0 4</td>
</tr>
</tbody>
</table>

*F. carica* and *V. vinifera* host plants at 22°. After sixteen weeks under *O. europaea, C. aurantium* and five cultivars of *L. esculentum* only J 1 and J 2 were recovered except under *L. esculentum* cv. Nematex where a few J 3 were recovered (Tab. 2).

The day/degree (day°) requirement, above a daily threshold of 10°, for the production of each egg was calculated for the two experiments (Tab. 3). In the two experiments the Italian female *X. index* required a mean of 21.3 day° and 23.5 day° respectively under *F. carica* host plants to produce an egg. Females from the U.S.A. population required a mean of 26.1 day° under *F. carica* to produce an egg. The similarity of these values contrasts with a mean of 48.3 day° required by Italian *X. index* under *V. vinifera* for each egg produced. Under *L. esculentum* cv. Moneymaker *X. index* from Israel and the U.S.A. required 89.6 and 84.0 day° respectively to produce an egg whereas Italian females required only 61.8 day°. 

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Reproductive capacity and longevity of Xiphinema index

Table 3
Number of day°, above a minimum threshold of 10° required for the production of eggs by female Xiphinema index from different populations and under different plant species

<table>
<thead>
<tr>
<th>Population : Italy</th>
<th>24 day°/egg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ficus carica</td>
<td>26 day°/egg</td>
</tr>
<tr>
<td>Lycopersicum esculentum cv. Moneymaker</td>
<td></td>
</tr>
<tr>
<td>Population : Italy</td>
<td>62 day°/egg</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>84 day°/egg</td>
</tr>
<tr>
<td>Israel</td>
<td>90 day°/egg</td>
</tr>
</tbody>
</table>

Table 1
Ficus carica

Table 2
Plant : Ficus carica
Vitis vinifera

21 day°/egg
48 day°/egg

Discussion

Techniques used in the present study of longevity and total reproductive capacity were similar to those used by Brown and Coiro (1983) with X. diversicaudatum under Fragaria × ananassa Duch. cv. Cambridge Favourite, and thus, results from both studies can be compared. The longevity of X. index on F. carica host plants and X. diversicaudatum on F. × ananassa was similar being 60 to 64 weeks and the total reproductive capacities for the two species were generally similar being 140 to 160 and 180 to 200 progeny respectively. Furthermore, X. diversicaudatum females produced an egg every 21 day° above a minimum daily threshold of 5° whereas X. index females produced an egg every 24-26 day° above a minimum daily threshold of 10°. The higher minimum threshold temperature was chosen for X. index as the nematode is associated with the warmer, Vitis growing, areas of the world, whereas, X. diversicaudatum is a northern European species (Brown, 1983). Female X. index from Italy and the U.S.A. had similar longevities and reproductive capacities under F. carica. Under L. esculentum cv. Moneymaker females from these and the Israel population also had similar longevities and reproductive capacities. However, total reproduction under L. esculentum was less than 20% of that under F. carica and the nematodes developed less rapidly than under F. carica. Furthermore, longevity of the original J 4 under L. esculentum was much reduced compared with F. carica, 32 to 40 weeks and 56 to 64 weeks respectively.

The day° requirement for individual egg production by Italian nematodes under F. carica was similar in experiments with small (25 ml) and large (250 ml) pots (24 day° and 21 day° respectively). In the larger pots a mean of 48 day° was required by the Italian nematodes to produce an egg under V. vinifera, and, only a few J 1 and J 2 were produced under several other commercial crops and root stocks. It appears therefore that F. carica is a better host than V. vinifera for X. index and that O. europaea, C. aurantium and four commercially grown L. esculentum cultivars and cv. Haubners Vollen dung are comparatively poor hosts for the nematode. These data are supported from field observations in southern Italy where X. index is frequently identified as large populations under Ficus and Vitis spp. but only occasionally associated with O. europaea and C. aurantium, and then only as relatively small populations. Furthermore, results from this study agree with those of Coiro and Brown (1984) who reported that L. esculentum cv. Moneymaker was a better host for X. index from Italy than was cv. Haubners Vollen dung. The four commercially grown L. esculentum cultivars also were poor hosts therefore in general L. esculentum is probably a poor host for X. index from Italy.

The present study reveals that the longevity and reproductive capacity of X. index, a thelytokous species, is similar to that of X. diversicaudatum, an amphimictic species (Brown & Coiro, 1983). It seems probable that the results obtained in these two studies can be extrapolated for use with other Xiphinema species. The minimum temperature for reproduction required by a Xiphinema species may be used with the day° requirement for longevity and egg production as recorded for X. index and X. diversicaudatum. These data and the local daily mean soil temperature may be used to predict the life cycle and reproduction of the species and therefore allows for the planning of a cropping system which may prevent the nematode from completing its life cycle, or, for better determining the timing of chemical applications for controlling nematodes.

References


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