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STUDIES ON THE LIFE-CYCLE OF *XIPHINEMA INDEX* (1)

by

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Information on the life cycle of *Xiphinema index* Thorne et Allen is limited and at variance. Radewald and Raski (1962) reported that the development from egg to adult took 22-27 days in the glasshouse, whereas Taylor (1963) suggested development from second stage juvenile to adult required about 36 days. More recently, in Israel, Cohn and Mordechai (1969, 1970) found that populations of *X. index* completed their life cycle in seven to nine months at 20-23° C and in three to five months at the optimal temperature of 28° C. In Sardinian vineyards the life cycle of the nematode was completed in 12 to 14 months (Prota and Garau, 1973).

The reproductive potential of two Italian populations of *X. index* was investigated in experiments carried out in glasshouse at Sassari and at Bari. The results of these investigations are herein illustrated and discussed.

a) *Experiments at Sassari.*

MATERIALS AND METHODS

The glasshouse temperature ranged from 20.5-22.5° C, but occasional minimum values between 15 and 19° C and maximum up to

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27° C. Two populations of *X. index* were collected from Sardinian vineyards and cultured on fig (*Ficus carica* L.) for several months in glasshouse. Twenty to fifty young females (without eggs in the uterus) were inoculated in the root area of one year old fig seedlings in 12 x 10 cm cylindrical plastic pots containing a mixture (1:1) of steam sterilized soil and sand. The pots were watered as required to avoid excessive fluctuations of the soil humidity.

To ascertain the life cycle, nematodes were extracted from three of the pots every 20 days, starting 20 days after inoculation. Extraction was by Seinhorst (1962 a) elutriator and all specimens were prepared for microscopical study (Seinhorst, 1962; Goodey, 1963) to determine their juvenile stage on the basis of the body and odontostyle length (Garau and Prota, 1977). The investigation was discontinued when new young females, still in the process of moulting from the preadult instar were found.

RESULTS

Eggs were present in the uteri of the females at the time of the first extraction, 20 days after inoculation. First stage juveniles were first found in the extraction at the 40th day when some were also moulting to the second juvenile stage (Table I). In pots which had been infested with gravid females the first juvenile stage were present at 30 days after inoculation but not at 15 days. The third and fourth stage juveniles were found at 60 and 100 days respectively after inoculation, and the first new young females, still in the moulting process from preadult instars, were present on the 120th day (Table I).

Table I - *Evolution of the life cycle of a Sardinian population of Xiphinema index.*

Stages of the nematode	Number of individuals of each stage (days after inoculation)					
	20	40	60	80	100	120
1st stage juveniles	0	17	21	11	70	30
2nd »	0	4	82	55	64	110
3rd »	0	0	25	72	77	100
4th »	0	0	0	0	128	70
females	9	13	2	8	5	31
gravid females	34	7	13	8	20	12

b) *Experiments at Bari.*

MATERIALS AND METHODS

Nematodes for the experiment were from an Apulian population of *X. index* reared for two years on fig in a glasshouse at 22° C. Twenty young females were inoculated to rooted fig cuttings planted in 0.5 l plastic pots filled with steam sterilized sand. The pots were kept in the glasshouse for the duration of the experiment. Three weeks after inoculation, and thereafter at weekly intervals, nematodes were extracted from two pots to determine the life stages present. The active stages of *X. index* were extracted from 450 ml of soil from each pot using Cobb's wet sieving technique; eggs were extracted by centrifugation from a 50 ml soil sample (Zacheo and Lamberti, 1974). The analysis continued until the eleventh week after inoculation.

RESULTS

At the first extraction, three weeks after inoculation, all the females present were gravid with one, two or three eggs in the uterus (Table II). First stage juveniles were present at 4 weeks after inoculation and second and third stage juveniles one and two weeks later respectively (Table II). Preadult juveniles were present 8 weeks after inoculation and the first new female, still in the process of moulting from the preadult, at 9 weeks (Table II). The second generation of

Table II - *Evolution of the life cycle of an Apulian population of X. index*

Stages of the nematode	Mean number of stages found/500 ml of soil at different intervals after inoculation								
	weeks 3	4	5	6	7	8	9	10	11
1st stage juveniles	0	15	65	141	40	0	3	7	20
2nd » »	0	0	15	155	152	53	41	60	135
3rd » »	0	0	0	43	250	255	186	350	325
4th » »	0	0	0	0	0	343	275	439	600
young females	0	0	0	0	0	0	1	6	109
gravid females	18	0	0	11	10	12	8	13	24
eggs	0	30	0	30	40	40	27	10	45
full developed non gravid females	0	17	5	2	4	4	9	5	0

nematodes was estimated to have started 10 to 11 weeks after inoculation.

DISCUSSION AND CONCLUSIONS

The results indicate that Italian population of *X. index* may complete their life cycle in two to four months at 20-22° C. This compares with seven to nine months in Israel (Cohn and Mordechai, 1969). These large differences may be due to the different procedures used to determine the development of the populations, but may also be due to some environmental factors which may have affected the life cycle and prolificity of *X. index*. Temperature has a considerable effect (Cotten *et al.*, 1970; Coiro and Lamberti, 1976), but was similar in the Israel and Italian investigations. The differences obtained between the Apulian and the Sardinian populations may be, however, partially attributed to the fluctuation of temperature in the experiment at Sassari. Soil type (Coiro and Lamberti, 1976) and host plant (Grimaldi De Zio *et al.*, 1975) are more likely to account for the differences observed: fig, used in our investigations, is a better host for *X. index* (Coiro and Lamberti, 1976) than either grapevine or sour orange used by Cohn and Mordechai (1969). Finally it cannot be excluded that different populations of *X. index* differ in their reproductive behaviour.

The Apulian population studied at Bari increased 60 fold in two months and a half and each female is estimated to have laid 25-45 eggs within nine to ten weeks. It seems likely that there is a fairly well-defined egg-laying period which commences soon after the females mature, and that the females die soon after they have exhausted their egg-laying capability. In fact, no oocytes were observed in the last weeks within the ovaries of the full developed non-gravid females.

S U M M A R Y

Italian populations of *Xiphinema index* Thorne *et* Allen completed their life cycle in two to four months, when maintained on fig (*Ficus carica* L.) in a glass-house at 20-22° C. Each female apparently laid 25 to 45 eggs in a period of ten weeks. The initial population increased 60-fold in two and a half months.

RIASSUNTO

Studi sul ciclo biologico di Xiphinema index

Popolazioni italiane di *Xiphinema index* Thorne et Allen hanno completato il loro ciclo biologico in due-quattro mesi se allevate su Fico (*Ficus carica* L.) in serra a 20-22° C. Ogni femmina sembra avere deposto da 25 a 45 uova in un periodo di dieci settimane. La popolazione iniziale del nematode si è moltiplicata 60 volte in due mesi e mezzo.

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