

# The status of some plants as hosts for four populations of *Xiphinema index* (Nematoda: Dorylaimida) <sup>(1)</sup>

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## SUMMARY

In small pot (25 ml) tests with single females of *Xiphinema index* from populations from France, Israel, Italy and U.S.A. *Lolium perenne*, *Ribes nigrum* cv. Ben Lomond and *Rubus idaeus* cv. Malling Jewel were found not to be hosts whereas *Fragaria* × *ananassa* cv. Cambridge Favourite, *Ficus carica*, *Petunia hybrida*, *Solanum demissum* and *Lycopersicon esculentum* cv. Moneymaker were hosts. *L. esculentum* cv. Haubners Vollendung was a better host for *X. index* from France and the USA than for nematodes from Israel and Italy. Also, significantly fewer *X. index* from the Israel than from the French population survived and produced progeny on *F. × ananassa* host plants. Reproduction and development of progeny from females from the four populations was slower on *F. × ananassa* than on *F. carica* plants. Furthermore nematodes from the four populations completed their life cycle on *F. carica* in less than twelve weeks at 18°, but took longer on *F. × ananassa*.

## RÉSUMÉ

*Statut de quelques plantes hôtes vis-à-vis de quatre populations de Xiphinema index (Nematoda: Dorylaimida)*

Des tests en pot (25 ml), avec une seule femelle de *Xiphinema index* provenant de populations de France, Israël, Italie et USA, ont montré que *Lolium perenne*, *Ribes nigrum* cv. Ben Lomond et *Rubus idaeus* cv. Malling Jewel ne sont pas hôtes pour cette espèce, à l'inverse de *Fragaria* × *ananassa* cv. Cambridge Favourite, *Ficus carica*, *Petunia hybrida*, *Solanum demissum* et *Lycopersicon esculentum* cv. Moneymaker. *L. esculentum* cv. Haubners Vollendung s'est montré meilleur hôte pour les populations venant de France et des USA que d'Israël et d'Italie. De plus, la survie et la reproduction sont plus faibles, sur *F. × ananassa*, pour la population venant d'Israël que pour celle venant de France. La reproduction et le développement de la descendance était plus faible, chez les quatre populations, sur *F. × ananassa* que sur *F. carica*. Enfin, pour les quatre populations, le nématode complète son cycle en moins de douze semaines, à 18°, sur *F. carica*, mais ce temps est plus long sur *F. × ananassa*.

The geographical distribution of *Xiphinema index* Thorne & Allen, 1950 is related to that of *Vitis vinifera* L. which is its principal plant host. Several other plant species have been reported to be hosts for the nematode but some of these reports contain inconsistencies concerning the ability of some of the plants to act as hosts for *X. index*: only two of three collections of *Parthenocissus tricuspidata* (Sieb. et Zucc.) Planch. and one of two collections of *Ampelopsis aconitifolia* Hort. from California, USA were hosts for *X. index* from California (Weiner & Raski, 1966); several species of *Vitis* were reported not to be hosts for *X. index* from the USA (Kunde, Lider & Schmitt, 1968) and France (Bouquet, 1981) although species of *Vitis* are generally excellent hosts for the nematode; *Lycopersicon esculentum* Mill. cv. Moneymaker was a host for *X. index* from the USA

(Cotton, 1973) but *L. esculentum* cv. Haubners Vollendung was not a host for *X. index* from Italy (Wyss, 1978); *Citrus aurantium* L. was reported to be a host for *X. index* from Israel (Cohn & Mordechai, 1969) but was not a host for nematodes from Italy (Coiro, Lamberti & Agostinelli, 1980).

## Materials and methods

Therefore, several plant species and two cultivars of *L. esculentum* were examined as hosts for individual female *X. index* from four geographically isolated populations.

The plant species examined were *Ficus carica* L., *Fragaria* × *ananassa* L. cv. Cambridge Favourite, *Lolium perenne* L., *Lycopersicon esculentum* Mill. cv.

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Moneymaker and cv. Haubners Vollendung, *Petunia hybrida* Vilm., *Ribes nigrum* L. cv. Ben Lomond, *Rubus idaeus* L. cv. Malling Jewel, and *Solanum demissum* L. Depending on their growth, plant species were used as two or four week-old seedlings, except *F. × ananassa* which were produced by plant tissue culture techniques (Boxus, 1974). *X. index* populations kept on cultures on *F. carica* host plants in a heated glasshouse at the Scottish Crop Research Institute, were originally obtained from stock cultures kept on *V. vinifera* host plants from California, USA (supplied by Prof. D.J. Raski, USA, via Dr. J.J.M. Flegg, U.K.); Bari, Italy (Prof. F. Lamberti); Bordeaux, France (Dr. A. Dalmasso) and Bet Dagan, Israel (Prof. E. Cohn).

Laboratory methods developed at the SCRI for studying reproduction of longidorids and transmission of plant viruses by nematodes were used in the

study (McElroy, Brown & Boag, 1977; Brown & Coiro, 1983). *X. index* were extracted from soil using the method of McElroy, Brown and Boag (1977), modified by replacing the 125 µm aperture sieve with one of 250 µm aperture and by collecting the nematodes from Baermann funnels after only 4 h. Individual fourth stage juvenile (J4) *X. index* were placed in a series of 25 ml plastic pots, without drainage holes, to which were added plant seedlings. Ten pots were used for each plant species or cultivar and were placed in a temperature controlled cabinet (Taylor & Brown, 1974) which maintained a temperature of  $18 \pm 1^\circ$ . Supplementary mercury vapour lamps provided a minimum 16 h day length. After twelve weeks all nematodes were extracted from the pots and counted differentiating the developmental stages, root galls caused by nematodes feeding were also counted.

Table 1

The number (from 10 replicates) of female *Xiphinema index* from four populations surviving and reproducing on five host-plant species

Host	X. index populations							
	Females reproducing/ females surviving				Progeny (means)			
	France	Israel	Italy	USA	France	Israel	Italy	USA
<i>Fragaria × ananassa</i>	8/8	2/3	6/7	4/6	12	12	7	10
<i>Petunia hybrida</i>	6/6	5/5	9/10	7/7	23	9	12	6
<i>Solanum demissum</i>	8/9	8/9	8/9	6/7	12	14	10	5
<i>Ficus carica</i>	9/10	8/8	10/10	8/8	62	44	114	69
<i>Lycopersicon esculentum</i> cv. Moneymaker	7/9	9/10	8/9	6/7	19	21	17	14
cv. Haubners Vollendung	9/9	2/6	3/5	9/10	8	1.5	2	14

Significance levels of main effects and interactions  
(analysis of deviance using non orthogonal analysis of logged data for progeny)

	All plants	L. esculentum only
Populations allowing for hosts	NS	NS
Hosts allowing for populations	0.1 %	1 %
Hosts/populations interaction	NS	5 %

NS : Not significant.

## Results

Two females from the French population produced one and three J1 respectively on *L. perenne*. No reproduction occurred and none of the original juveniles were recovered from the remaining pots with *L. perenne*, *R. nigrum* and *R. idaeus* plants. Significantly ( $P < 0.05$ ) fewer of the original *X. index* from the Israel population, than from the French population, survived and produced progeny on the *F. × ananassa* plants. Generally, the mean numbers of progeny varied considerably between the populations and between the hosts with the largest numbers being produced on the *F. carica* plants. Also, the mean numbers of progeny were correlated with the numbers of females producing progeny on the different host plants and this accounted for 39% of the variability of the recorded data (Tab. 1).

The *X. index* progeny recovered from *F. × ananassa* plants were predominantly J1, J2 and J3 with only an occasional J4 and no new adults were recovered (Tab. 2). However, the numbers of all four juvenile stages and adults recovered from the *F. carica* plants were similar. Seinhorst (1975) suggested that two parameters might be used to characterise host status of plants: « the maximum rate of multiplication (occurring at low densities) and the equilibrium density (the highest density that can be sustained by the host) ». In the present study the maximum rate of multiplication differed between *F. carica* and *F. × ananassa* the difference being the

result of slower reproduction and development of *X. index* on *F. × ananassa*.

Significant differences were recorded in the number of progeny produced by nematodes from the four populations when two cultivars of *L. esculentum* were used as host plants. The principal differences occurred in the mean numbers of progeny produced by nematodes from Israel and Italy on *L. esculentum* cvs Moneymaker and Haubners Vollendung (Tab. 1).

## Discussion

In the present study *R. nigrum* cv. Ben Lomond, *L. perenne* and *R. idaeus* cv. Malling Jewel were found not to be hosts for *X. index* from four populations although previously *R. nigrum* had been reported as a host for *X. index* (Fritzsche & Thiele, 1979). Cotten (1973) listed several *Solanum* spp. as being hosts for *X. index* and that list increased with the inclusion of *S. demissum* which, together with *F. × ananassa* cv. Cambridge Favourite, *P. hybrida*, *F. carica* and *L. esculentum* cv. Moneymaker, were found to be hosts for *X. index*. The results obtained with the two *L. esculentum* cultivars and *X. index*, from the four populations, confirm the results reported by Cotten (1973) and Wyss (1978). The differences in reproduction between the populations of *X. index* when the two cultivars of *L. esculentum* were used as host-plants also confirms the report by Taylor and Brown (1981) that physiological differences occur between populations of *X. index*.

Table 2

Percentage means of females and juvenile stages, produced in 12 weeks by individual female *Xiphinema index* from four populations, present on *Ficus carica* and *Fragaria × ananassa*

Nematode population	Ficus carica					Fragaria × ananassa				
	J1	J2	J3	J4	female	J1	J2	J3	J4	female
France	26	25	28	12	9	54	39	7	0	0
Israel	18	35	24	9	14	67	21	12	0	0
Italy	25	24	20	10	21	80	17	3	0	0
USA	21	25	29	10	15	55	30	12	3	0
Grand means	24	26	24	10	16	63	28	8	1	0

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