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EFFECT OF DIFFERENT TEMPERATURES ON EGG HATCH
OF *MELOIDOGYNE ARTIELLIA*

by

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Meloidogyne artiellia Franklin was first reported from eastern England on *Brassica oleracea* var. *capitata* (Franklin, 1961). Later it was recorded on wheat in Greece (Kyrou, 1969), on cabbage, cereals and legumes in France (Ritter, 1972), on barley and wheat in Spain (Tobar-Jimenez, 1973), on legumes in the north east of Syria (Mamluk *et al.*, 1983) and on chickpea in Italy (Greco, 1984). In 1984, Greco *et al.* detected this root-knot nematode in 12% of the root samples collected from chickpea fields in Syria, showing yellowish and stunted plants.

There is plenty of information on the influence of the temperature on the hatching of the most common root-knot nematodes (Ekanayake and Di Vito, 1984), but its effect on *M. artiellia* is still unknown. Therefore the aim of this study was to investigate the effect of cold periods and different temperatures on the egg hatch of an Italian population of *M. artiellia*.

Materials and Methods

A population of *M. artiellia* obtained from roots of chickpea at Monopoli (Bari) was reared on chickpea in a glasshouse. Fifty uni-

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form egg masses (about 25,000 eggs) were placed on each of several microsieves (75 μm aperture, 20 mm diam.), which were then placed in petri dishes and partially filled with distilled water or chickpea (line « ILC 482 ») root leachate, sufficient to cover the egg masses (Greco *et al.*, 1982). The root leachate was obtained by drenching the soil of 40 pots, containing one month old plants, with two litres of distilled water and collecting the leachate during a 48 hour period. The leachate was centrifuged at 1500 xg for 30 minutes and then stored at 3-4°C.

To investigate whether a cold period is required to hatch *M. artiellia*, two series of 24 dishes, each containing egg masses in either distilled water or chickpea root leachate, were used. Half of each series was incubated at 5 or 10°C and after 10, 20 or 60 days, four of them were transferred to 20°C for a further six weeks.

The distilled water or chickpea root leachate were changed at 10 days intervals during the cold periods and then weekly when incubated at 20°C; counts of emerging juveniles were also made at the same time.

To study the effect of different temperatures on nematode hatching, two more series of 24 dishes, one with distilled water and the other with chickpea root leachate, were prepared. Each dish contained 50 egg masses. Four of the dishes in each series were incubated at 5, 10, 15, 20, 25 or 30°C (± 2). Changes of hatching media and counts of emerging juveniles were done weekly.

At the end of both experiments, the unhatched eggs were extracted from the egg masses by dissolving the gelatinous matrix in a 50 ml glass bottle containing 20 ml of a 1% sodium hypochlorite solution (Hussey and Barker, 1973). The eggs were counted and egg hatch expressed as percent of total initial population and analysed by a split-plot in time analysis of variance.

Results

The maximum cumulative hatch was less than 8% at 5°C both in distilled water and chickpea root leachate, irrespective of the exposure times (Fig. 1A); but at 10°C it was 3, 45 and 98% in both media after 10, 20 and 60 days of exposure, respectively (Fig. 1B). When the egg masses kept at 5°C were transferred to 20°C, 43-69% hatched in a week. A significantly ($P = 0.01$) large hatch (63-69%)

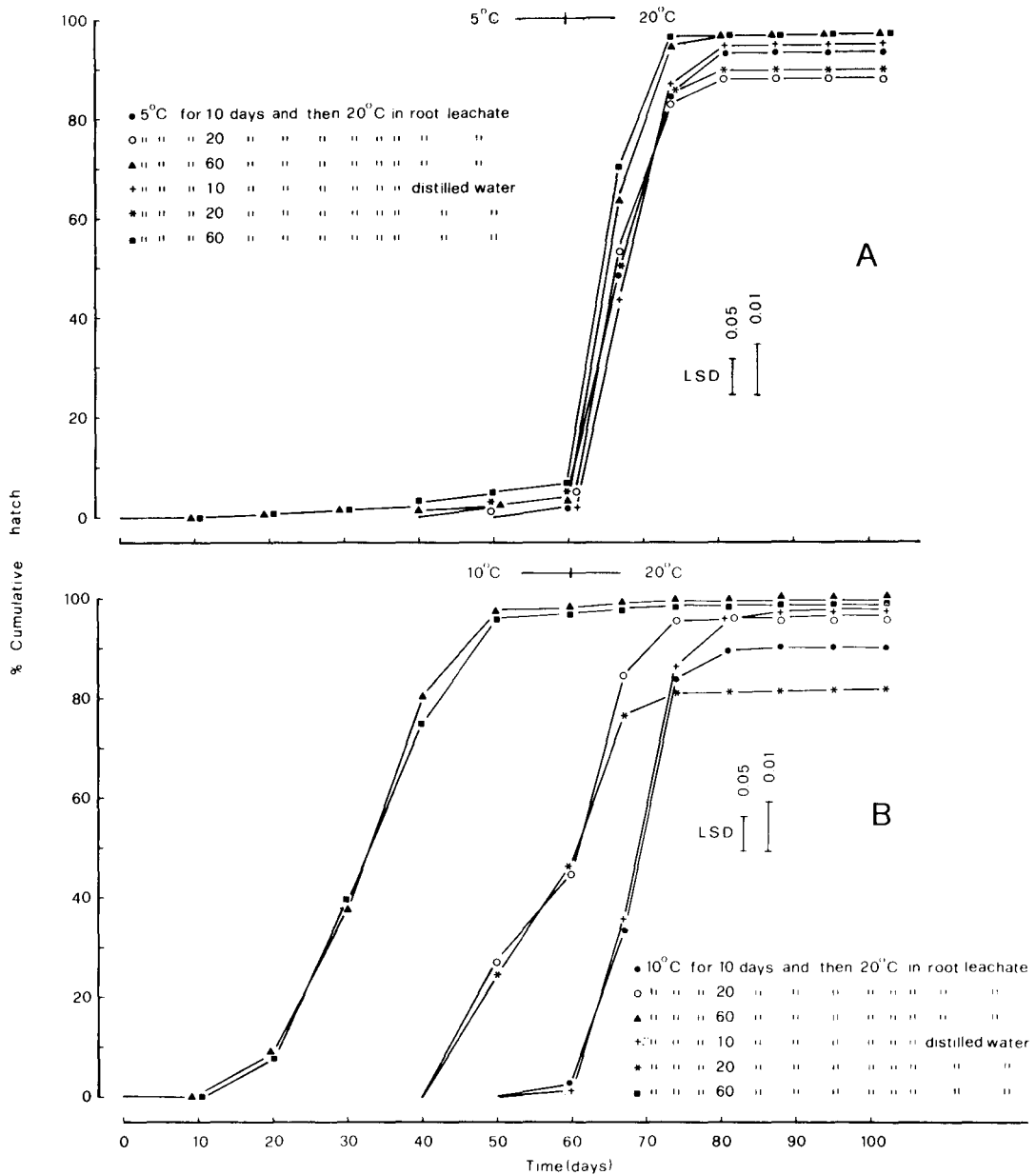


Fig. 1 - Influence of temperature on the egg hatch of *Meloidogyne artiellia* in distilled water and chickpea root leachate; cold period (10, 20, 60 days) at 5°C and then at 20°C (A); cold period (10, 20, 60 days) at 10°C and then at 20°C (B).

occurred in those incubated at 5°C low temperature for 60 days. After three weeks incubation at 20°C all eggs had hatched and juveniles had emerged (88-97%) and only slight differences remained among the treatments.

Pre-treatment at 10°C resulted in a remarkable hatch of eggs, and nearly all the juveniles emerged when the egg masses were incubated at this temperature for sixty days (Fig. 1B). Hatching of eggs maintained at 10°C for 10 or 20 days was completed after three weeks at 20°C. Total hatches ranged from 81% to 98% and although some significant differences were observed they were small.

Generally, no substantial differences of final hatching occurred when the egg masses were incubated in distilled water or chickpea root leachate or when they were pre-treated at 5 or 10°C.

In the second experiment, eggs of *M. artiellia* hatched promptly at temperature $\geq 15^\circ\text{C}$ and significant differences were observed even during the first week (Fig. 2). Thereafter the hatching was almost completely suppressed at 30°C (final hatch 75%) but continued at 15, 20 and 25°C for three more weeks when 94-96% of the eggs had already hatched. No substantial emergence of juveniles occurred at 10°C during the first two weeks, but during the next six weeks 96% of the eggs had hatched. Hatching was much slower when the eggs were incubated at 5°C. At this temperature only a few juveniles emerged during the first seven weeks, but from then onwards hatching increased and continued until seventeen weeks to give a total cumulative hatch of 88%, which was significantly higher than the hatch at 30°C and significantly lower than at all other temperatures tested (Fig. 2A and B).

In general the hatching pattern of the eggs kept in chickpea root leachate or distilled water was very similar (Fig. 2A and B).

Discussion

Meloidogyne artiellia develops during rather cool months on cereals and legumes in several Mediterranean countries. Infested host plant roots containing females with external egg masses are very common in this area by April to May, when the soil temperature is below 15°C (Greco, 1984).

In many *Meloidogyne* spp. newly formed eggs hatch promptly

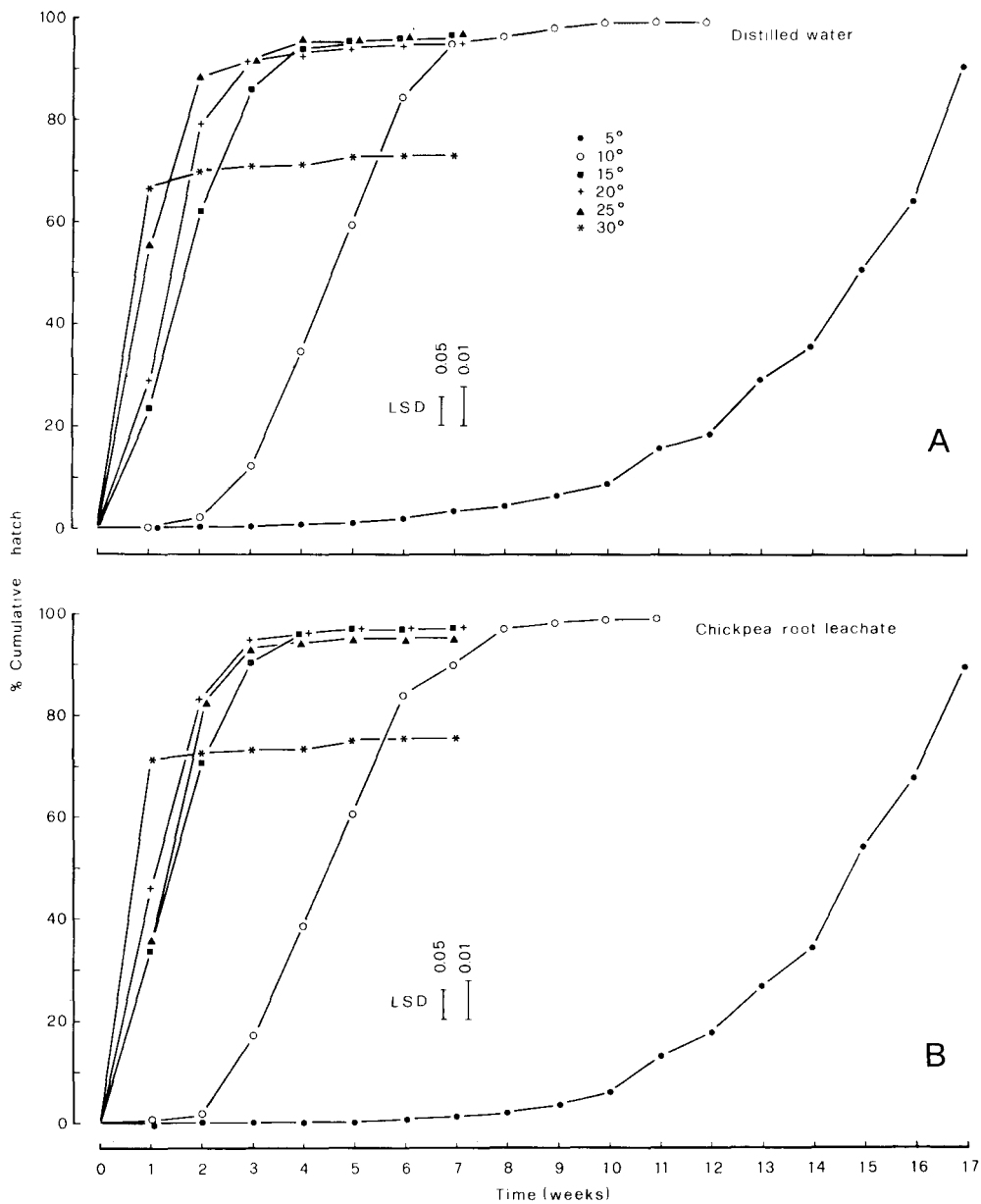


Fig. 2 - Influence of temperature on the egg hatch of *Meloidogyne artiellia* in distilled water (A) and in root leachate of chickpea (B).

and could initiate another generation. However, it has been shown that *Meloidogyne naasi* Franklin needs a colder period before a substantial hatch occurs (Franklin *et al.*, 1971; Watson and Lownsbery, 1970). It has been suggested that *M. artiellia* may require a period of low temperature before juveniles can emerge and only one generation is therefore likely to occur annually (Tobar-Jimenez, 1973).

Our experiments indicate that no cool period is necessary for egg hatch of *M. artiellia*. The second experiment showed that egg hatch of *M. artiellia*, at 5-30°C, was similar to the most common *Meloidogyne* spp. (Ekanayake and Di Vito, 1984). However, optimal temperatures for *M. artiellia* were 15-25°C; in this range more than 95% eggs hatched in three weeks. At 30°C about 70% egg hatch occurred in one week but thereafter hatching was suppressed.

After harvest of the host crop, soil temperatures can be unsuitable for egg hatching, lack of soil moisture may inhibit hatching and thus eggs can survive in hot and dry seasons in a dormant state.

The egg masses used in these experiments were obtained under greenhouse conditions and no dormancy was induced, but under field conditions the rise of the temperature, the decrease of the soil moisture and senescence of the host plant as harvesting of the crop approaches may have a physiological effect on the eggs of *M. artiellia* and give a different response from that obtained in the greenhouse. Therefore investigations on the biology of *M. artiellia* under field conditions are needed to provide information that can be used for the management of this nematode.

S U M M A R Y

The hatching of *Meloidogyne artiellia* in chickpea root leachate and distilled water was studied by incubating egg masses of the nematode either at 5 or 10°C for 10, 20 or 60 days and then at 20°C, or continuously at 5, 10, 15, 20, 25 or 30°C. The chickpea root leachate did not influence egg hatching but temperature greatly affected the emergence of second stage juveniles. There were no differences in the hatch of the eggs incubated for 10, 20 or 60 days at 5 or 10°C and then at 20°C. With continuous incubation at 15-25°C more than 90% of the eggs hatched in 3 weeks. At 30°C about 70% of the eggs hatched after one week but no juveniles emerged thereafter. The hatching was slow at 10°C and very slow at 5°C, with 90% or 80% of the eggs hatching after eight weeks or four months, respectively.

The authors thank Mr. V. Radicci for assistance with the figures.

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Accepted for publication on 24 April 1985.