



How to detect stem and bulb nematodes in garlic

- Extraction method -

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Important warnings

- *This method is not quantitative and should not be used for diagnosis or to certify seeds. It is intended for personal use, for information only.*
- *For any formal identification or quantification, refer to the Laboratoire d'expertise et de diagnostic en phytoprotection du MAPAQ. (50\$ for the analysis, 25\$ for organic growers and free for new producers)*
 - *Garlic lots from outside of your farm should be tested by the MAPAQ laboratory.*
 - *Yours can be tested with this method. However, if you detect nematodes, even if there are only a few, it is strongly suggested to send your sample to the MAPAQ laboratory for validation.*



Important warnings (continued)

- *This method is not suitable for soil analysis. Several nematodes colonize the soil and they will be impossible to differentiate.*
- *It is possible to perform the test without removing the skin of garlic cloves, but make sure that the cloves are clean otherwise you could extract nematodes from the soil and mistakenly take them for the stem and bulb nematode.*
- *Nematodes viability decreases rapidly under these conditions, seeing dead nematodes does not mean that they are not problematic... most of them were alive before the extraction.*



Stem and bulb nematode

Ditylenchus dipsaci

- Microscopic worm of about 1-2 mm.
- Lives and multiplies in stem, foliage and bulb and causes yield losses of up to 90 %.
- The garlic plants can be asymptomatic, there may be presence of nematodes even if the cloves look fine !



These cloves were full
of nematodes !!!



Extraction materials:

- Garlic bulbs
- Scissors
- Container, bowl or glass (metal, glass or plastic)
- Sink strainer or colander
- Aluminium foil or paper/cardboard
- Turkey baster
- Clear plastic glasses



Equipment for observation:

Examples of what can be used:

(links are indicative only)

- 40 X magnifier with light (between 5\$ and 25\$)

https://www.amazon.ca/Illuminated-Jewelers-Loupe-40x-25mm-lighting/dp/B007GJJRZC/ref=sr_1_2?ie=UTF8&qid=1531939653&sr=8-2&keywords=loupe+40x



- Objective 10 X for cellular (about 10\$)

https://www.amazon.ca/Universal-Phone-Camera-Lens-Smartphones/dp/B07C923LVJ/ref=sr_1_10?ie=UTF8&qid=1531940065&sr=8-10&keywords=objectif+10+x+pour+cellulaire



- USB Digital Microscope 1000X (30\$)

https://www.amazon.ca/Jiusion-Magnification-Endoscope-Microscope-Compatible/dp/B06WD843ZM/ref=sr_1_sc_1?ie=UTF8&keywords=microscope%20usb%20digital&language=en_CA&qid=1531940644&sr=8-1-spell



Extraction of stem and bulb nematodes in 3 steps:

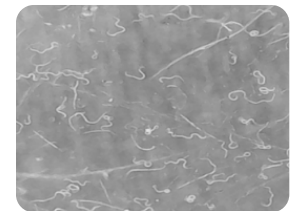
Soaking
24 h



Sedimentation
3h



**Observation
of nematodes**



Step #1: Soaking garlic cloves

- 1.1 Separate the cloves from the bulb, remove the skin and put the cloves in the bottom of a glass or other container. (we can put them in a strainer to facilitate the other steps but it is not mandatory)
 - 1.2 Pour cold water to cover the cloves and let them soak for 24 h at room temperature.
- * Do not cut the cloves because the solution will become cloudy and the nematodes will be harder to see.
- ** For large quantities use a large bowl and a colander.



Step #2: Sedimentation



- 2.1 After 24 h, remove the cloves by hand or by simply removing the strainer or colander.
- 2.2 Let the nematodes settle (sink) in the bottom of the container for 3 h, without stirring the liquid or container.
- 2.3 Next, take the top layer of liquid with the Turkey baster, stirring as little as possible and discard it. Keep only the bottom liquid (~1 cm thick) that contains the nematodes.



Step #3: Observation

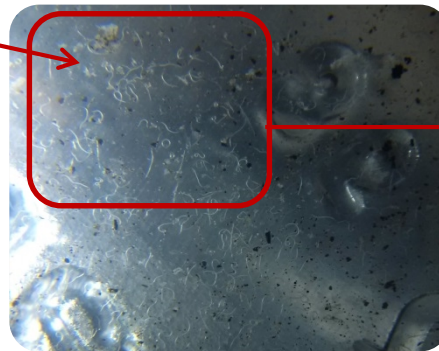
- 3.1 Take a clear plastic glass and cut it about 2 cm from the bottom with scissors.
- 3.2 Stir the remaining liquid and pour it into the bottom of the glass. Wait few minutes for the nematodes to settle.
- 3.3 Put the glass on an aluminium foil, this will allow a better reflection of the light for the observation of the nematodes.

*A black background can also be used.
(paper or cardboard)

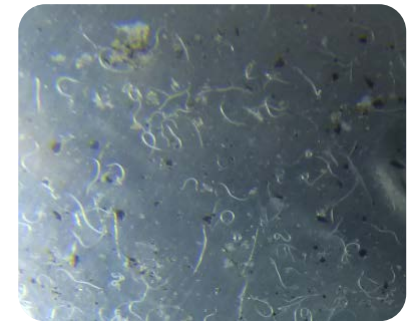


Observation with 40X magnifier

- Turn on the light under the magnifier and get closer to the surface of the liquid to observe the nematodes. Your eye must also be very close to the magnifier.
- You will see small lines or white curves, these are the stem and bulb nematodes !



View with 40 X magnifier



* A certain proportion of the nematodes will move, the dead ones will look like sticks (small straight lines). If the cloves have been cut, most will have died from exposure to allicin.

Observation with a cell phone

- Install the 10 X lens on the camera of your phone.
- Turn on the camera and observe the nematodes directly with your phone.
- The magnification of your camera could be sufficient to observe the nematodes without the addition of a lens.



Observation with a digital microscope

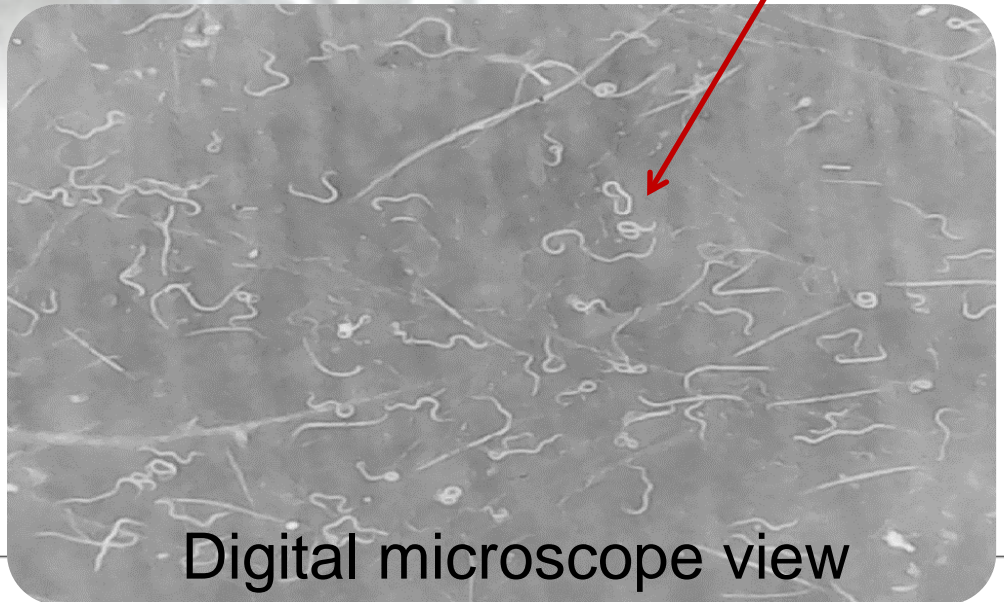
- Follow the manufacturer's instructions to install the software on your computer or phone.
- As soon as you plug the microscope into a computer or phone, the light should turn on.
- Remove the protective cover on the lens and bring the tip as close to the liquid as possible.
- Adjust the focus by turning the silver wheel in the center of the microscope and/or the distance between the microscope and the liquid surface.



View of nematodes under microscope



**Nematodes =
Small white
worms**



Digital microscope view



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Recommendations

- If find nematodes in your garlic, it should not be replanted or sold as seed cloves... but it can be consumed without problems, these nematodes are completely harmless to humans.
- The best ways to manage this nematode are:
 - Use cloves free of nematodes
 - Plant in a soil free of nematodes
 - Do not leave plant residues (stems and leaves) in the field after harvest
 - Implement crop rotation with non-host plants such as: carrot, lettuce, alfalfa, corn, mustard, barley, soybean...





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