RESPONSES OF ITALIAN POPULATIONS OF *GLOBODERA ROSTOCHIENSIS* AND *G. PALLIDA* TO HATCHING AGENTS

G. Russo and N. Greco

Istituto per la Protezione delle Piante, Sezione di Bari, C.N.R., Via Amendola 122-D, 70126 Bari, Italy

Summary. An investigation was conducted to assess the hatching response of Italian populations of the cyst nematodes, *Globodera rostochiensis* and *G. pallida*, to potato root diffusate, picrolonic acid and sodium metavanadate, in comparison with distilled water, at 20 ± 2 °C. Almost no eggs hatched after six weeks incubation of cysts of either species in distilled water. In potato root diffusate, 23% of the eggs of *G. rostochiensis* and 41% of those of *G. pallida* hatched in the first week and 47.4% and 55.7%, respectively, in six weeks. After nine weeks, egg hatch in picrolonic acid was 60.9% for *G. rostochiensis* and only 0.9% for *G. pallida*. In sodium metavanadate the cumulative hatching after six weeks was 31.9% for *G. rostochiensis* and 10.4% for *G. pallida*.

Key words: Potato cyst nematodes, egg hatch.

Among plant parasitic nematodes, the cyst nematodes are rather peculiar in that in most species eggs will hatch only when stimulated by the root diffusate of the host plant (Shepherd, 1962). However, artificial hatching agents for cyst nematodes have also been reported (Shepherd, 1962; 1970). From these, several have also been tested for hatching of potato cyst nematodes.

Knowledge of the hatchability of eggs within cysts is very often used as an indication of egg viability and information on hatching dynamics is also useful for an understanding of the survival strategy of a cyst nematode and its pathogenicity to the host crop.

In the past, contradictory hatching responses of Italian populations of the potato cyst nematodes, *Globodera rostochiensis* (Woll.) Behrens and *G. pallida* (Stone) Behrens, to sodium metavanadate and picrolonic acid have been observed (Greco, unpublished). Moreover, hatch in sodium metavanadate was large (about 80%) with northern populations of *G. rostochiensis* and rather low with southern populations of both nematode species. Therefore, a hatching test was conducted to compare the hatching response of these potato cyst nematodes to potato root diffusate and solutions of 0.6 mM sodium metavanadate and 0.3 mM picrolonic acid in distilled water, with plain distilled water used as a control.

Cysts of *G. rostochiensis* and *G. pallida* were collected in March 2003 from two different fields, 1 km apart, at Polignano a Mare (province of Bari, south Italy), from which potatoes had been harvested the previous June. The soil ("Terra rossa") was similar in both fields and was kept in plastic trays outdoors in the shade until use (early April). Cysts were extracted from 200 cm^3 sub-samples (not dried), separated from soil debris, put in 1.5-cm-diam. sieves with a 215 µm aperture and arranged in 3-cm-diam. plastic Petri dishes (Greco *et al.*, 1982) containing 3 ml of tap water.

Root diffusate was collected from 15 cm tall potato cv. Spunta plants grown in 22-cm-diam. pots containing sandy soil (89% sand), filtered through paper filter and stored in a freezer until the day before use. There were four replicates per nematode species and hatching agent, according to a completely randomized design, each averaging 305 cysts of *G. rostochiensis* or 277 of *G. pallida*. The tap water was then removed and the cysts were incubated in the test hatching agents at 20 ± 2 °C in the dark for six weeks, except the cysts of *G. rostochiensis* in picrolonic acid, which were incubated for nine weeks.

Each week, the emerged second stage juveniles were counted and discarded and the hatching agent was renewed. At the end of the test, the cysts were crushed according to Seinhorst and Den Ouden (1966) and non-hatched eggs were counted. The sum of these and of total second stage juveniles emerged was considered as the total egg content of the cysts per replicate at the beginning of the test and, from this, the weekly cumulative percentage egg hatch was calculated for each replicate. Data were subjected to analysis of variance to calculate LSDs.

Results (Fig. 1) show that egg hatch of both nematodes in distilled water was negligible (0.1-0.5%). In potato root diffusate, egg hatch was rapid even from the first week, when the proportion of the eggs of *G. pallida* hatched (41.1%) was significantly larger than that of *G. rostochiensis* (23.1%). Most of the eggs hatched during the first three weeks. By the sixth week the observed differences were reduced but remained significant at $P < 0.05$.

In picrolonic acid, the hatching response of *G. pallida* was negligible (maximum 1%), while 61% of the eggs of *G. rostochiensis* had hatched by nine weeks. However, in this agent the per cent hatch was significantly less than in potato root diffusate during the first four weeks.

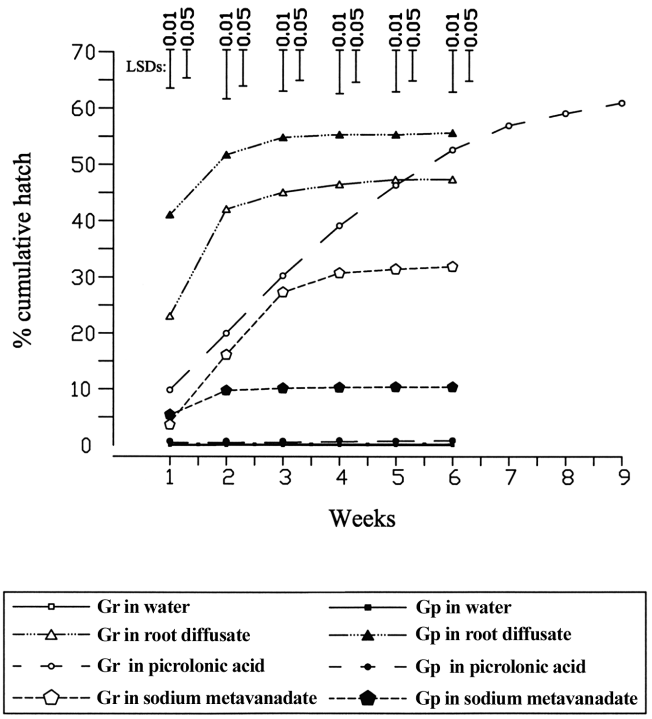

Fig. 1. Cumulative per cent hatch of eggs within cysts of *Globodera rostochiensis* (Gr) and *G. pallida* (Gp), incubated in different hatching agents at 20 ± 2 °C.

In sodium metavanadate, egg hatch of *G. rostochiensis* (maximum 32%) was significantly less than in potato root diffusate and in picrolonic acid. The hatching response of *G. pallida* was only one third of that of *G. rostochiensis* and less than one fifth of that of the same nematode in potato root diffusate.

Our findings demonstrated that potato root diffusate stimulated egg hatch of both nematodes better than any other hatching agent. Hatching of *G. rostochiensis* in picrolonic acid was almost as good as in potato root diffusate but rather slow. Greet (1974) obtained similar results in potato root diffusate and sodium metavanadate although emergence of juveniles of *G. rostochiensis* in the latter was nearly double that in the former. Also, this author observed similar egg hatch of *G. pallida* in picrolonic acid and sodium metavanadate. Egg hatch of up to 84% was obtained with Chilean (Greco and Moreno, 1992) and 90% with Venezuelan (Jimenez, unpublished) populations of this nematode. Evans (1983) observed that hatching response of potato cyst nematode to potato root diffusate varied with the potato cultivar and that, in general, that of *G. rostochiensis* was larger than that of *G. pallida*. Robinson *et al.* (1987) also reported hatch of *G. rostochiensis* faster than that of *G. pallida* and demonstrated that the faster hatching pattern of *G. rostochiensis* was positively correlated with lipid utilization of the juveniles of *G. rostochiensis*, which was faster than that of juveniles of *G. pallida*. This different hatching behaviour is assumed to be one of the causes of the slower population decline of *G. pallida* and of the greater damage that it causes in many areas. In our test, the hatching response of *G. pallida* was similar to (in sodium metavanadate) or faster than (in potato root diffusate) that of *G. rostochiensis*. This would explain, at least partially, the slightly lower tolerance limit of early potato to *G. pallida* (1.7 eggs/g soil) than to *G. rostochiensis* (2.1 eggs/g soil) (Greco *et al.*, 1982). All this would indicate that the response of potato cyst nematodes to hatching agents, beside being affected by potato cultivars (Evans, 1983) and a number of other factors (Perry, 2002), may vary not only according to species but also with populations of the same species. Therefore, a preliminary test with different hatching agents is suggested before running hatching tests to assess the true hatchability of potato cyst nematode populations.

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