Influence of temperature on the Potato Cyst Nematode life cycle

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Introduction

The potato cyst nematodes (PCN) *Globodera rostochiensis* and *G. pallida* are major parasites of potatoes and other members of the *Solanaceae* family.

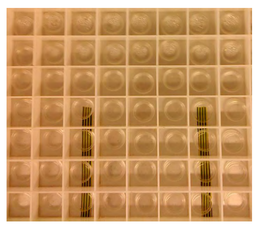
Temperature is one of the most influential environmental factors affecting the nematode life cycle and the possibility for a second generation within the growing season. The aim of this work is to examine the relationship between temperature and population dynamics of PCN and particularly to assess the effect of temperature increases associated with climate change on nematode reproductive rates.

Methods

Hatching tests

Hatching tests were performed on a temperature gradient table, which was set to have a continuous temperature range of 5ºC to 29ºC.

Ten cysts were exposed to potato root diffusate in replicated 5cm dishes and juveniles were counted over a five-week period.



Modelling the Population Dynamics of PCN

The preliminary analysis is based on work by Moxens and Hausken (2007) which focused on the number of eggs per unit mass of soil over time.

Growth cabinet experiment

Three growth cabinets were set with soil temperatures at 14ºC, 17ºC and 20ºC. Potato plants were inoculated with bags of 30 cysts. Two plants were taken from each treatment once a week for 15 weeks. Juveniles and males were extracted with a Baerrman funnel and counted.

Future prospects

Improvements to the PCL (Potato Council Ltd) PCN model with regard to:

-the potential and risk of a second generation of potato cyst nematodes in the field

-the effect of temperature on PCN population dynamics in the field

In addition, the project will investigate the additive benefits of combining resistances to both species of PCN.

Results and conclusions

Hatching experiments

The optimal hatching temperature of *G. rostochiensis* cysts was 21°C, and of *G. pallida* 17°C with the highest number of total juveniles. A delayed hatching was observed at higher temperatures for *G. rostochiensis*.

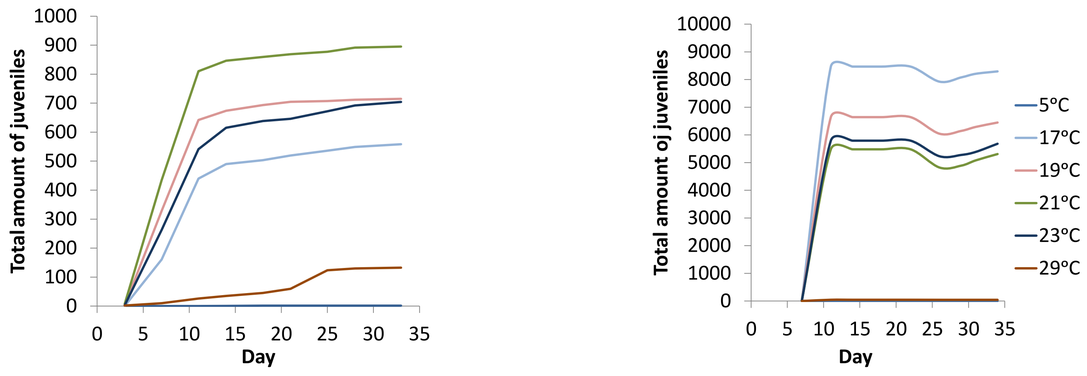


Figure 1. Cumulative number of juveniles hatching over time for *G. rostochiensis* (left) and *G. pallida* (right).

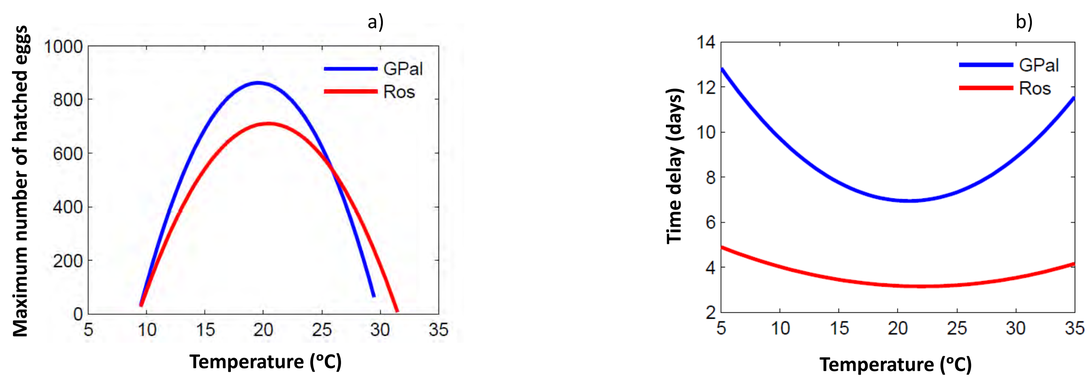


Figure 2. Comparing parameters,[a) maximum number of hatched eggs and b) time delay in days before hatching begins], as a function of temperature .

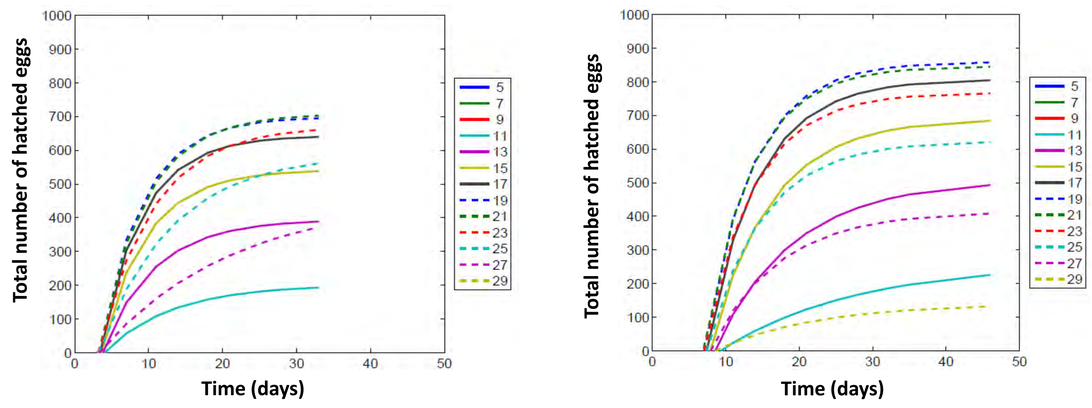


Figure 3. Modelled number of hatched eggs (cumulative) over time, for each temperature for *G. rostochiensis* (left) and *G. pallida* (right)

Growth cabinet experiment

In vivo assays had the highest and fastest life cycle at 20°C. Hatching of the 1st generation of cysts was observed within 10 weeks (Fig. 4). Numbers of males were higher and detected earlier at 20°C (Fig. 5.), implying that a rise in temperature not only affects hatching but also adult development during the nematode life cycle.

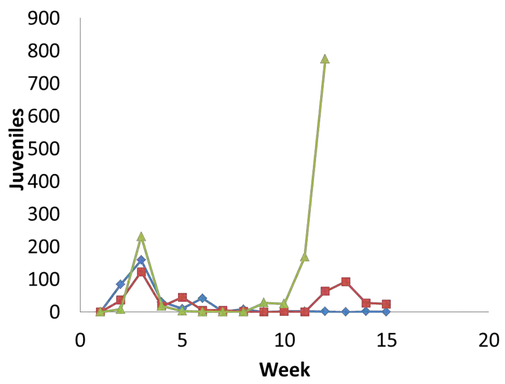


Figure 4. Number of juveniles of *G. rostochiensis* in soil over time

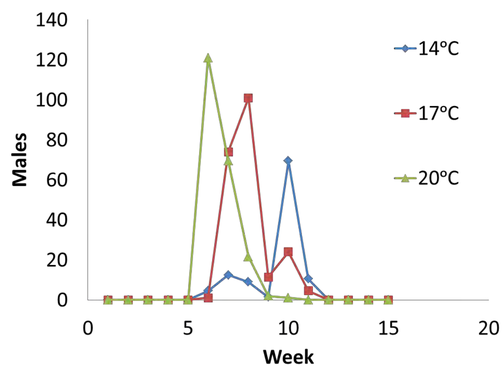


Figure 5. Number of males of *G. rostochiensis* in soil over time.

An increase in temperature could promote a faster and more efficient hatching of PCN, potentially leading to a harmful second generation.