

Life cycle of the root-knot nematodes *Meloidogyne chitwoodi*, *M. fallax* and *M. minor* on potato and consequences for damage development.

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Agriculture and Fisheries Policy Area

Introduction

M. chitwoodi

Described in 1980 (Golden, A.M., O'Bannon, J.H., Santo, G.S. & Finley, A.M. (1980). Description and SEM observations of *Meloidogyne chitwoodi* n. sp. (Meloidogynidae), a root-knot nematode on **potato** in the Pacific Northwest. *Journal of Nematology* 12, 319-327.)

M. fallax

- Described in 1996 (Karssen, G. (1996). Description of *Meloidogyne fallax* n. sp. (Nematoda: Heterodoridae), a root-knot nematode from the Netherlands. *Fundamental and Applied Nematology* 19, 593-599.)

M. minor

- Described in 2004 (Karssen G., Bolk R.J., Van Aelst A.C., van den Beld I., Kox L.F.F., Korthals G., Molendijk L., Zijlstra C., Van Hoof R. & Cook R. (2004). Description of *Meloidogyne minor* n. sp. (Nematoda: Meloidogynidae), a root-knot nematode associated with **yellow patch disease in golf courses**. *Nematology* 6, 59-72

Introduction

M. chitwoodi / *M. fallax*

- Q-organism (EC Directive 2000/29/EC)
- Limited distribution but severe impact
- Wide host range (including weeds)
- *M. chitwoodi*: Argentina, Belgium, France, Germany, Mexico, Portugal, South Africa, Switzerland, The Netherlands, Turkey, USA
- *M. fallax*: Australia, Belgium, France, Germany, New Zealand, The Netherlands, South Africa, Switzerland, UK, USA(?)



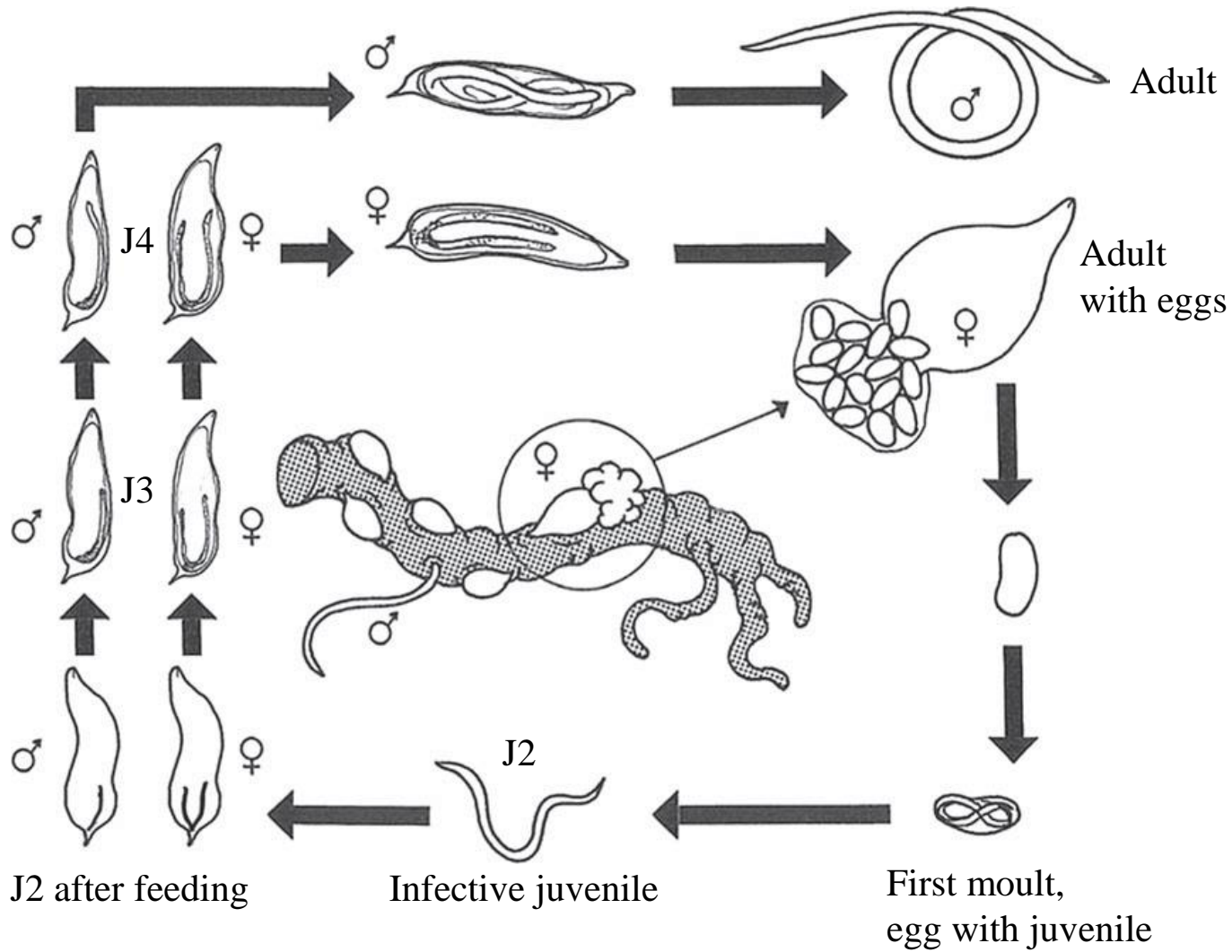
Introduction

M. minor

- In 2000: significant **damage in potato field** in the Netherlands
- Reported in Belgium, Chile, Ireland, the Netherlands, Portugal, UK and USA
- 2006: PRA for the EU (Lammers *et al.*)



Life cycle



Adapted from Karszen *et al.*, 2013

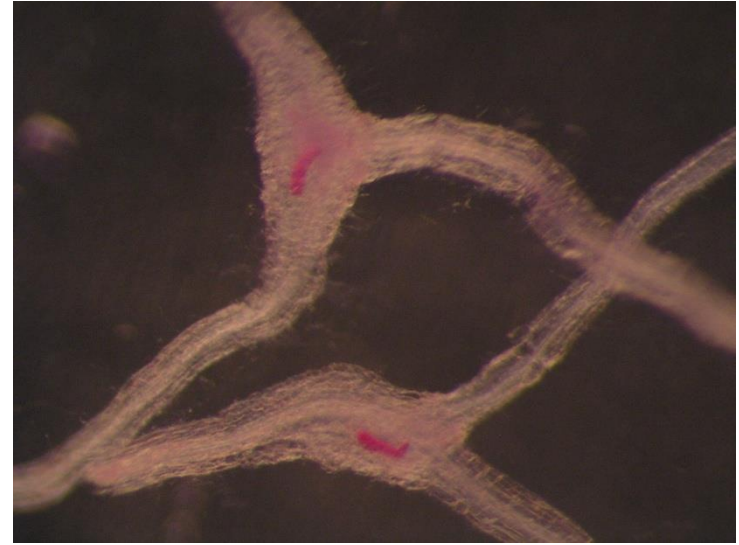
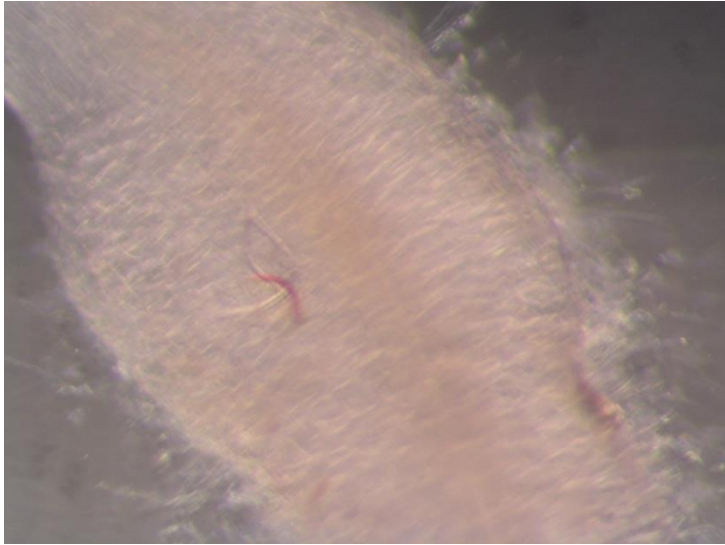
Life cycle



Life cycle



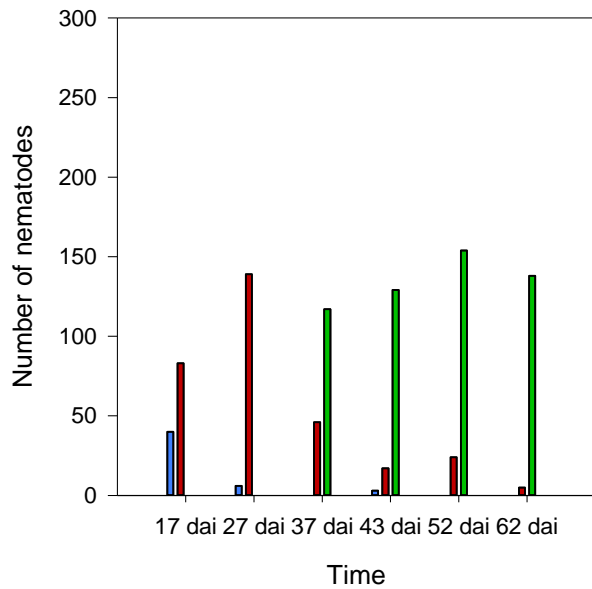
Life cycle



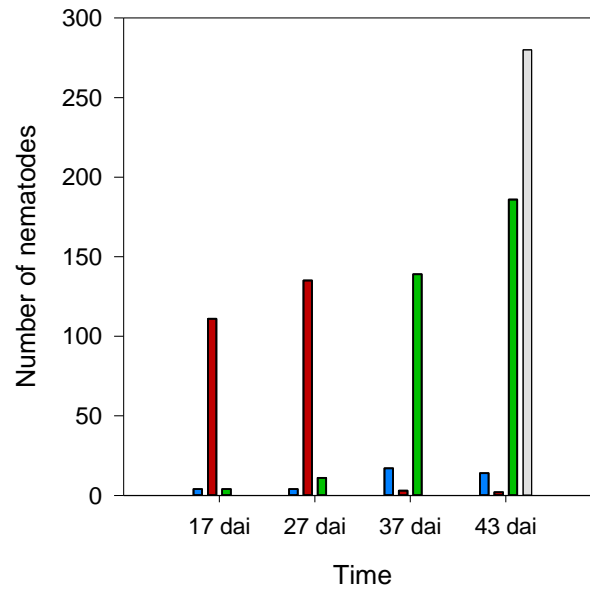
Life cycle

M. chitwoodi

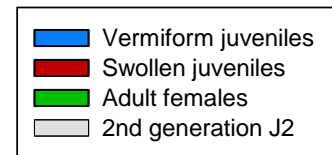
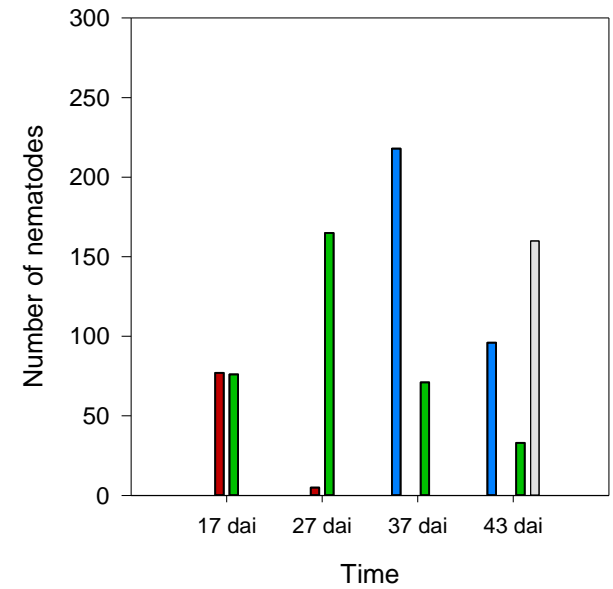
15°C



20°C



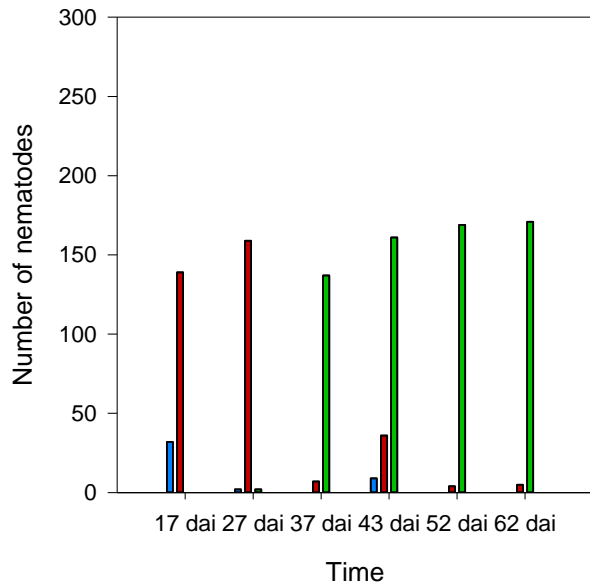
25°C



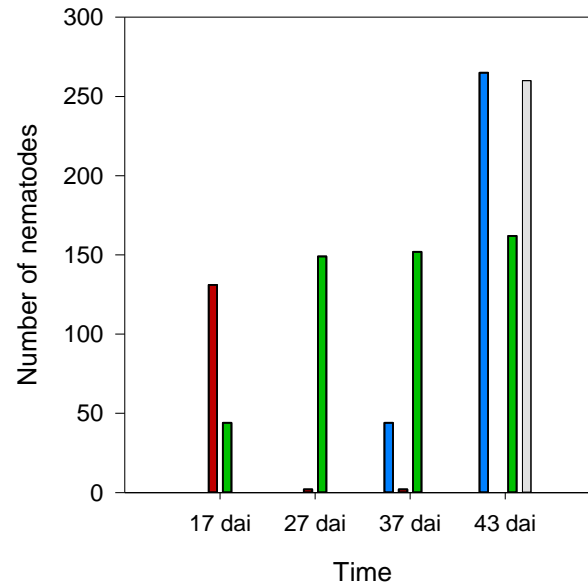
Life cycle

M. fallax

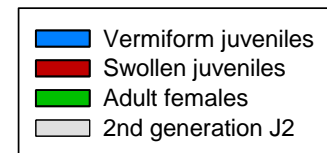
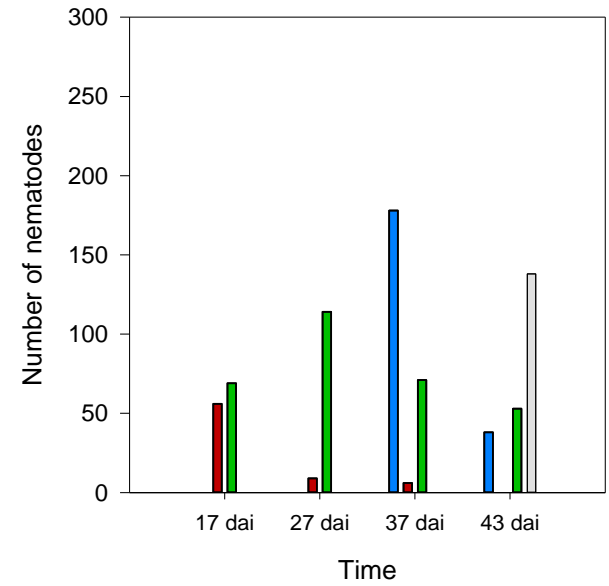
15°C



20°C



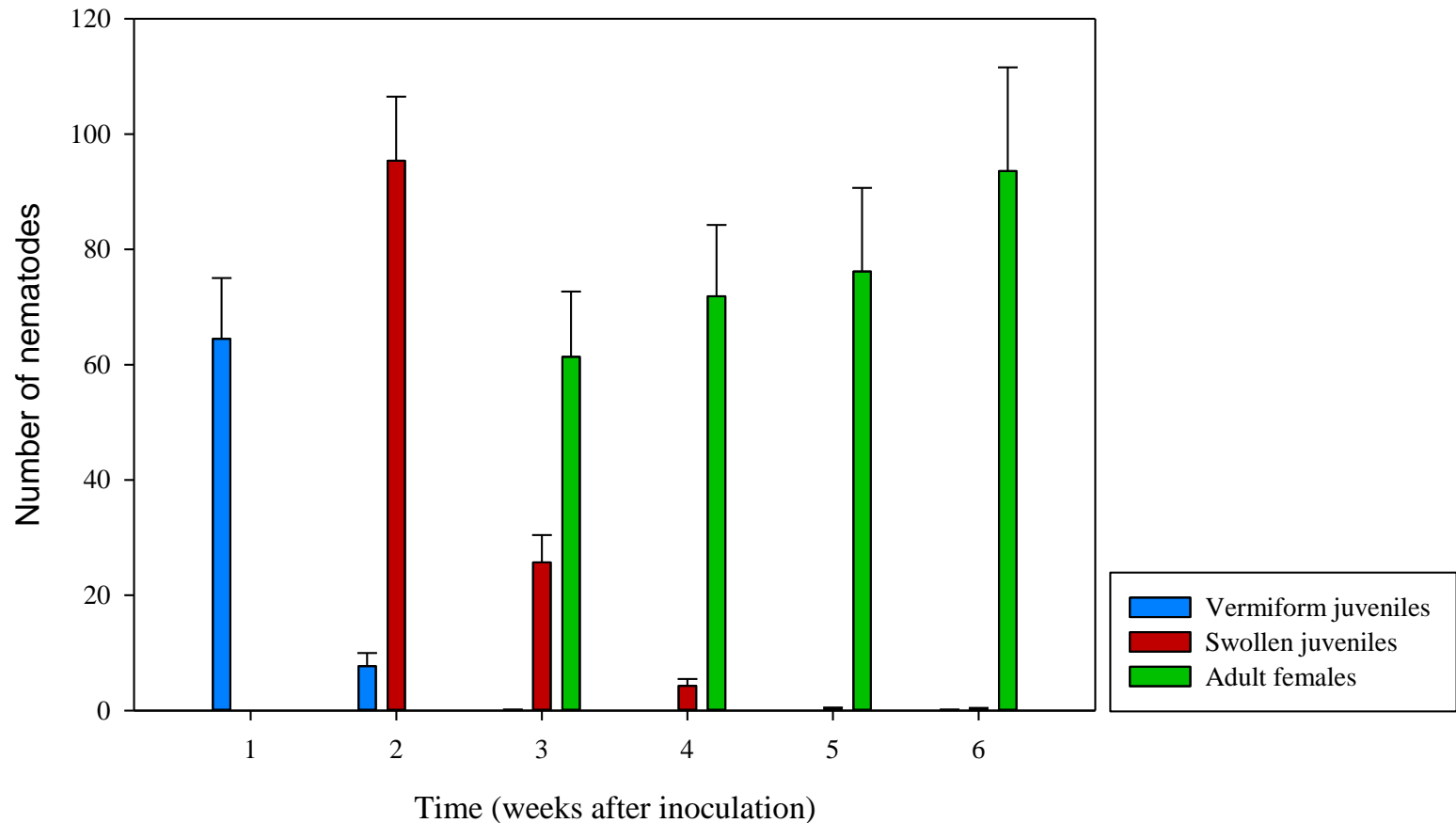
25°C



Life cycle

M. minor

22.3°C



Life cycle

- Degree days (base 5°C) for completion of life cycle for *M. chitwoodi* and *M. fallax* on potato: 555-740 DD₅
(Khan *et al.*, 2014. Russian Journal of Nematology 22)
- Degree days (base 5°C) for completion of life cycle for *M. chitwoodi* on potato: 600-800 DD₅
(Pinkerton *et al.*, 1991. Journal of Nematology 23)
- Degree days (base 5°C) for completion of life cycle for *M. minor* on potato: 606-727 DD₅
(Wesemael *et al.*, 2014. Nematology 16)

Host plant status



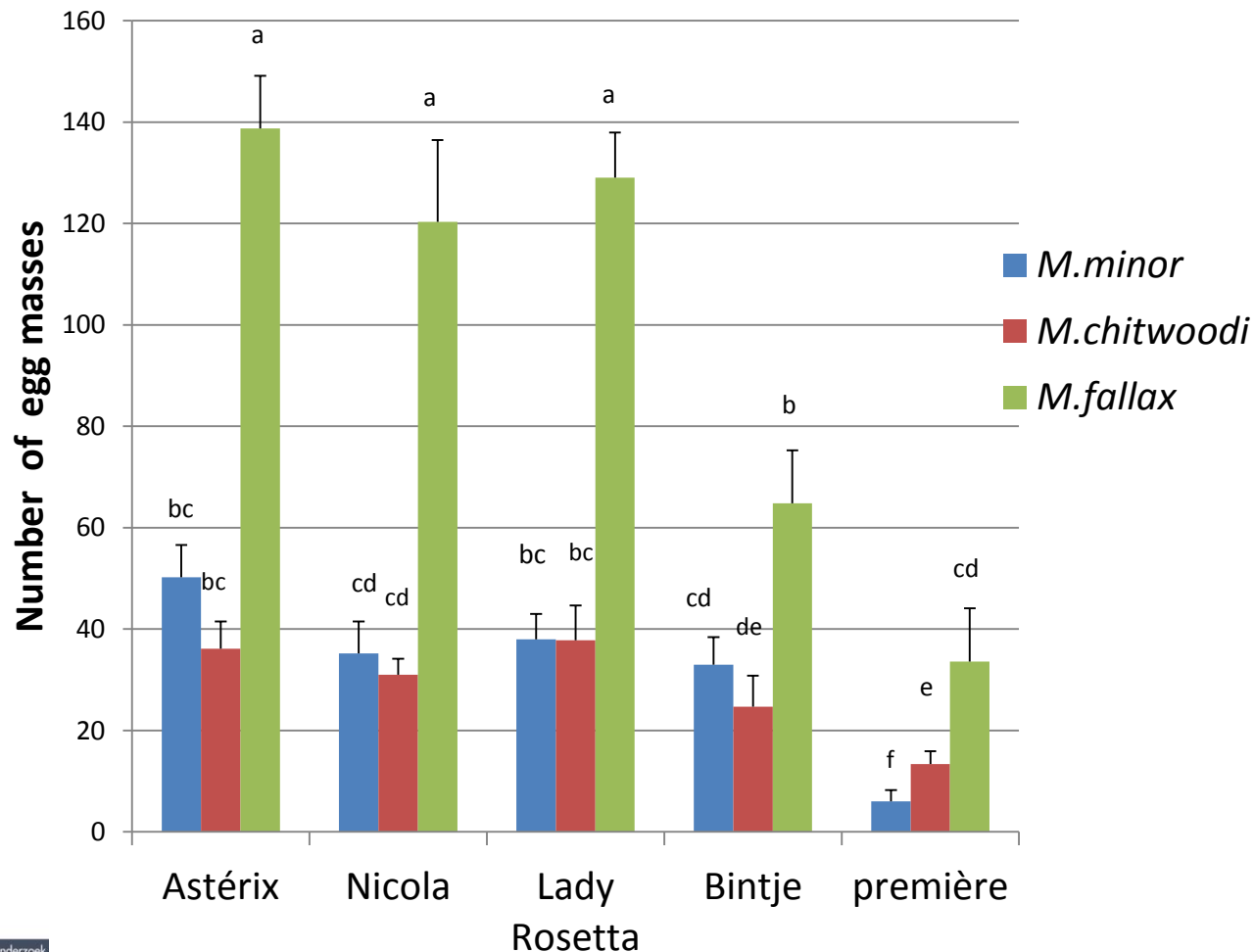
Host plant status

Staining of gelatinous matrix with Phloxine B



Host plant status

Mean number of egg masses (\pm SE) per pot of *Meloidogyne minor*, *M. chitwoodi* and *M. fallax* found on five different potato cultivars (Astérix, Nicola, Lady Rosetta, Bintje and Première). Different letters indicate significant differences (LSD-test, $p < 0.05$).



Damage

- Potato cv. Bintje
- Pot experiment (2000 cm³) in glasshouse (20-26 °C)
- Inoculation 3 weeks after planting with freshly hatched (< 24h) J2
- $P_i = 0, 1, 2, 5, 10, 50, 75, 100, 125, 150$ and 250 per 100 cm³
- Visual evaluation of damage (after 3 months): presence of knots – severely damaged tubers (non processable)

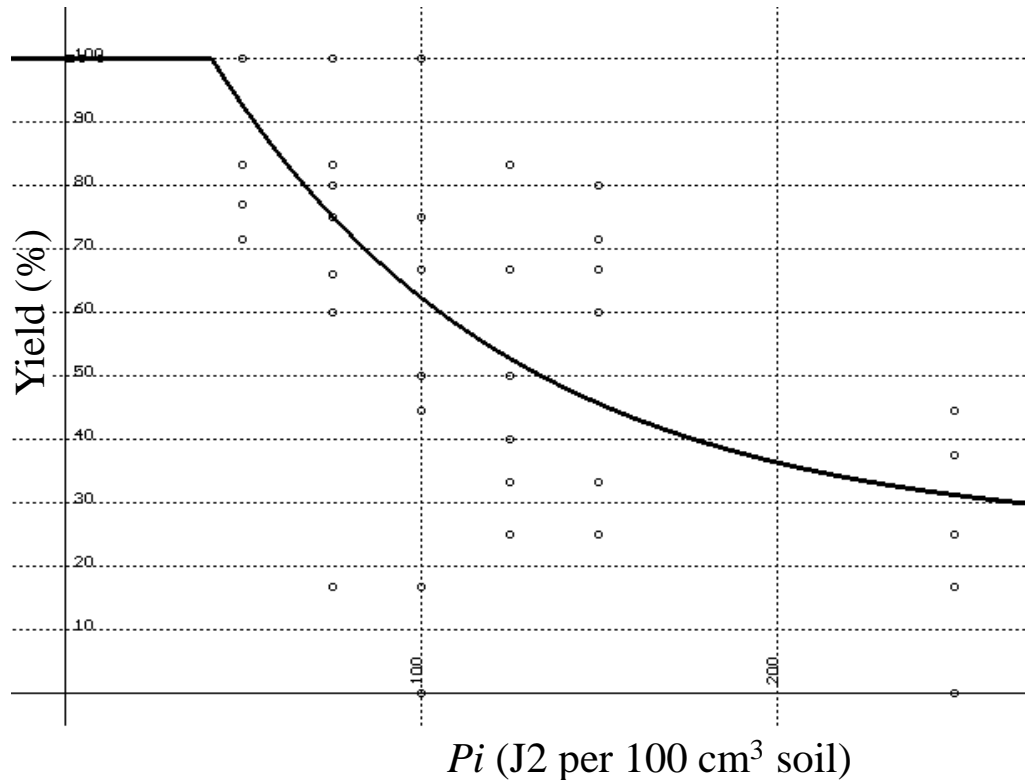
Damage

Damage caused by *M. minor* on potato cv. Bintje



Damage

Parameter estimates of the Seinhorst model for damage on tubers of potato cv. Bintje grown in 2000 cm³ pots caused by *Meloidogyne minor* at 11 initial population densities (P_i) from 0 to 250 J2 per 100 cm³ soil.



Parameter ^a					$y_{m.m}$	R^2
m	T	z	y_m			
0.25	41	0.99	100	25	0.58	

Damage

M. chitwoodi

- Damage threshold on potato: 1 J2/250 cm³ soil (Santo *et al.* 1981); 10 J2/100 cm³ soil (Norshie *et al.*, 2011); degree-day accumulation more important than *Pi* (Griffin, 1985).

M. minor

- Damage threshold on potato: 41 J2/100 cm³ soil (Wesemael *et al.* 2014)

M. fallax

- ?

Conclusion

- Average degree-days (base 5 °C) for Belgium
April-October: 2250

→ 1-4 generations of *M. chitwoodi*, *M. fallax* and
M. minor on potato per growing season allowing
damage development

- *M. minor* is a potential threat for potato culture and
further spread should be avoided

Acknowledgement

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