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LIFE-CYCLE STUDIES OF INDIVIDUAL *LONGIDORUS ATHESINUS* (NEMATODA) ON S. LUCIE CHERRY

by
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Summary. In a laboratory study, individual female *Longidorus athesinus* from a north-eastern Italy population had a longevity of c 26 wk on S. Lucie cherry seedlings. The reproductive span of the nematode was *c* 14 wk and estimated mean total reproductive capacity was 468-490. It was calculated that development from egg to adult took 55-60 days. The relationship between cumulative total progeny production and observation times (weeks) for this species fits closely (r=0.984) a logarithmic curve.

Longidorus athesinus Lamberti, Coiro *et* Agostinelli was described from the rhizosphere of a cherry tree and grapevines, during nematode surveys in the vineyards of north-eastern Italy. Since there is virtually no information on the biology and ecology of a species which might be a pathogen to economically important crops, the overall length of its life cycle was investigated in an experiment done in controlled conditions, using specimens from a population originating from the rhizosphere of a cherry tree in the type locality near Verona.

Materials and methods

L. athesinus was maintained on S. Lucie cherry (*Prunus mahaleb* L.) in a glass-house. Nematodes were extracted from soil using Cobb's decanting-sieving technique and recovered by final extraction in Baermann funnels after four hours (Brown and Boag, 1988). Groups of one female and two males were hand-picked and added to each of 10 clay pots (50 ml) without drainage holes, containing heat sterilized sandy soil. A single newly germinated S. Lucie cherry seedling was then planted. The pots were placed in a growth chamber operating at 12h day length and 26±2 °C. After 7 days, the cherry seedlings were gently removed from the pots to allow direct observation of the roots. This was repeated at weekly intervals until wk 4 and on each occasion the female and the two males were returned to the pots. Then nematodes in each pot were extracted at 5, 7, 11, 15, 19, 23 and 25 weeks after adding individual females and males to the pots. On each occasion males, females and juveniles were counted and their developmental stage was estimated by eye into four size grades using a dissecting microscope. The original female, when recovered, was always returned with the males to a new pot, containing a fresh S. Lucie cherry seedling. The experiment was terminated at week 27.

Results

Seven days after inoculation the stele of attacked cherry roots was characteristically de-

Fig. 1 - Roots of S. Lucie cherry showing extensive necroses and brown tips caused by *Longidorus athesinus*.

TABLE I - *The reproductive capacity of individual female* Longidorus athesinus *at 26 °C on S. Lucie cherry.*

Nematodes/ replicate 1♀ 2♂ Pot n°	Eggs*	Number of juveniles						
		Weeks						
	5	7	11	15	19	23	25**	Total
1	4	62	–	–	–	–	–	62
2	3	63	160	–	-	–	–	223
3	4	58	149	–	–	–	–	207
4	4	67	168	180	141	9	–	565
5	5	68	170	189	124	10	–	561
6	3	53	144	189	119	7	0	512
7	5	70	161	214	128	11	0	584
8	3	56	136	201	128	5	0	526
9	4	65	187	216	136	8	0	612
10	3	70	173	224	137	7	0	611
Mean	4	63	161	202	130	8	0	446

* Up to week 5 no juveniles had developed, but eggs were present in the uteri;
– No females were recovered;
** No juveniles or females were recovered, also at 27 wk.

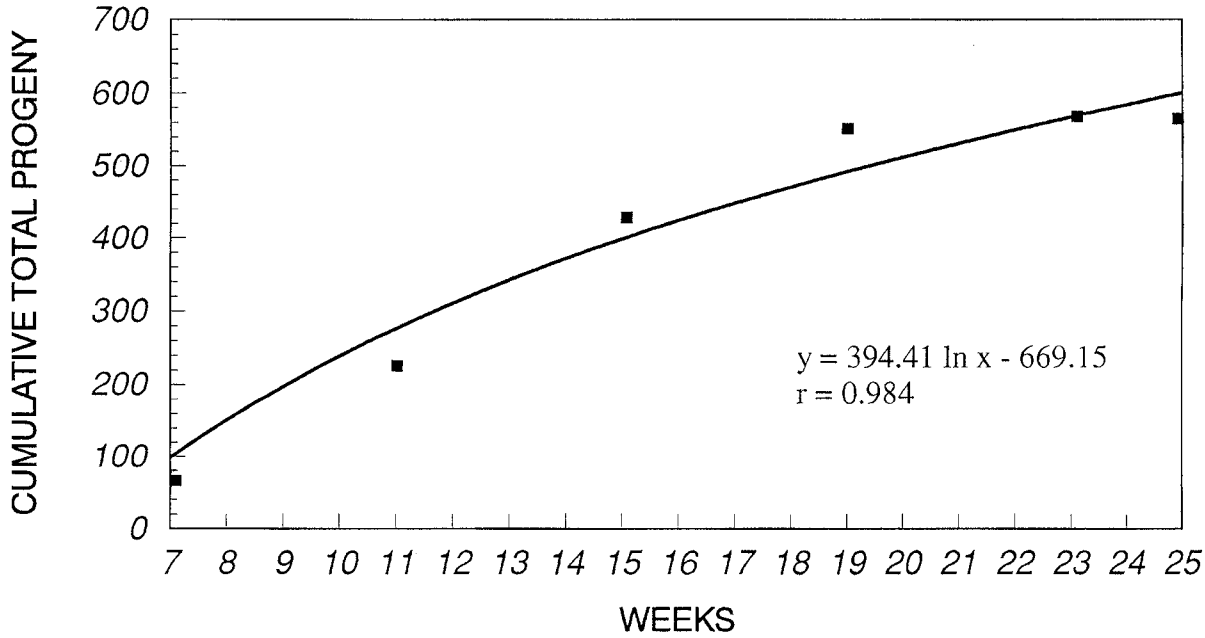

Fig. 2 - Relation between cumulative total progeny production and observation times (weeks) for *L. athesinus*.

formed and showed extensive brown necrosis and the root tips were black (Fig. 1). Injury usually occurred around the entire circumference of the root. Ripe eggs, indicating the onset of reproduction, were first observed in the uteri of the females (up to 5/female) at week 5 and the first juveniles were present 2 wk later. Thereafter, there was a period of intense reproductive activity from week 7 to week 19. Between weeks 19 to 23 males disappeared (presumably had died) and egg production markedly decreased (Table I). At wk 7 a mean of 63 juveniles (53-70) was recovered from 10 females, all of which were gravid with a mean of 4.6 (4-5) eggs in the uterus (Table II). At wk 11 one female was not recovered and the remaining 9 females had produced a mean of 161 (136-187) progeny, comprising J1 (19%), J2 (25%), J3 (25%) and J4 (31%). Also, all females were gravid when recovered with a mean of 4.1 (3-5) eggs. From weeks 11 to 15 a mean of 202 (180-224) instars was produced by the remaining 7 females, viz. J1 (17%), J2 (23%), J3 (27%) and J4 (33%). Females were still gravid with a mean of 4.4 (4-5) eggs per individual. At wk 19 seven females had produced a mean of 130 (124-141) progeny, comprising J1 (18%), J2 (21%), J3 (30%) and J4 (31%). These females were still gravid, with a mean of 3.0 (2-4) eggs/uterus. At this time only a few males were collected. At wk 23 females had produced a mean of 8 (5-11) progeny, comprising J1 (12%), J2 (12%), J3 (38%) and J4 (38%). The males had disappeared completely and females were not gravid and their bodies were becoming translucent. No progeny were recovered at wk 25 and the remaining 5 females had translucent bodies and moved very sluggishly (Tables I, II). At wk 27 no progeny or live females were recovered from the pots.

Discussion

The methods used in this study are similar to those used by Brown and Coiro (1983; 1985), Coiro and Sasanelli (1994) and Coiro *et al.* (1995) with longidorid and trichodorid nema-

TABLE II - *Population structure of* L. athesinus *produced by single females at 2 and 4 intervals on S. Lucie cherry at 26°C.*

Week	Mean n° eggs/uteri	Mean n° juvenile stages*			
		J1	J2	J3	J4
5	3.8 (3-5)	0	0	0	0
7	4.6 (4-5)	27	36	0	0
11	4.1 (3-5)	30	41	41	49
15	4.4 (4-5)	35	46	55	66
19	3.0 (2-4)	23	28	39	40
23	0.0 (0)	1	1	3	3
25	0.0 (0)	0	0	0	0

* Mean of 10 replicates; ( ) range of n° eggs observed in the uteri.

todes. It is calculated that the development of *L. athesinus* from egg to adult takes 55-60 days. The longevity of females was *c* 26 wk and their reproductive span was *c* 14 wk. A mean total of 446 instars was produced per female in an 18 wk period, although this number is probably an underestimate as some losses may have occurred during the extraction procedure and, also, unhatched eggs were not recovered. Therefore, assuming losses of 5 to 10% (Coiro, unpublished) the estimated total reproductive capacity of an individual female *L. athesinus* is 468-490 progeny. The longevity of males was less than that of females. At wk 15 only 8 of the 20 males were recovered and at wk 19 all had disappeared, presumed dead.

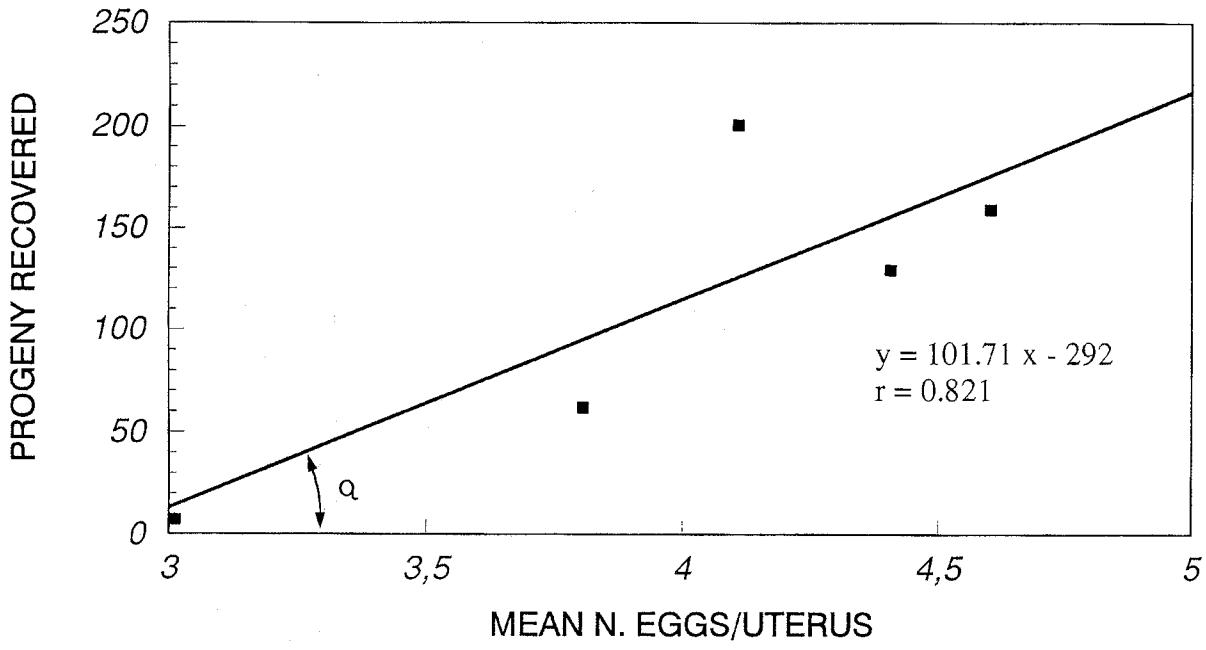

Fig. 3 - Relation between progeny recovered at different intervals and mean number of eggs noted in the previous observation in the uteri of *L. athesinus*.

Data from studies on the reproductive capacity and longevity of *L. athesinus* were used to test several interpolation formulae to explain the reproductive behaviour of this species. Data were tested using the following interpolation formulae: 1) Linear ($y=mx\pm b$); 2) Power ($y=bx^m$); 3) Exponential ($y=be^{mx}$); 4) Logarithmic ($y=ml_nx\pm b$). The best fit to the data on mean cumulative total reproductive capacity and observation times was obtained by the logarithmic equation from which the coefficient for the species was r=0.984, with a significance of P=0.01 (Fig. 2).

The relation between progeny recovered during the experiment and the mean number of eggs in the uteri of *L. athesinus* females can be represented by a linear regression from which it is possible to calculate the egg deposition rate of this species (Fig. 3). The deposition rate was definited by Coiro and Sasanelli for *Trichodorus sparsus* Szczygiel (1994) as ratio between the progeny recovered and the mean number of eggs observed in the uteri in the previous period of observation. It corresponds to the "m" value (m=101.71) of the linear equation of regression, that is tangent of α angle between interpolation straight line and abscissa axis (Fig. 3).

The method used in this study allowed several aspects of the biology of *L. athesinus* to be examined eg. g. logevity, reproductive cycle and reproductive capacity and could be applied in the future to an examination of the biology of other longidorid or trichodorid nematodes.

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