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THE TOTAL REPRODUCTIVE CAPACITY AND LONGEVITY OF INDIVIDUAL FEMALE *XIPHINEMA DIVERSICAUDATUM* (NEMATODA: DORYLAIMIDA)

by

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Little information is available on the longevity of longidorid nematodes and the reproductive capacity of individual females due to the relatively long life spans of the nematodes and difficulties encountered in culturing nematodes (Griffin and Darling, 1964; Flegg, 1968; Cohn and Mordechai, 1970; Cohn, 1975). A laboratory method, based on techniques used at the SCRI to examine the transmission of plant viruses by nematodes (Trudgill and Brown, 1978) was used to examine the longevity and total reproductive capacity of individual female *Xiphinema diversicaudatum.*

Materials and Methods

The population of *X. diversicaudatum* tested was from a mixed woodland, Inchmartine, Dundee. Specimens were extracted from soil as described by McElroy *et al.* (1977), the procedure being modified by replacing the 125 μm aperture sieve with a 250 μm aperture sieve and collecting the nematodes from Baermann funnels after only 4 h. Groups of three males and one fourth stage juvenile (presumed female) *X. diversicaudatum* were hand-picked and added to 20 small (25 ml) plastic pots without drainage holes. A sieved sand soil mixture was added to the pots which were planted with a strawberry, *Fragaria* × *ananassa* cv Cambridge Favourite, plantlet, free of pathogens, produced by plant tissue culture techniques (Boxus, 1974). The pots were

maintained at 18°C ± 1°C in a temperature controlled cabinet (Taylor and Brown, 1974) and supplementary mercury vapour lamps maintained a minimum 16 h day length. After 6 wk growth all leaves, except the two youngest, were removed from the plantlets to reduce evapotranspiration .After 12 wk the nematodes were extracted from each pot, the progeny counted and each female (see Results below) placed in a clean plastic pot together with three new males and a new strawberry plantlet. This procedure was repeated each 12 wk during a 60 wk period.

Results

At the end of the first 12 wk, 12 of the fourth stages had moulted to females and had been fertilized, producing a mean of 39 progeny (range 34 to 47 progeny). Of the remaining eight, four had become males, two were not recovered and two had become females and had produced a few progeny, but also were not recovered. After 24, 36 and 48 wk four, three and two females were not recovered. The results from these replicates were not used as the females had produced only a few progeny during the 12 wk prior to their non-recovery at an extraction date (Table I).

At 24, 36 and 48 wk eight, five and three females produced means of 68 (58 to 83), 34 (20 to 43) and 21 (13 to 28) progeny. Also, at each extraction date except 48 and 60 wk, many of the females were gravid and the progeny recovered comprised first, second and third stage juveniles. After 12, 24 and 36 wk the bodies of the females and males were opaque, but the bodies of females at 48 and 60 wk were translucent and these females moved sluggishly.

Discussion

Numbers of progeny recovered from each female were probably incomplete as some losses may have occurred during the extraction procedure. Also, unhatched eggs were not recovered. Assuming losses of 10 to 20% the estimated total reproductive capacity of an individual female *X. diversicaudatum* is 180 to 200 progeny. Little information is available about the total reproductive capacity of plant parasitic nematodes. Croll and Matthews (1977) reported that the number of

Table I - *The total reproductive capacity of individual female* Xiphinema diversicaudatum, *from a Scottish population, at 18°C under* Fragaria *x* ananassa *host plants.*

Nematodes/replicate		JUVENILES RECOVERED (cumulative totals) Week					
4th stage juvenile	Males	12	24	36	48	60	72
1	3	Male	—	—	—	—	—
1	3	Male	—	—	—	—	—
1	3	Male	—	—	—	—	—
1	3	Male	—	—	—	—	—
1	3	0	—	—	—	—	—
1	3	0	—	—	—	—	—
1	3	2	—	—	—	—	—
1	3	8	—	—	—	—	—
1	3	40	40	—	—	—	—
1	3	37	38	—	—	—	—
1	3	37	38	—	—	—	—
1	3	34	43	—	—	—	—
1	3	45	106	106	—	—	—
1	3	38	115	115	—	—	—
1	3	41	99	103	—	—	—
1	3	44	118	155	155	—	—
1	3	36	105	135	135	—	—
1	3	35	118	138	151	151	—
1	3	38	95	135	163	163	163
1	3	47	109	152	175	175	175
Mean		39	108	143	163	163	—

+ Results above the bar line in each column not used in calculating means.

eggs per female for *Meloidogyne javanica* was 350, for *Anguina agrostis* 1000 and for *Globodera rostochiensis* 200.

No periodicity occurred in progeny production, which confirms that plant root production is probably a factor limiting reproduction by the nematodes under field conditions (Flegg, 1968).

The value obtained for the total reproductive capacity of individual *X. diversicaudatum* may be atypical as only three females from the Scottish population were considered to have completed their life span. Nevertheless, the similarity of the results obtained for the three nematodes suggests that the value obtained is representative of the population.

In the present study, development from egg to adult took slightly more than 12 wk, which was equivalent to more than 1090 day degrees above a daily threshold temperature of 5°C (*X. diversicaudatum* eggs do not hatch at temperatures below 5°C (Flegg, 1969). The longevity of females in the study was *c* 60 wk, equivalent to 5460 day degrees, and their reproductive span was *c* 36 wk, equivalent to 3276 day degrees. Also, between 12 and 36 wk females produced a mean total of 104 progeny, equivalent to one progeny for 21 day degrees above 5°C. Cotten and Roberts (1980) reported a yearly mean of *c* 1500 accumulated day degrees above 5°C in south-eastern England. Therefore, using these results it can be calculated that *X. diversicaudatum* females have a yearly production of 68 progeny and a reproductive span of 3 years in south-eastern England. These results agree with those of Flegg (1968) who reported that under field conditions in south-eastern England *X. diversicaudatum* took 2 years to develop from eggs to adult and had a life span of at least 3 to 5 years. The results from the present study do not agree with those of Flegg *et al.* (1970) who stated that females probably produce 10 to 20 eggs each year. These values multiplied by the life span minus egg to adult time given by Flegg (1968) suggest that the total reproductive capacity of *X. diversicaudatum* is only between 10 and 60 eggs, which is one third of the figure obtained for the Scottish nematodes. A possible explanation for the difference in the results between the present study and those of Flegg *et al.* (1970) is that nematodes from south-eastern England have a different reproductive capacity than those used in the present study. In a separate study, using a standard system, three populations of *X. diversicaudatum,* including one from south-eastern England, produced only one third as many progeny than did eight other popula-

tions, including the population used in the present study (Brown, unpublished).

The laboratory method used in this study overcame problems of culturing and rearing longidorids which had previously been reported. Also, the method allowed several aspects of the biology of *X. diversicaudatum* to be examined e. g. longevity, reproductive-cycle, reproductive-capacity and the suitability of strawberry as a host for the nematode. The method described could be applied to an examination of the biology of other longidorid species.

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SUMMARY

In a laboratory study individual female *Xiphinema diversicaudatum* from a Scottish population had a longevity of *c* 60 wk on strawberry, *Fragaria* x *ananassa* cv. Cambridge Favourite. This result was equivalent to *c* 5460 day degrees but the reproductive span of the nematode was only *c* 36 wk, equivalent to *c* 3276 day degrees. The estimated mean total reproductive capacity was 180 to 200 progeny, with an egg laid every 21 day degrees above a daily threshold of 5°C. No periodicity occurred in the production of progeny confirming that plant root production is probably a factor limiting reproduction by the nematodes under natural conditions.

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