A1821

Stubby Root Nematode and Sampling in Sugar Beet

Mohamed F.R. Khan, Professor and Extension Specialist, North Dakota State University and University of Minnesota

Sahar Arabiat, Research Associate, North Dakota State University

Guiping Yan, Assistant Professor, North Dakota State University

Ashok K. Chanda, Assistant Professor, University of Minnesota

Stubby root nematode (SRN) represents an economically important group of nematodes belonging to the genera *Trichodorus* and *Paratrichodorus*. SRN often are found in light (sandy) soils and are more problematic when cool, wet soil conditions exist. For example, yield losses as high as 50 percent can be observed in cool and wet growing seasons.

Traditionally, SRN has been a threat to sugar beet production in Europe, California and Idaho. In 2015, SRN (*Paratrichodorus allius*) was detected in Clay County, Minn. (Figures 1 and 2). Given the threat of SRN, understanding the identification and management of this nematode is important.

Figure 1. Stubby root nematodes were found in a sugar beet field in Minnesota (A) with stunted plants and small roots (B). (*Mohamed F.R. Khan, NDSU and University of Minnesota*)

University of Minnesota Extension

NDSU Extension Service

North Dakota State University
November 2016

Symptoms and Signs

Above-ground symptoms may include poor growth, mild yellowing, interveinal chlorosis and stunted plants. Field symptoms often are observed in patches (Figure 1 – foreground). At the seedling stage, SRN destroys the tip of the tap root, and lateral roots become thick and brown, and some die. Surviving tap roots can be reduced in size and have abnormal branched lateral roots (Figure 3).

Life Cycle and Survival

Stubby root nematode is a migratory ectoparasite that feeds on epidermal root cells. The life cycle includes eggs, juveniles and adults. All juvenile and adult stages are wormlike and found in the soil (Figure 4).

SRN has four larval stages (juvenile 1-4) that resemble the adult stage. Its population increases rapidly when hosts are available and declines rapidly in the absences of the host.

SRN completes its life cycle in three to seven weeks, depending on the soil temperature, and has several generations per year. The optimum temperature for development and reproduction is 69 to 75 F. SRN overwinters by migrating deep in the soil.

Host Range and Spread

Stubby root nematode has a wide host range, including cereals, potato, sugar beet, corn, onion, avocado, lemon, grapevine, olive and apple. SRN typically migrates vertically in soil and can be found at soil depths of 24 inches. SRN can spread from field to field in soil that adheres to machines, animals and workers, and also by wind and flowing water.

Management

All efforts should be made to prevent or delay the introduction of SRN into areas where it has not been reported. **Avoid** the use of machinery and equipment from areas with known SRN problems, and thoroughly **wash** used machinery and equipment if coming from areas with SRN problems. Use proper **sanitation/sterilization** measures after visiting areas with known SRN problems.

Crop rotation is not effective because of the wide host range. **Nematicides** are available but difficult to apply and are uneconomical. Sugar beet varieties with resistance to *P. allius* are being identified.

Figure 2. No stubby root nematode was found in the same sugar beet field (A) with healthy plants and large roots (B). (*Mohamed F.R. Khan, NDSU and University of Minnesota*)

Figure 3. Smaller tap root with profuse lateral branching symptoms caused by nematode infection in Sweden. (Asa Olsson, Nordic Beet Research)

Figure 4. The vermiform stubby root nematode *Paratrichodorus allius* isolated from the infested sugar beet field in Minnesota, showing entire nematode body with its characteristic "spear" stylet. (*Guiping Yan, NDSU*)

Sampling and Diagnosis

Sampling time is critical for determining SRN population density. The nematode population can increase or decline rapidly in the presence or absence of a host. The best time for sampling is at harvest, when the nematode is at a high population density and the result from sampling will help management decisions for the following season. The best methods to sample for SRN are as follows:

- Use a zig-zag pattern.
- Divide the field into subdivisions based on variations in crop growth, soil texture, moisture and draining patterns.
- Remove the upper 2 inches of soil before taking the soil cores to a depth of 12 to 20 inches because nematodes may not survive in the upper 1 to 2 inches of soil due to hot or freezing temperatures.
- Take soil cores from the plant root zone. Take soil and plant samples from affected and unaffected areas for comparison.
- Bulk soil cores in a clean bucket, mix, place 1 quart of the mixture in a strong moisture-retaining bag and label clearly. Include sampling date, grower's name, location, soil type, symptoms, variety, cropping history and any nematicide used. One sample is a composite of multiple soil cores, with a minimum of three cores per acre.
- Store samples at 50 to 55 F and away from direct sunlight to keep the nematodes alive.
- Send samples to the Nematology Laboratory, Plant Pathology Department, North Dakota State University, Walster Hall 322, Fargo, ND 58108-6050.
- The nematode population density, expressed as nematode number per 100 centimeters^3 of soil, will be reported.

References

Agrios, G.N. Plant disease caused by nematodes, in *Plant Pathology*, ed. Agrios, G.N. Elsevier Academic Press, USA. pp 863-864 (2005).

Ayala, A., Allen, M.W., and Noffsinger, E.M. Host range, biology, and factors affecting survival and reproduction of the stubby root nematode. *Journal of Agriculture of the University of Puerto Rico*. 54, 341-369 (1970).

Franc, G.D., Harveson, R.M., Kerr, E.D., and Jacobsen, B.J. Disease management. in *Sugar Beet Production Guide*, ed. by Wilson, R.G. University of Nebraska, USA. pp 131-160 (2001).

Gray, F.A. Sugar beet cyst nematode. in *Compendium of Beet Diseases and Pests*, eds. Harveson, R.M., Hanson, L.E., and Hein, G.L. APS press, USA. pp 70-71 (2009)

Hafez, S. Sampling procedure to diagnose nematode infestations. CIS 1056. University of Idaho, USA. (1997).

Hafez, S. Sugar beet nematodes in Idaho and eastern Oregon. CIS 1072. University of Idaho, USA. (1998).

Ingham, R.E., Hamm, P.B., Williams, R.E., and Swanson, W.H. Control of *Paratrichodorus allius* and corky ringspot disease of potato in the Columbia Basin of Oregon. *Supplement of the Journal of Nematology*. 32, 566-575 (2000)

Mojtahedi, H., and Santo, G.S. Ecology of *Paratrichodorus allius* and its relationship to the corky ring-spot disease of potato in the Pacific Northwest. *American Journal of Potato Research*. 76, 273-280 (1999).

Yan, G.P., Khan, M., Huang, D., Lai, X., and Handoo, Z.A. 2016. First report of the stubby root nematode *Paratrichodorus allius* on sugar beet in Minnesota. *Plant Disease* 100: 1022. (http://dx.doi.org/10.1094/PDIS-10-15-1231-PDN).

For more information on this and other topics, see **www.ag.ndsu.edu**