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HATCHING OF CYSTS AND INFECTIVITY OF *HETERODERA CICERI* ON CHICKPEA[1]

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A cyst nematode, tentatively identified as *Heterodera rosii* Duggan *et* Brennan, was reported for the first time on chickpea (*Cicer arietinum* L.) in Syria, causing great yield losses (Mamluk *et al.*, 1983). Later, a cyst nematode was reported again on chickpea in the same area (Greco *et al.*, 1984). Further investigation showed that it was a new species and was named *H. ciceri* (Vovlas *et al.*, 1985).

A preliminary host range study revealed that *H. ciceri* can also infest lentil, lathyrus, pea, soybean, lupin, bean, medics and vetch (Anonymous, 1984). No further information has since been published on the nematode and therefore investigations were made to determine the effects of different temperatures on the hatching of cysts and host infestation by the second-stage juveniles.

Materials and Methods

A soil sample infested with *H. ciceri* was collected from Syria and the nematode population reared on a susceptible chickpea cv. «ILC 482» in

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a greenhouse at 20-25°C. Cysts were extracted from the moist infested soil using the Fenwick can. One hundred cysts were placed on each of 30, 215 μm net microsieves, 2 cm in diameter (Greco *et al.*, 1982). Each set of 5 microsieves, serving as a replicate, was enclosed in a culture dish 15 cm diameter and the dishes were incubated in growth chambers at 5, 10, 15, 20, 25 or 30°C (± 2°C). Two litres of root leachate, used as hatching agent, were obtained by drenching the soil of thirty 1330 cm^3 clay pots containing four one-month old chickpea plants. The root leachate was centrifuged at 1300 g for 30 min to eliminate soil particles and then stored in a freezer until used. Small quantities for immediate use were stored at 5°C. Counts of emerged juveniles and fresh changes of root leachate were made weekly for a period of 5 weeks. At the end of the experiment the cysts were crushed, as described by Seinhorst and Den Ouden (1966), and the unhatched eggs and juveniles were counted. Emerged juveniles were expressed as a cumulative percentage of the eggs and juveniles contained within the cysts at the beginning of the experiment.

The ability of second-stage juveniles to invade the roots of chickpea plants was investigated at 5 different temperatures, 10, 15, 20, 25 and 30°C. Two pregerminated chickpea cv. ILC 482 seedlings were planted in each 170 cm^3 plastic pot containing steam sterilized sandy soil (sand 89.1%, clay 7%, silt 3.9% and 2.3% organic matter). After a week each pot was inoculated with 1000 second-stage juveniles by pouring a water suspension of the nematodes into three holes dug around the root systems of the seedlings. The juveniles had been obtained from cysts immersed in chickpea root leachate for 48 hrs. Four pot replicates were maintained in growth chambers for 3 days at each temperature. The plants were then uprooted and carefully washed in water to free the roots from soil particles. The roots were weighed and comminuted in a blender in water with a few drops of antifoam (2% silicone), for 30 seconds. The resulting suspension was diluted up to 100 ml and juveniles were counted in 3 aliquots of 5 ml each to determine the total number of juveniles invading the root systems of the two chickpea seedlings.

Results and Discussion

A temperature range of 15 to 25°C was most favourable for the hatching of cysts. The highest percentage hatch (31%) occurred at 25°C, which was not significantly different from that at 20°C and 15°C, but significantly ($P = 0.05$) higher than achieved at all other temperatures. Although

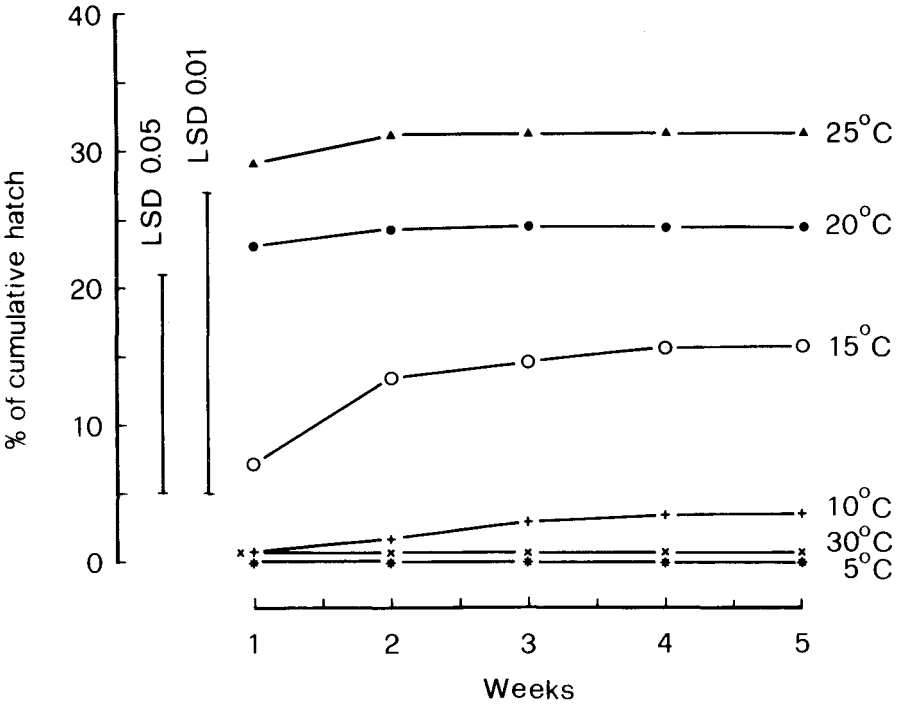

Fig. 1 - Percent cumulative hatch of cysts of *Heterodera ciceri* at different temperatures during a five week period.

the emergence of juveniles (Fig. 1) was very low (<1%) at 5°C, it did not differ significantly (P=0.05) from those observed at 10°C (4%), 15°C (16%), and 30°C (1%).

Eggs hatched promptly and most of the juveniles emerged during the first two weeks at 15-25°C and 4 weeks at 10 and 30°C. At 5°C, emergence remained at less than 1% even after a period of 5 weeks. In contrast with *H. avenae* in Canada (Fusthey and Johnson, 1966), no low temperature treatment is required to achieve a substantial hatch.

A low number of second-stage juveniles of *H. ciceri* were observed in the roots of seedlings grown at 30°C (Table I), but significantly (P=0.01) larger numbers of juveniles were recovered from the roots of seedlings grown at 10, 15, 20 and 25°C. Moreover, significant (P=0.05) differences were also observed between the numbers of juveniles found in the roots of seedlings kept at 10°C and those at 25°C.

Table I - *Infectivity of second-stage juveniles of* Heterodera ciceri *on roots of chickpea at different temperatures.*

Temperature °C	Number of juveniles within the roots*		
10	320	a**	A
15	263	a b	A
20	229	a b	A
25	211	b	A
30	83	c	B

* Average of four replications with two plants each.

** Figures followed by the same letters are not significantly different according to Duncan's multiple range test. Small letters for P=0.05 and capital letters for P=0.01.

It is noteworthy that large numbers of juveniles invaded the roots of chickpea even at temperatures as low as 10°C. This was in agreement with field observations in which many females were observed in the roots of chickpea plants during April when soil temperatures are moderate to low.

SUMMARY

Two experiments were conducted to study the effects of temperatures on hatching of cysts of *Heterodera ciceri* and on the infectivity of its second-stage juveniles to chickpea seedlings. Hatching tests showed that the emergence of juveniles was substantial at 10, 15, 20, and 25°C and negligible at 5 and 30°C. Maximum emergence was obtained at 25°C (31%), which was not significantly different from that of 20°C (25%) and 15°C (16%) at P=0.05. Significantly more second-stage juveniles invaded the roots of chickpea seedlings at 10, 15 and 20°C than at 25 and 30°C.

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