Nematol. medit. (1990), 18: 55-57

Istituto di Nematologia Agraria, C.N.R — 70126 Bari, Italy

THE EFFECT OF NATURAL AND ARTIFICIAL HATCHING AGENTS ON THE EMERGENCE OF JUVENILES OF *HETERODERA FICI*

by
M. Di Vito and N. Sasanelli

Summary. The emergence of juveniles from cysts of *Heterodera fici* was investigated in natural and artificial hatching agents at 24°C ± 2 in a growth cabinet for a 7 week period. The cysts were collected from commercial fig roots and batches of 100 each were incubated in leachates from ornamental or commercial fig roots, picrolonic acid, sodium metavanadate, zinc chloride, zinc sulphate or distilled water. More juveniles emerged from cysts in commercial (97%) than in ornamental fig root leachate (45%). Emergence in sodium metavanadate was 64%, in zinc chloride 40% and zinc sulphate 27%. Emergence in picrolonic acid was very low (5%) and less than that in distilled water (10%).

The fig cyst nematode, *Heterodera fici* Kirjianova, is world-wide in distribution (Golden *et al.*, 1988). The nematode has been found on commercial (*Ficus carica* L.) and ornamental fig plants (*Ficus elastica* Roxb.) and on *Ficus macrophylla* Desf in Italy (Di Vito, 1976). Damage was more severe on seedlings of the two species than on trees (Di Vito and Inserra, 1982). The emergence of juveniles of cyst nematodes is affected by root diffusate, temperature, aeration and soil moisture (Greco, 1981; Perry, 1986). In commercial fig root leachate and at 25°C, 85% of eggs in the cysts of *H. fici* hatched after two weeks incubation (Di Vito, 1986). There is, however, no information on the emergence of juveniles in ornamental fig root leachate or in some chemical solutions and therefore this was investigated using an Italian population of *H. fici*.

Materials and methods

The population of *H. fici* was obtained from Barile (Potenza) and reared on commercial fig in a glasshouse at 19-25°C. Newly formed cysts were then collected from the fig roots and four batches of 100 each (about 190 eggs and juveniles/cyst) were placed in 5 cm diam Petri dishes (Greco *et al.*, 1982) containing 3 ml of distilled water, commercial or ornamental fig root leachate, and solutions of 3mM zinc chloride, 3mM zinc sulphate, 0.6 mM sodium metavanadate, or 0.3 mM of picrolonic acid. Cysts were kept in a growth cabinet at 24°C ± 2. The root leachates were obtained by drenching the soil of twenty 2,500 cm^3 clay pots planted with three-month old commercial (cv. Dottato) or ornamental (cv. Decora) fig plants. The root leachates were centrifuged at 1,300 g for 30 min to eliminate soil particles and stored in a freezer until used. Small quantities, for immediate use were kept at 5°C.

Counts of emerged juveniles and fresh changes of root leachates and chemical solutions were made weekly over a seven week period. At the end of the experiment the cysts were crushed, as described by Seinhorst and Den Ouden (1966) and unhatched eggs and juveniles were counted. The numbers of juveniles emerging weekly were expressed as cumulative percentages of the total egg content of the cysts at the beginning of the experiment. Data were statistically analysed by split-plot on time and LSD'S calculated.

Results and discussion

Few juveniles emerged from cysts incubated in picrolonic acid (4,6%) and distilled water (9,9%) after seven weeks, but significantly more eggs hatched in fig root leachates and in the other chemical solutions (Fig. 1). The cumulative hatching of juveniles was 27.3% in zinc chloride, 40,2% in zinc sulphate, 44,7% in ornamental fig root leachate, 64% in sodium metavanadate and 97% in commercial fig root leachate.

No significant differences were observed during the first week between picrolonic acid, zinc chloride, zinc sulphate, ornamental fig root leachate and distilled water. Cumulative hatch in commercial fig root leachate and in sodium metavanadate were statistically different ($P = 0.01$) from each other and both were more efficient hatching agents than all other treatments. The emergence of juveniles from cysts incubated in picrolonic acid and distilled water were 4.2 and 9%, respectively, after three weeks

and remained substantially the same until the end of the experiment. The hatch of eggs incubated in commercial or ornamental leachates or in sodium metavanadate was more prompt, reaching 88.4, 29, and 48%, respectively, after three weeks.

The experiment confirms that leachate from commercial fig root is the best natural hatching agent for eggs of *H. fici* (Di Vito, 1986) and in our experiment about 90% of juveniles had emerged after three weeks incubation. In leachate from ornamental fig root the cumulative hatch was about 45%. Sodium metavanadate and zinc chloride are good artificial hatching agents for *H. fici*, the former being the more effective. Zinc sulphate is a poor artificial hatching agent of the fig cyst nematode.

The emergence of juveniles appeared to be inhibited by picrolonic acid since the hatch was about 50% of that in distilled water. The effect of this chemical on hatch of cyst nematodes varies with nematode species; it has been reported to be effective on *Globodera rostochiensis*, but not on *G. pallida*, *G. tabacum tabacum*, *G. tabacum solanacearum* and *G. tabacum virginiae* (Greet, 1974).

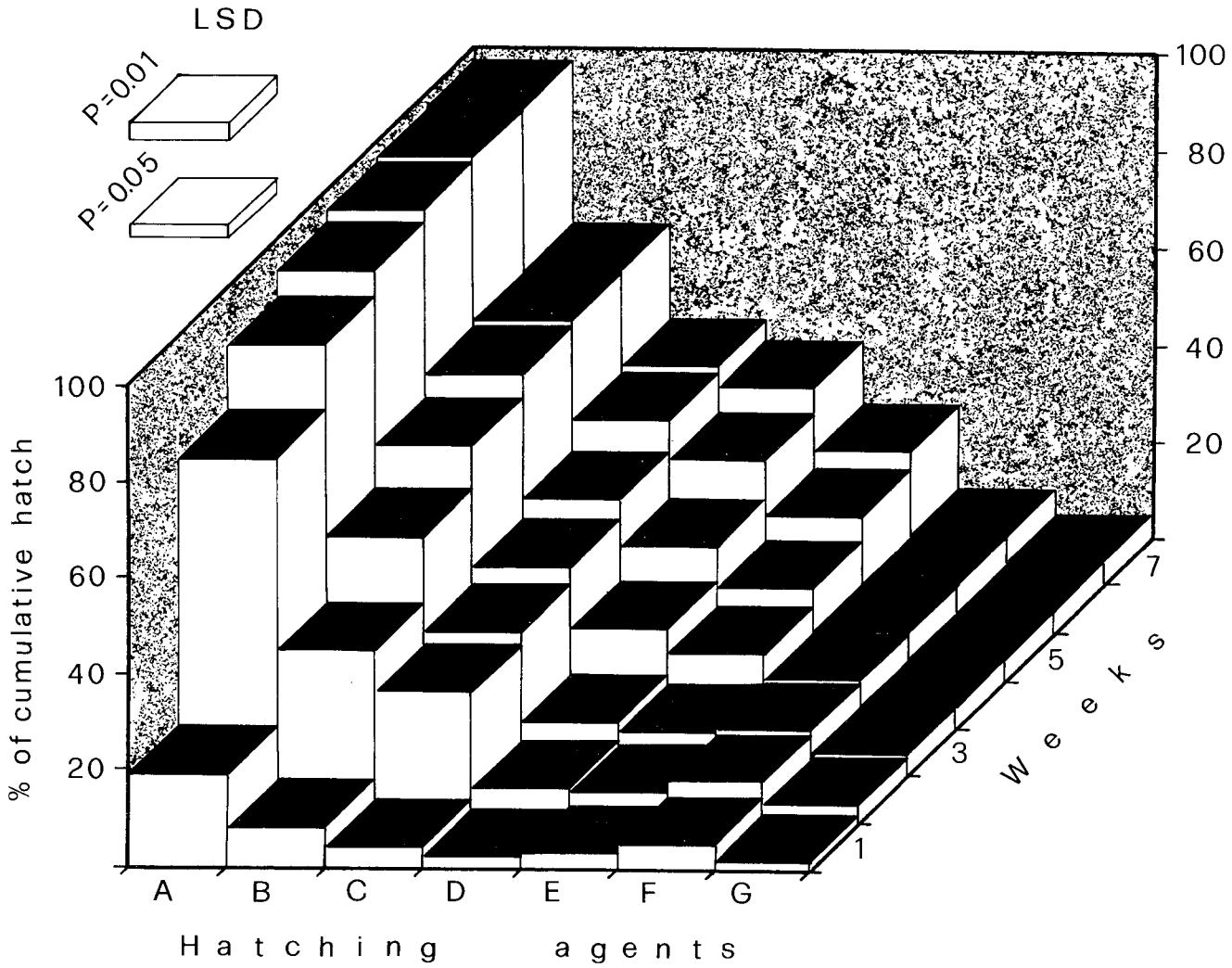

Fig. 1. Effect of commercial (A) and ornamental fig root leachates (C), sodium metavanadate (B), zinc chloride (D), zinc sulphate (E), picrolonic acid (G) and distilled water (F) on emergence of juveniles from cysts of *Heterodera fici* at 24°C ± 2.

Literature cited

Di Vito M., 1976 - *Heterodera fici* su *Ficus carica* in Basilicata. *Nematol. medit.*, *4*: 107.

Di Vito M., 1986 - Effect of temperatures and fig root leachate on hatch of *Heterodera fici*. *Nematol. medit.*, *14*: 231-234.

Di Vito M. and Inserra R.N., 1982 - Effect of *Heterodera fici* on the growth of commercial fig seedlings in pots. *J. Nematol.*, *14*: 416-418.

Golden A.M., Maqbool M.A. and Shahina F., 1988 - Redescription of *Heterodera fici* (Nematoda: *Heteroderidae*) with SEM observation. *J. Nematol.*, *20*: 381-391.

Greco N., 1981 - Hatching of *Heterodera carotae* and *H. avenae*. *Nematologica*, *27*: 366-371.

Greco N., Brandonisio A. and De Marinis G., 1982 - Investigation on the biology of *Heterodera schachtii* in Italy. *Nematol. medit.*, *10*: 201-204.

Greet D.N., 1974 - The response of five round cyst nematodes (*Heteroderidae*) to five artificial hatching agents. *Nematologica*, *20*: 363-364.

Perry R.N., 1986 - Physiology of hatching, pp. 119-131. *In* "Cyst Nematodes" (F. Lamberti and C.E. Taylor Eds) Plenum Press, London.

Seinhorst J.W. and Den Ouden H., 1966 - An improvement of Bijloo's method for determining the egg content of *Heterodera* cysts. *Nematologica*, *12*: 170-171.

Accepted for publication on 28 February 1990.