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OBSERVATIONS ON THE POPULATION DYNAMICS OF *LONGIDORUS BELLOI* IN CEREAL FIELDS OF THE CENTRAL REGION (SPAIN)

by
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Summary. The population dynamics of *Longidorus belloi* was followed between November 1984 and June 1986 in wheat crops of the central region of Spain.Soil samples taken at monthly intervals indicated once-yearly reproduction in the summer, with a maximum in July. First stage juveniles were recovered from all samples and reached their peak in winter (about 50% of the total population). The other juvenile stages (J_2, J_3, J_4) constituted 10-15% of the population and showed low variations except the 4th stage which peaked in summer. Adults reached their maximum (30%) in summer, coincident with the appearance of gravid females, but they decreased in autumn, reaching the lowest level in winter. Analysis of *L. belloi* fluctuations indicated a marked seasonal variation of the adult population, this fluctuation reflecting the influences of soil temperature and growth stage of the host.

Longidorus belloi Andres *et* Arias, 1988, is the most widespread species of the genus in Spain, particularly in the cereal growing areas of the Central Region. Large populations have been detected in association with wheat and barley crops, and with legumes such as vetch and lentil which are used in crop rotations. The vertical distribution of the nematode (Andres and Arias, 1982; Andres and Bello, 1985) and the effect of environmental factors on spatial distribution (Arias *et al.*, 1985) have been reported when the species was assumed to be *L. profundorum*.

This paper presents the results of investigations on the fluctuations in numbers of *L. belloi* in a cereal field over a two year period.

Materials and methods

The experiments were located in a field naturally infested with *L. belloi* at the experimental station «La Higueruela» Sta Olalla (Toledo). Soil samples were taken at 15-40 cm depth from four plots bearing a wheat crop at monthly intervals from November 1984 to June 1986. Sowing was made at the beginning of November and the harvest was made at the end of July.

The soil samples were processed using Flegg's (1967) modification of Cobb's decanting and sieving technique and juvenile stages and adults were counted separately with the aid of a dissecting microscope.

Results

Fluctuations in the numbers of adult and juvenile stages of *L. belloi* during the period from November 1984 to June 1986 are shown in Fig. 1. There was only one period of reproduction in the year; it started in spring with the presence of some gravid females and reached the maximun in summer (July) coinciding with the highest population densities.First stage juveniles formed a large percentage of the total population throughout the year but there was a minor peak in winter (January) when they constituted 50-60% of the total. After February the number of 1st stage juveniles decreased slightly reaching the minimun in spring. The other juvenile stages (J_2, J_3, J_4) constituted 10-15% of the population throughout the life cycle and they were quite stable in number, except the 4th stage which had a peak in summer (July).

Adults reached their highest level (30%) in summer, at the same time as the gravid females; they decreased in autumn and constituted only 8-9% of the population in January-February. Seasonal fluctuation of adults for each cropping year were evaluated using the Student's t-test (Table I). All the combinations significantly differed, except when populations from autumn and spring 1985-1986 were compared, indicating that adults were much influenced by seasonal changes.

The seasonal fluctuation of the adult population probably reflects variations of temperature and the growth stage of the host. The influence of temperature is demonstrated by the highly significant data obtained through the correlation and regression analysis between adult stage numbers and mean temperature of the soil at the depth sampled ($r = 0.8313$; $t = 5.96$; d.f. $= 16$) (Fig. 2). Furthermore, the single period of reproduction and highest

TABLE I - *Seasonal variation of adult population of* Longidorus belloi.

Seasonal period	No. of replicates	Adults (x ± S.E.)
1984-1985		
AUTUMN	8	61.6 ± 5.69 (a)
WINTER	12	44.3 ± 2.98 (b)
SPRING	12	91.6 ± 5.02 (c)
SUMMER	8	238.2 ± 28.7 (d)
1986-1987		
AUTUMN	12	72.5 ± 4.57 (ac)
WINTER	12	48.8 ± 3.35 (b)
SPRING	8	84.6 ± 8.90 (c)

N. B. - Statistical significance was determined according to the Student's *t*-test. Means followed by different letter in the columns, for each crop year, are significantly different ($P \leq 0.05$).

level of adults coincided with the time of maximum root growth of the host plant (wheat) in early summer.

Discussion

The population dynamics of *Longidorus belloi* in the central region of Spain are similar to those reported for other Longidoridae in the field (Flegg, 1968). There is a restricted period of ovogenesis between spring and early summer; adults and the juvenile stages are present at all times. The absence of a discrete annual cycle suggests that the length of each stage is variable and may be long, perhaps extending over several months. Thus it is posible that the life cycle of *L. belloi*, in common with some other species of *Longidorus* and *Xiphinema* (Flegg, 1968; Cotten, 1976), extends over more than one year under field conditions.

The absence of a pyramidal structure of the population, the low rate of reproduction and an assumed long cycle suggest that predation, disease and adverse environmental

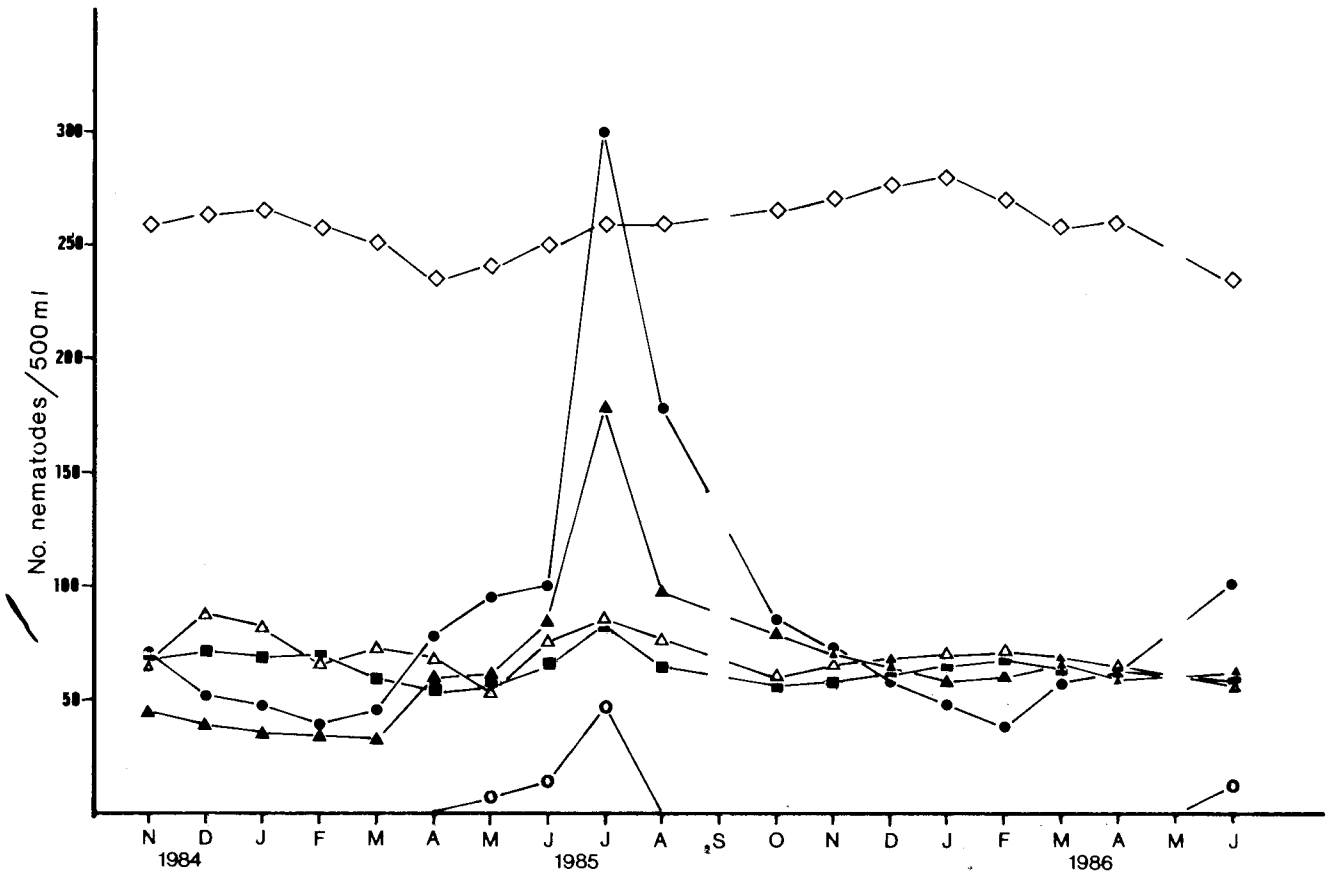

Fig. 1 - Population structure of *Longidorus belloi* in a wheat crop, November 1984 to June 1986. Samples taken at monthly intervals, except for September 1985 and May 1986. (● adults, ○ gravid females, ▲ J_4 △ J_3 ■ J_2 ◇ J_1).

conditions are unlikely to severely affect the dynamics of the population (Flegg, 1968). A detailed analysis of fluctuation in numbers of *L. belloi* indicates that there is a marked seasonal variation of the adult population. The same pattern was observed by other authors with *Longidorus* and *Xiphinema* sp. (Flegg, 1968; Wyss, 1970; Prota and Garau, 1973; Cotten, 1977; Harris, 1979). There is a peak in the number of adults in summer, quickly followed by a drop and a corresponding increase in the proportion of 1st stage juveniles. One would expect the number of succeeding juvenile stages to be less because of adverse environmental conditions, but for the J_1 the opposite was observed as in the winter they reached their highest level.

The importance of temperature on *Longidorus* spp. populations, especially in controlled conditions, has been reported (Cohn and Mordechai, 1969, 1970; Wyss, 1970). Our observations indicate that, in field situations, there is a high positive correlation between soil temperature and adult numbers, as observed for *Xiphinema index* (Prota and Garau, 1973). The higher soil temperatures are conducive to reproduction and thus an increase in population, either directly or trough increased plant growth. The highest populations of *L. profundorum* and the egg-laying period occurred during spring, when the crops were actively growing (Flegg, 1968). Furthermore, Thomas (1969) has reported that there are two times of egg laying for *L. elongatus* on strawberry and rye grass during spring and late summer, respectively, coinciding with the two different times of root production.This is in agreement with our observations of a significant interaction between nematode reproduction and the growth of the wheat crop.

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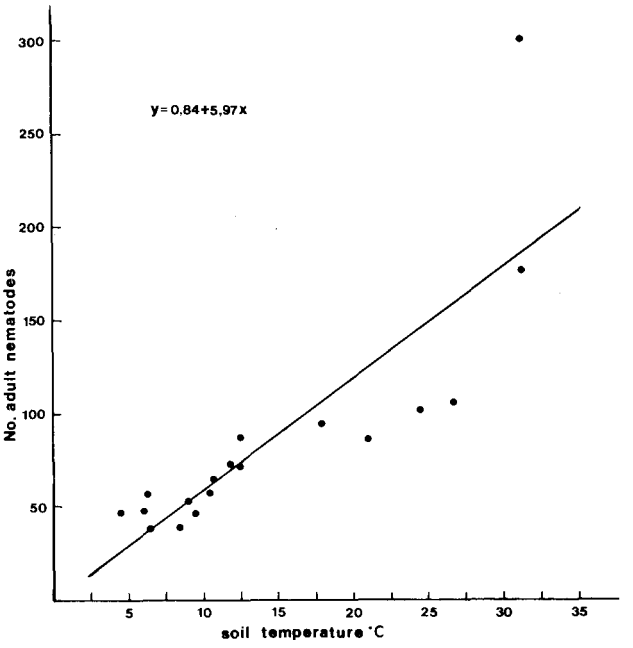

Fig. 2 - Relation between soil temperature and adult population of *L. belloi*.

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