

## Columbia Root Knot Nematode

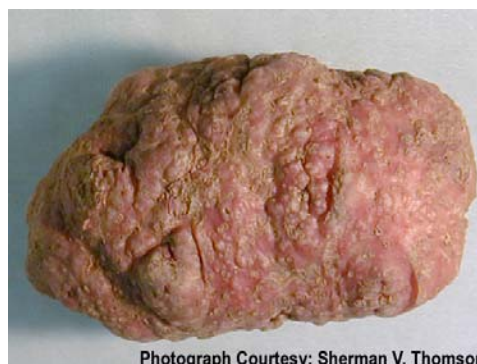
### *Meloidogyne chitwoodi*

EPMS 003

#### Quick Facts

- Root Knot nematodes of greatest concern to Utah potato growers are Columbia Root Knot nematode (*Meloidogyne chitwoodi*), and Northern Root Knot nematode (*M. hapla*).
- *M. chitwoodi* can survive on potato, onion, many vegetable crops, grain, field corn and watermelon.
- *M. chitwoodi* can reproduce at soil temperatures of 5°C (41°F).
- *M. chitwoodi* can migrate vertically 120cm (~48") to infect a crop.
- Tubers that are asymptomatic for nematode infections can become symptomatic and unmarketable during storage
- Nematicides and fumigants are labeled for suppression but not control of *M. chitwoodi*.

that affect Utah agriculture: *Meloidogyne incognita*, *Meloidogyne hapla*, and *Meloidogyne chitwoodi*. *Meloidogyne incognita* (Southern Root Knot nematode) is a major pest in greenhouse production, but does not usually affect field crops in Utah since it cannot survive in the low soil temperatures during winter. *M. hapla* (Northern Root Knot nematode) is of larger consequence to Utah agriculture, but is easily controlled by rotating into a grain crop. Grains are non-hosts for the Northern Root Knot nematode, but grain crops can be infected by *M. chitwoodi* (Columbia Root Knot nematode). Although grain crops are not seriously impacted by a *M. chitwoodi* infestation, they aid *M. chitwoodi* by providing a reproductive substrate to retain a low but consistent population of nematodes. Once the 1-2 year grain rotation is complete and a potato or onion crop is reintroduced into the field, *M. chitwoodi* populations increase rapidly causing significant tuber and bulb damage.



Photograph Courtesy: Sherman V. Thomson

**Figure 1.** Pimple-like lesions caused by *M. chitwoodi* encompassing the surface of a red skinned potato.

Root Knot nematodes commonly infect root crops, rendering them unmarketable. There are three major species of root knot nematode

## Symptoms:

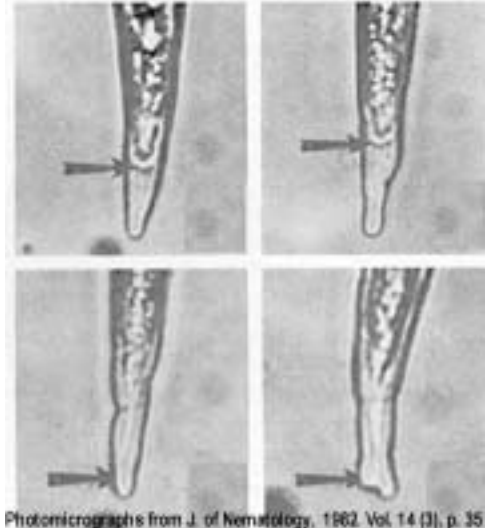
*M. chitwoodi* primarily infects tubers and bulbs but rarely small feeder roots, therefore above ground symptoms are normally absent. Infected tubers have small pimple-like bumps on their surface and in the case of extreme nematode populations; these pimple-like bumps may encompass the complete tuber surface (Figure 1). *M. hapla* infections result in a general swelling of the tuber surface which can be easily confused with normal tuber growth. Tubers infected with either nematode have small brownish spots present in their vascular ring. These spots are the sedentary female and egg masses, which measure approximately 1mm in diameter (Figure 2).



**Figure 2.** Small brownish spots within the vascular ring of a red skinned potato. Spots indicate the presence of an egg-laying female Columbia Root Knot nematode or a Northern Root Knot nematode.

*M. chitwoodi* can be identified in the laboratory by examining external and internal tuber symptoms, juvenile hypodermis characteristics or perineal patterns.

Many invertebrate organisms have a thin layer of cells surrounding their internal organs known as the hypodermis. The juvenile *M. hapla* hypodermis extends fully into the posterior portion of the body cavity, whereas a *M. chitwoodi* juvenile hypodermis is truncated well before it reaches the most posterior portion of the body cavity (Figure 3).



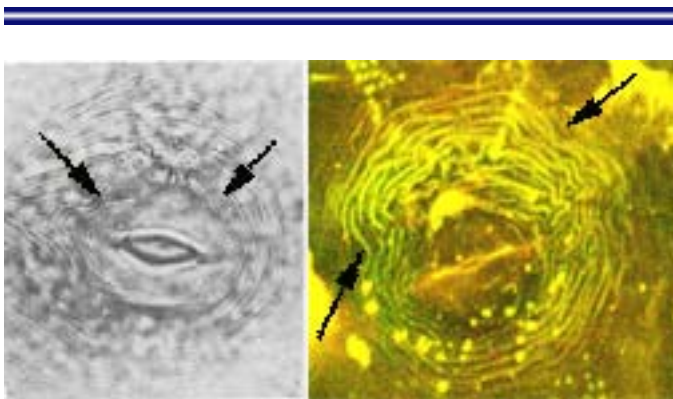
**Figure 3.** Hypodermis truncation of juvenile *M. chitwoodi* nematode (top). Hypodermis extended fully into posterior of *M. hapla* juvenile (bottom).

The perineum covers the nematode similar to skin. Each nematode species has unique Perineal patterns which enables their identification using a microscope. The perineum surrounding the vulva and anus of *M. chitwoodi* has a distinct “shoulder” appearance compared the smooth non convoluted pattern found in *M. hapla* (Figure 4).

## Causal Agent:

*M. chitwoodi* in addition to all other nematodes in the genus *Meloidogyne* are classified as root knot nematodes. These nematodes commonly infect root tissue of host plants. *M. chitwoodi* is most devastating when it infects potato

tubers. Males and juvenile stages are motile whereas the female adult forms are immobile and reside in the vascular ring of tubers where they produce an egg sac that contains 200-1000 individual eggs. Reproduction can occur at soil temperatures as low as 5°C (41°F) compared to *M. hapla*, which cannot reproduce at soil temperatures less than 10°C (50°F). This difference in reproductivity allows *M. chitwoodi* to produce 1-2 more generations per growing season than *M. hapla*. *M. chitwoodi* can also survive in regions further north.



**Figure 4.** Smoothed “shoulder” appearance of *M. hapla* perineal pattern (left). Indented “shoulders” on *M. chitwoodi* perineal pattern (right). Shoulders indicated by arrows.

*M. chitwoodi* is further divided into two races, race 1 and race 2. These two races are differentiated by host specificity. Race 1 is unable to infect alfalfa, however alfalfa is an excellent host plant for race 2. It is difficult to control race 2 because it resides very deep in the soil.

## Control:

Avoiding introduction and preventing spread of *M. chitwoodi* into non-infested fields is paramount.

- Infected seed pieces are difficult to identify, therefore growers are advised to purchase seed pieces grown in fields

that have been tested and shown to be free of *M. chitwoodi*.

- Clean all farm equipment between infested and non-infested fields. Work non-infested fields first if possible.
- Tubers planted in infested soils should be harvested early and marketed to the fresh market, because symptoms can become evident during storage.
- Crop rotation. Non-host crops include: asparagus, fodder radish, lima bean, Scotch spearmint, popcorn and super sweet corn. Certain varieties of Sudangrass are resistant to *M. chitwoodi* and can be used as a green manure to supplement chemical control treatments. A good weed control program must accompany crop rotation since many common weeds are hosts for *M. chitwoodi*.
- Sudangrass or rapeseed can be planted following a short season crop to aid in suppressing nematode populations. Sudangrass should be incorporated into the soil in the fall before frost and rapeseed incorporated into the soil in the spring, 3-4 weeks before planting potato seed pieces.
- Many operations may not find it a viable option, but a single growing season where an infested field is left fallow with excellent weed control can reduce nematode populations as effectively as fumigation.

## Chemical Control:

The following chemical control recommendations are taken directly from: The 2002 PNW Plant Disease Management Handbook. pp. 298-299.

No control technique eliminates nematodes from soil and eventually they infect tubers. However, these recommendations should reduce the impact of the disease.

- Soil fumigation in fall is highly recommended, but spring fumigation is possible if criteria for fumigation conditions are met. Generally, soil temperatures and moisture for fumigation are better in fall than spring. In addition, nematode populations are more active in fall and therefore more susceptible.
  - Telone II at 20 gal/A for mineral soils, 36 gal/A for muck soils. 72-hr REI. **Restricted use pesticide.**
  - Telone C-17 at 24 gal/A for mineral soils and at 41 gal/A for muck soils. 72-hr REI. **Restricted use pesticide.**
  - Metam sodium 32.7% (Vapam, Soil-Prep, Nemasol) can reduce nematode populations. In certain fields sprinkler-applied (1" of water) metam sodium cannot adequately reduce nematode populations 2 to 3 feet deep in soil. For best control, apply metam sodium as a broadcast spray at a depth of 14 to 16 inches using a Noble plow or similar shanks with spray nozzles attached. Follow by metam sodium applied on the surface in an inch of water or sprayed on the surface and incorporated by discing 4-6 inches deep. 48-hr REI.
- Mocap 10G at 120 lb/A in combination with soil fumigation for suppression. Mocap protects treated area from migrating nematodes for 5 to 6 weeks. Broadcast Mocap a close to planting time as possible and incorporate immediately in the top 4 to 6 inches of soil by rototilling or discing. 48-hr REI.
- Combining preplant soil fumigation and nematicide application can be used for high populations of *M. chitwoodi* located deep in soil.
  - Telone II at 20 gal/A plus Mocap 10G at 120 lb/A applied broadcast and incorporated 4-6 inches deep by rototilling or discing just before planting. 72-REI. **Restricted use pesticide.**
  - Telone II at 10 to 15 gal/A followed by metam sodium at 30-40 gal/A applied by sprinkler in inch water or broadcast and incorporated 4 to 6 inches deep. 72-hr REI. **Restricted use pesticide.**

**Information compiled and presented by:**  
**Scott C. Ockey M.S. / Senior Research Associate**  
**Sherman V. Thomson Ph. D. / Extension Plant Pathologist Emeritus**

Listing of commercial products implies no endorsement by the authors or the Utah State Cooperative Extension Service. Criticism of products not listed is neither implied nor intended. Persons using such products are responsible for their use according to the current label directions of the manufacturer. Pesticide labels are legal documents, and it is a violation of federal and state laws to use a pesticide inconsistent with its labeling. The pesticide applicator is legally responsible for its proper use. Always read and follow the label.

## Information to request for samples of *M. chitwoodi*.

### Grower Information

Name:

Address:

Farm Location:

### Crop Information:

Origin of seed pieces or seeds:

Plant and Variety:

Source of irrigation water

Irrigation type and frequency:

Soil type:

Have fumigants or nematicides been applied specifically for *M. chitwoodi* control: yes/no

    If yes, which pesticide combinations were applied:

    Has the incidence of infestation changed: yes/no

Crop rotation history (current and previous 4 years):

### Miscellaneous:

Pesticides applied:

Fertilizers applied:

Neighboring farms with host plants: yes/no

    Are neighboring farms experiencing same nematode infestation: yes/no