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EFFECT OF ROOT LEACHATES OF SOME LEGUMES OF DIFFERENT AGES ON THE HATCHING OF *HETERODERA CICERI*

by

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Summary. The emergence of juveniles from cysts of *Heterodera ciceri* was investigated in root leachates of pea, grasspea, lentil, chickpea, *Cicer bijugum* and *C. pinnatifidum*, collected at emergence of plants and 10, 20, 30, 40, 50 or 60 days after, and maintained at $20^{\circ}\text{C} \pm 2$ for a five week period. Highest hatch of eggs was obtained from cysts incubated in root leachates from pea, chickpea, lentil, *C. bijugum* and *C. pinnatifidum* collected 10 days after plant emergence onwards. All root leachates collected at plant emergence had limited effect on egg hatch. Root leachates collected from grasspea at all plant age were also poorly effective.

The chickpea cyst nematode, *Heterodera ciceri* Vovlas, Greco *et al.* Di Vito, is noxious to chickpea (*Cicer arietinum* L.) and lentil (*Lens culinaris* Medic.) in Northern Syria (Vovlas *et al.*, 1985; Greco *et al.*, 1988). Pea (*Pisum sativum* L.) and grasspea (*Lathyrus sativus* L.) are also good hosts for the nematode. Hatch response has been reported to vary according to cyst age (Elleby and Smith, 1967), plant age (Perry *et al.*, 1980; Greco and Brandonisio, 1986) and concentration of the root diffusate which is, however, difficult to measure and involves physiological processes (Perry, 1986). Moreover, the use of an artificial hatching agent of known concentration is desirable to compare data obtained by independent investigators. Hatch response of *H. ciceri* cysts of different ages has been investigated (Greco *et al.*, 1992) but without information on the effect of plant age on the emergence of juveniles. Therefore, an experiment was undertaken to ascertain the effect of root leachates collected from some leguminous plants of different ages, on the emergence of juveniles from cysts of *H. ciceri*.

Materials and methods

A population of *H. ciceri* collected from an infested field at Idlib (Syria) was reared on chickpea cv. Ghab 1 in a plastic-house. The newly formed cysts were then extracted from the soil with a Fenwick can and four batches of 70 cysts each (averaging 74 eggs/cyst) were placed on 2 cm diam sieves in 5 cm diam Petri dishes (Greco *et al.*, 1982), containing 3 ml of leachates collected from pots planted with chickpea cv. Ghab 1, lentil line ILL 4400, grasspea cv. Local Syrian, pea cv. Progress 9, and from pots planted with the wild lines ILWC 75 of *Cicer bijugum*

Rech. and ILWC 212 of *C. pinnatifidum* Jaub *et al.* Sp., both resistant to the nematode (Singh *et al.*, 1989; Di Vito *et al.*, 1992). A 3 mM zinc chloride solution, previously reported as an efficient artificial hatching agent for *H. ciceri* (Greco *et al.*, 1992), was used as control. Twenty pots containing 800 cm³ of steam sterilized sandy soil (7% clay, 4% silt, 89% sand and 2% organic matter) were sown to each of the tested plants in a glasshouse at $23^{\circ}\text{C} \pm 3$. Root leachates were collected at plant emergence and 10, 20, 40, 50, and 60 days later, by drenching the soil of each plot with excess tap water. Root leachates of *C. bijugum* and *C. pinnatifidum* were collected only at 10 and 20 days after plant emergence and chickpea up to 50 days after plant emergence when the plants died. Each root leachate (about 0.5 l per plant species and different plant age) was then centrifuged at 1,300 g for 30 min, to eliminate soil particles, and stored in a freezer (-20°C). Small quantities for immediate use were stored at 5°C . Cysts were incubated in a growth chamber at $20^{\circ}\text{C} \pm 2$.

Counts of emerged juveniles and fresh change of hatching agents were made weekly on a five week period. The cysts were then crushed (Seinhorst and Den Ouden, 1966) and unhatched eggs counted. The numbers of juveniles emerging weekly were expressed as cumulative percentages of the total egg content of the cysts at beginning of the experiment.

Data were statistically analysed by ANOVA and LSD's calculated.

Results and discussion

The ultimate hatch of eggs of *H. ciceri* was significantly ($P \leq 0.01$) higher in root leachates of pea, lentil and chick-

pea, and in 3 mM of zinc chloride solution than in leachates of grasspea (Fig. 1). However, emergence of juveniles was prompt in all hatching agents.

In root leachates of pea collected at 10, 20, 30, 40, 50, and 60 days after plant emergence, hatch of eggs was 73, 68, 83, 79, 75 and 73%, respectively, and was significantly ($P \leq 0.01$) more than that obtained in the root leachate of the same host at plant emergence (13%) (Fig. 1). In root leachates of lentil collected at same plant age, hatch of eggs was significantly ($P \leq 0.01$) higher 69, 81, 76, 76 and 68%, respectively, than that of the same host but collected at plant emergence (17%). The emergence of juveniles also increased significantly ($P \leq 0.01$) with the increase of plant age of the susceptible chickpea (cv. Ghab 1), and cumulative hatch per cent of 65, 52, 51, 46 and 48 occurred in root leachates collected at 10, 20, 30, 40 and 50 days after plant emergence, respectively.

Hatch of *H. ciceri* eggs also was higher (from 43 to 54%) in root leachates of the resistant wild lines of *C. bijugum* and *C. pinnatifidum* collected at 10 and 20 days after plant emergence. Emergence of juveniles in root leachate of grasspea was least (from 16 to 31%).

Pea, lentil and chickpea root leachates were the most effective hatching agents for eggs of *H. ciceri*, while grasspea had limited or no effect, thus confirming results obtained previously (Greco *et al.*, 1992).

The root leachates of the resistant wild lines of *C. bijugum* and *C. pinnatifidum* were as good natural hatching agents for *H. ciceri* as those from susceptible chickpea. This indicates that the factor affecting the emergence of juveniles from eggs of *H. ciceri* is not linked to plant resistance. A similar phenomenon was also observed in others species of *Heterodera*; Steele *et al.* (1982) reported a similar per cent hatch with root diffusates from susceptible sugarbeet (*Beta vulgaris* L.) and lines of *B. patellaris* Moq., *B. procumbens* Moz. and *B. maritima* L., all resistant to *H. schachtii* Schmidt. Also, no significant differences in egg hatch of *H. glycines* Ichinohe were observed in root leachates from resistant and susceptible cultivars of soybean (*Glycine max* Merr.) (Schmitt and Riggs, 1991).

In our investigation the age of the plants did not affect hatch of *H. ciceri* since similar numbers of juveniles emerged in root leachate collected from 10 days after plant emergence onwards. Greco and Brandonisio (1986), however, observed the greatest hatch of *H. carotae* Jones in root leachates collected from 5-7 week old carrots (*Daucus carota* L.). Also, Perry *et al.* (1980) and Beane and Perry (1983) observed that the age of pea and broad bean (*Vicia faba* L.) plants affected hatch of *H. goettingiana* Liebscher. Probably, different amounts of roots and/or chemicals occurring in the pots with host plants of different age may account for differences obtained with different nematodes and plant species.

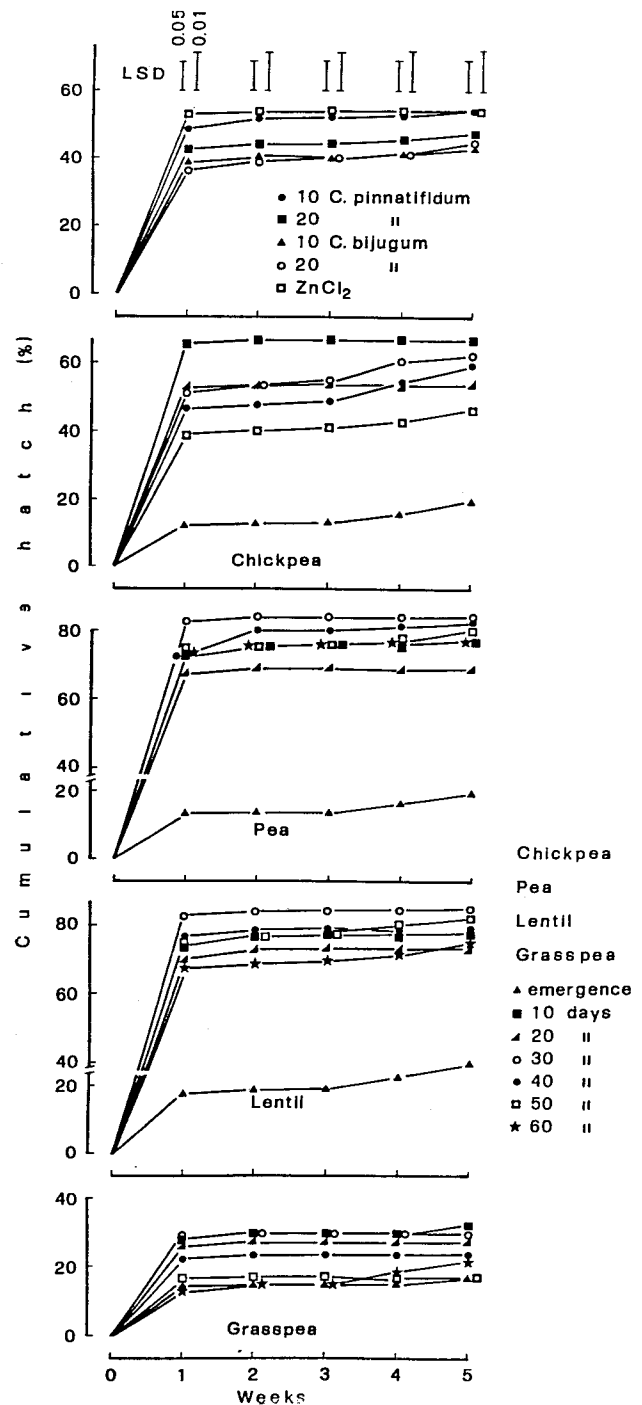


Fig. 1 - Effect of root leachates of grasspea, lentil and pea collected at plant emergence and 10, 20, 30, 40, 50, and 60 days later; of chickpea collected until 50 days after plant emergence; of *C. bijugum* and *C. pinnatifidum* collected at 10 and 20 days from plant emergence, and of 3 mM zinc chloride solution on egg hatch of *Heterodera ciceri* at 20°C.

Our findings suggest that transferring the resistance occurring in *C. bijugum* and *C. pinnatifidum* to *C. arietinum*, would be useful in reducing yield losses caused by *H. ciceri* and increase the decline of the nematode population under field conditions.

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