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# THE LIFE CYCLE OF A POPULATION OF *XIPHINEMA DIVERSICAUDATUM* FROM SLOVAKIA (NEMATODA)

by

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**Summary**. In a laboratory study at 24 °C a population of *Xiphinema diversicaudatum* from Slovakia developed from egg to adult in about 12 wk, on *Lolium perenne*. Longevity of females was about 56 wk and reproductive span 36 wk. Between week 12 and week 36 each female produced a mean total of 33 progeny. It is estimated that during a period of 48 wk an individual female has a reproductive capacity of 60-70 progeny. Egg laying rate is the ratio between progeny recovered and mean number of eggs observed in the uteri in the previous period of observation.

The life cycle and reproductive potential of British populations *Xiphinema diversicaudatum* have been the subject of several studies (Flegg, 1968; 1969; Flegg *et al.*, 1970; Cotten and Roberts, 1980; Brown and Coiro, 1983). However, little is known about the biology of this economically important species of plant parasitic nematode on continental Europe where it is widespread (Brown and Taylor, 1987) and under field conditions is a vector of certain plant viruses (Brown *et al.*, 1994).

*Xiphinema diversicaudatum* also occurs in Slovakia (Lisková *et al.*, 1995). A population of *Xiphinema diversicaudatum* found during a nematode survey in this country (Lamberti *et al.*, 1999) was used for a study of the life-cycle conducted under controlled conditions in Bari, Italy.

## Materials and methods

A population identified as *Xiphinema diversicaudatum* (Micoletzky) Thorne (Lamberti *et al.*, 1999) was collected from the rhizosphere of

plum (*Prunus domestica* L.) trees at Hronsky Benadik in western Slovakia.

Nematodes were extracted from soil by decanting and sieving. Couples consisting of one fourth stage juvenile (presumed female) and one adult male were handpicked and deposited on the roots of seedlings of *Lolium perenne* L. contained in small (25 ml) clay pots without drainage holes and filled with heat sterilized sand (Trudgill and Brown, 1978). Nematodes forming ten couples were selected using a dissecting microscope for their vitality. The pots were maintained in trays filled with wet peat and covered by porous cellophan covers, to minimize moisture loss. The trays of pots were placed on a shelf in a room at a temperature of 20-24 °C, with natural light and day length.

After 12 weeks the nematodes were extracted from each pot and each of the stages were counted. Each female, together with a male, if found, was placed again in a newly prepared pot. This procedure was repeated each 12 weeks, until nematodes were no longer recovered, at wk 60.

## Results

At the end of the first 12 wk period, eight of the fourth stage juveniles had moulted to adult females and had been fertilized, producing a mean of 21 (range 12 to 30) progeny (Table I). Of the remaining two pots, one had only a male and from the other no nematodes were recovered. After 24 wk (the second 12 wk period) only seven pots produced progeny, an average of 19 (11 to 26) individuals. Progeny were produced in six pots in the third period (36 wk), a mean of 13 nematodes (range 10-19) and only in five pots at the end of the 48 wk, with a mean of ten nematodes (range 7 to 16). At 36 wk males had disappeared, but females were still gravid, whereas at 48 wk the remaining females were devoid of eggs in the uterus, translucent and moved luggishly.

## Discussion

In the present study, development from egg to adult took about 12 wk, which is equivalent to 1428 day degrees, above a daily threshold temperature of 5 °C; according to Flegg (1969) *X. diversicaudatum* eggs do not hatch below 5 °C.

On *L. perenne*, the longevity of females of *X. diversicaudatum* from Slovakia is estimated to be, about 56 wk, equivalent to 6664 day degrees, and their reproductive span was 36 wk, equivalent to 4284 day degrees. Between weeks 12 and 36, females produced a mean total of 33 progeny each, equivalent to one progeny for 86 day degrees above 5 °C. In a period of 48 wks a mean total of 54 juveniles were produced, which is an underestimated number, because of possible losses during extraction procedures and presence of unhatched eggs, which were not extracted.

Assuming losses of 5 to 10%, the estimated total reproductive capacity of an individual female from the Slovakian population is around 60-70 progeny, which is one third of the figure obtained for Scottish population (Brown and Coiro, 1983). Whether is this due to genetic characteristics of the populations or to operational conditions is a matter of conjecture but would be interesting to investigate.

Data on the reproductive capacity and longevity of the Slovakian population of *X. diversicaudatum* were used in various interpolation

TABLE I - *Reproductive capacity of individual female* Xiphinema diversicaudatum *from Slovakia on* Lolium perenne.

| Nem/ Replic. $1♀J_4 + 1♂$ | Number of juveniles per week | | | | | |
|---|---|---|---|---|---|---|
| | 12 | 24 | 36 | 48 | 60 | Tot. |
| 1 | — | — | — | — | — | — |
| 2 | — | — | — | — | — | — |
| 3 | 13 | — | — | — | — | 13 |
| 4 | 30 | 16 | — | — | — | 46 |
| 5 | 12 | 18 | 13 | — | — | 43 |
| 6 | 24 | 23 | 19 | 16 | — | 82 |
| 7 | 22 | 11 | 10 | 8 | — | 51 |
| 8 | 22 | 16 | 10 | 7 | — | 55 |
| 9 | 15 | 25 | 15 | 7 | — | 62 |
| 10 | 28 | 26 | 14 | 10 | — | 78 |
| Mean | 21 | 19 | 13 | 10 | — | 54 |

TABLE II - *Progeny analysis of* X. diversicaudatum *from Slovakia at 12 wk intervals on* L. perenne.

| Week | Mean n° eggs/uterus | Mean n° developmental stages[*] | | | |
|---|---|---|---|---|---|
| | | $J_1$ | $J_2$ | $J_3$ | $J_4$ |
| 12 | 5.00 (0-6)[**] | 8 | 12 | 0,25 | 0 |
| 24 | 4.14 (2-6) | 1 | 6 | 7 | 6 |
| 36 | 2.83 (0-5) | 0 | 1,33 | 5 | 7 |
| 48 | 0.00 (0-0) | 0 | 2 | 5 | 4 |
| 60 | 0.00 (0-0) | 0 | 0 | 0 | 0 |

[*] Mean of 8 replicates; [**] range of n° eggs observed in the uteri.
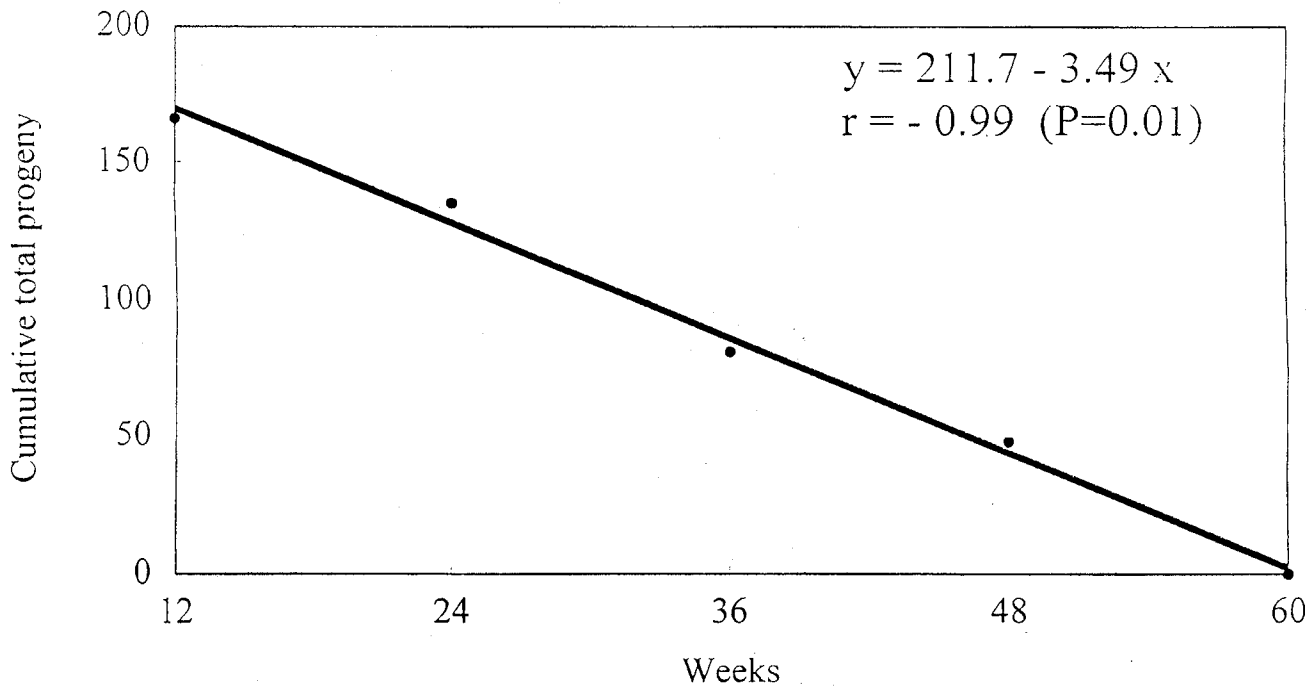
$$y = 211.7 - 3.49 \, x$$
$$r = -0.99 \quad (P=0.01)$$

Fig. 1 - Relation between cumulative total progeny production and observation times (weeks) for *Xiphinema diversicaudatum* from Slovakia.



$$y = 3.5898x - 0.2423$$
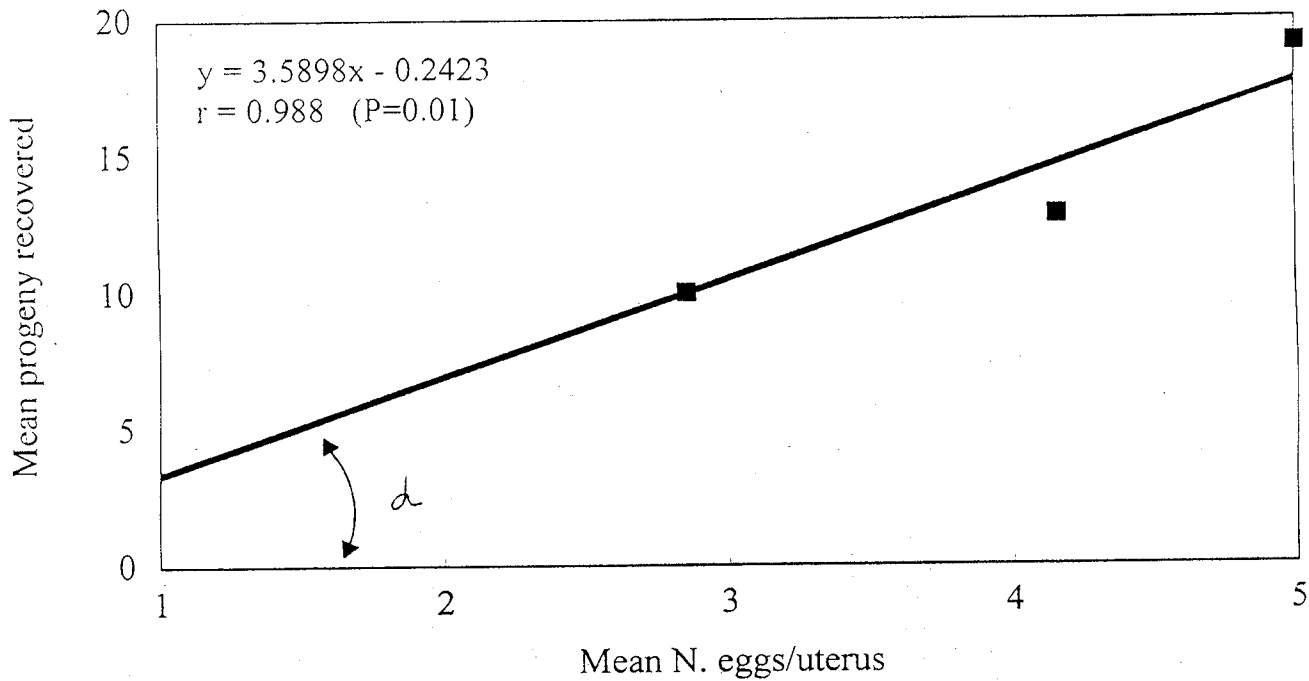$$r = 0.988 \quad (P=0.01)$$

Fig. 2 - Relation between progeny recovered at 12 wk intervals and mean number of eggs observed in the previous observation in the uteri of *X. diversicaudatum* from Slovakia.

formulae, such as linear, power, exponential and logarithmic, to explain its reproductive behaviour.

The best fit to the data on mean cumulative total reproductive capacity and observation times was obtained by the linear equation $y = mx \pm b$, from which the correlation coefficient - 0.99 was significant at $P = 0.01$ (Fig. 1), indicating a decresing reproductive capacity from weeks 12 to 48 and cessation at wk 60. The relation between progeny recorded at 12 wk intervals and mean number of eggs in the uteri (Table II) may be represented by a linear regression from which laying rate can be calculated (Fig. 2). Laying rate is the ratio between progenies recovered and mean number of eggs observed in the uteri in the previous period of observation. It corresponds to the "m" value of the linear equation of regression that is tangent of angle between the interpolation straight line and the abscissa axis.

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