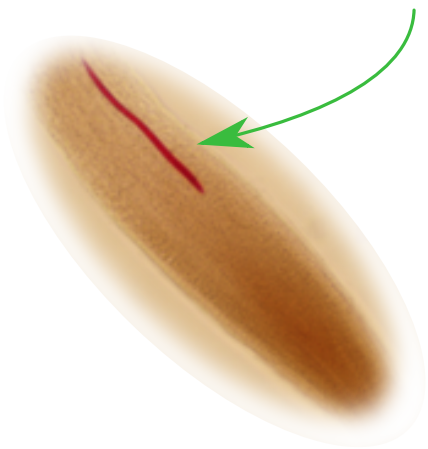## *Plant parasitic nematodes?*

- small, subterranean, sedentary endoparasitic invertebrates
- exceeding diversity (only insects are more diverse)
- they fill almost every niche on earth that contains some amount of water
- discovered in 1743

Root knot nematode in a host plant's root

Why are they important?

- annual loss of 110 billion EUR in global food production
- root knot nematodes and potato cyst nematodes are at 1. and 2. place among top 10 high-impact plant parasitic nematodes
- RKN and PCN account for more than 5% of global food losses

Project partners

Kmetijski inštitut Slovenije
Agricultural Institute of Slovenia

ILVO
Institute for Agricultural and Fisheries Research

Project co-financed by the European food safety authority, grant number GP/EFSA/ALPHA/2018/02

efsa
European Food Safety Authority

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NemDetect

Early detection of quarantine nematodes in potatoes using remote sensing

Methods of spreading?

- low motility (up to 1 meter in soil)
- most common vectors are farming equipment and shoes
- infested planting material

Current methods of identification?

- visual inspection of roots and tubers
- laboratory analyses for species identification
- invasive and impractical for large scale use
- effects on canopy are non-specific and are identical to signs of drought or nutrient depletion

There is a clear need for early detection of infestations with high spatial accuracy for effective management.

Why remote sensing?

- enables accurate determination of plant health status
- enables differentiation between abiotic and biotic stress
- can be applied over large areas using UAVs, airplanes and satelites
- different parts of the light spectrum reflected off plants carry different information

Main goals of the project

- bridge the gap between science and implementation
- pilot case study using hyperspectral, multispectral and thermal imaging on different platforms and spatial scales to detect nematode infestations
- pilot case study focused on two root knot nematode and two potato cyst nematode species, and two potato varieties
- organise workshops and seminars for NPPOs and other stakeholders
- prepare a monography on remote sensing applications for nematode infestation detection
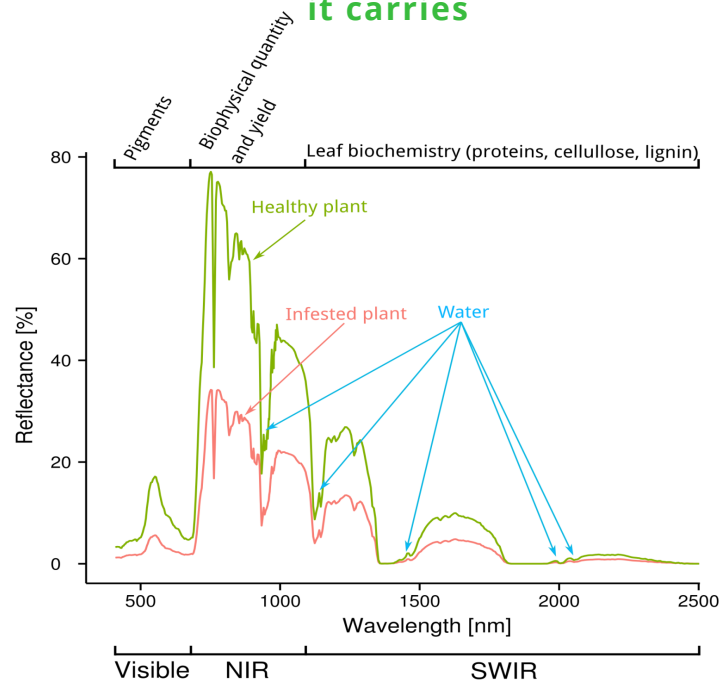- prepare guidelines for NPPOs for implementing remote sensing applications

Cysts on potato roots

Detail of larvae
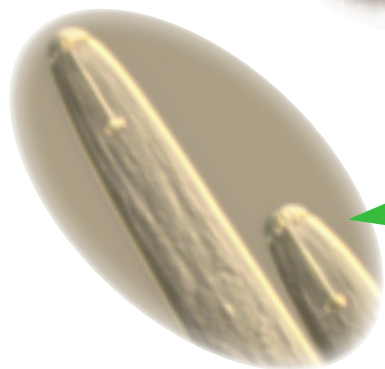
The visible, near infrared, and short-wave infrared light spectrum and the information it carries

A hyperspectral data cube; each pixel carries information from the visible, near infrared, and short-wave infrared light spectrum