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THE COLUMBIA ROOT-KNOT NEMATODE PROBLEM[1]

The Problem

Gordon Powell, program officer of Import and Export Surveys of Agriculture Canada, confirmed that a ban on seed potatoes from Washington state became effective December 1, 1981..."There will be additional regulations concerning other types of plants -logs, vegetable transplants, nursery stock," Powell stated. "These will be developed and published by February 1, 1982"(1). And, **as of October 1982, the regulations will require that all production areas be officially surveyed (2). The action is being taken by Canada to protect its growers from the Columbia root-knot nematode, which according to Powell (1) is not found in Canada at this time.** (See Figure 1, 'survey map').

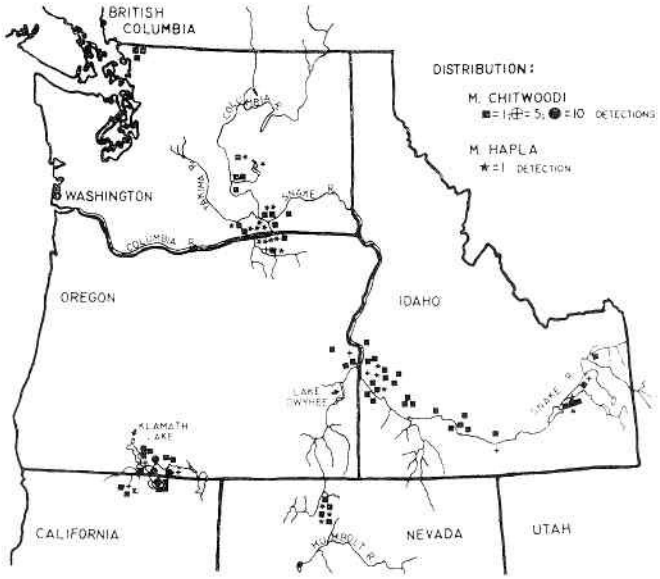

Figure 1. Map showing incidence of Columbia root-knot nematode within the limited survey region. Note, survey did not extend into Canada but did extend to the common border between Washington and British Columbia. (Courtesy of John H. O'Bannon, A.P. Nyczepir, and G. Santo -map currently in press, Journal of Nematology).

According to Powell, field-grown plants from an area free of Columbia root-knot nematode will be admissible. Non-host, preshipment washed, bare-root plants from areas that might be quarantined or regulated would likely be admissible. To determine if economically important

woody ornamentals are hosts of the Columbia root-knot nematode, Dr. Gerry Santo (Associate Nematologist, Washington State University Research and Extension Center, Prosser, Washington) is currently screening a wide range of woody ornamental plants. (2).

Recent "Headlines" and News Stories

Maine Protests Canadian Spud Imports

"Since more than 60 percent of Canada's potatoes are grown in the eastern provinces of New Brunswick, Prince Edward Island, Nova Scotia and Quebec, about 90 percent of the Canadian imports enter the U.S. through Maine ... Maine has enacted legislation to control the quality of seed entering the state." (7).

Border Battle Rages...

"Maine's seed regulations include strict measures to stop spread of diseases such **as golden nematode, root knot nematode,** and bacterial ring rot ... Canadian statements described stringent controls on these diseases within Canada, including assertions that golden nematode is confined to the islands of Vancouver and Newfoundland." (5)

"Maine may have sounded like a voice in the wilderness as the state protested the importation of Canadian potatoes last year, **but the scope of the problem has grown, as it begins to affect other states and other industries."** (6).

Legal Threat

"...the fear is that Canada will retaliate against U.S. exports going north ... the repercussions (of the Maine ruling) could be 'very unfortunate'. (4).

Columbia Root-Knot Nematode in the Pacific Northwest (3)

Many species of nematodes are harmless or even beneficial. The several species of *Meloidogyne,* however, make up the most important and destructive group of plant parasitic nematodes.

Symptoms on the plant above ground, though not distinct, resemble drought injury or nutrient deficiency. Below ground, characteristic knots or galls are formed in the roots by the feeding of the root-knot nematodes. After the plant is weakened, secondary pathogens may cause root rotting. Infestations reduce quality and yields unless controls are used.

Until recently, only three species of *Meloidogyne* were known to be important in the Pacific Northwest. They were the Northern root-knot nematode (*Meloidogyne hapla*), Southern root-knot nematode (*Meloidogyne incognita*), and the Barley root-knot nematode (*Meloidogyne naasi*). In 1978, a fourth root-knot nematode was discovered parasitizing potatoes in Washington and Idaho. It was named *Meloidogyne chitwoodi* and is more commonly referred to as the Columbia root-knot nematode, since it was initially identified in the Columbia River drainage.

Distribution

Limited surveys have found the Columbia root-knot nematode to be locally distributed in Washington, Idaho, Oregon, California and Nevada (see Figure 1, map showing incidence of Columbia root-knot nematode in the limited region surveyed by U.S. nematologists. Note, their survey did not extend into Canada, but did extend to the border between Washington and British Columbia).

Habitat

Temperature affects species distribution. The relatively cool climate of the Pacific Northwest favors the Columbia root-knot nematode.

Life Cycle

The life cycle of all root-knot nematodes is similar. Eggs, produced the previous season, hatch when soils warm. Some may hatch before hosts are available. Or, infective second-stage juveniles may later emerge from eggs and penetrate the growing root tips of host plants. Root-knot nematode invasions may stimulate almost immediate gall formation on the roots, making them appear swollen and knotted. However, it should be noted that the Columbia root-knot nematode rarely produces large galls on the majority of known host plants. The worm-like juveniles migrate through the root tissues and select a permanent feeding site in the vascular tissues, which conduct food and water. They trigger the formation of specialized giant cells in the vascular system, enlarge, become immobile, and undergo three additional molts. At the end of the final molt, mating occurs. The female continues to feed from the giant plant cells surrounding its head. Females produce an average of 300 eggs, deposited in a protective jelly-like sac at the root surface of most hosts. The life cycle generally takes about 30 days, depending upon the host and environmental conditions.

Soil temperatures greatly influence the reproduction of the Columbia root-knot nematode. It reproduces best at lower soil temperatures, 60-75 degrees Fahrenheit.

Hosts

Reported hosts to date for the Columbia root-knot nematode are herbaceous plants. Potato, sugarbeet, tomato, grass crops (corn, wheat, barley and oats) and weeds (dandelion, nightshade, barnyard-grass, shepherdspurse, red and meadow fescues, smooth brome, orchardgrass, and Russian thistle) are hosts for the Columbia root-knot nematode.

Dr. Gerry Santo is currently screening a wide range of woody ornamentals to determine if they are included in the host range of the Columbia root-knot nematode.

How Nematodes Spread

Root-knot nematodes are spread by irrigation water, soil on farm equipment and by infected plant material, such as potato tubers. Precautions should be taken to avoid contamination because it is extremely difficult to eliminate nematodes from fields after they have been contaminated.

Controls

Crop rotation, chemical control, sanitation, and resistant varieties (where available) are important control practices to limit nematode damage.

Crop rotations with nonhost crops are frequently used to control nematodes. A rotation without potatoes or other susceptible hosts including weeds for four or more years will reduce levels of root-knot nematodes. Therefore, managing weeds and volunteer host plants is essential. It should be noted that while crop rotations with corn and small grains reduce the levels of most Northern root-knot nematodes, rotations with corn and small grains favor the increase of Columbia root-knot nematode. On-the-other-hand, rotations with alfalfa reduce the level of Columbia root-knot nematodes, but favor increase of the Northern root-knot nematodes. Both Columbia and Northern root-knot nematodes can occur in the same field which results in a "catch 22" situation with regard to crop rotation. Host range studies are being conducted to determine which crops could be grown in rotation when this infrequent double infestation occurs.

Fall fumigation controls Columbia root-knot nematodes; however; spring fumigation does not always effectively reduce Columbia root-knot nematode populations. Disease history, cropping sequence, and soil sampling to determine nematode populations and types will help determine practical control methods. Tillage prior to fall fumigation helps break down hardpans, clods, and organic debris, increasing the distribution of the fumigant in the soil and improving control. Fumigation in the fall after fallow or a non-susceptible crop will effectively reduce nematode levels.

Sanitation may prevent the spread of nematodes from infested to noninfested fields. Precautions should be taken to avoid moving infested soil or "tail water" to non-infested fields. Infected plants and plant parts may spread nematodes. Volunteer host plants, including weeds, may be a reservoir for nematodes in years and areas where deep frosts do not occur.

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[1](This report is a compilation of information from the trade magazines and ROOT-KNOT NEMATODES OF THE PACIFIC NORTHWEST, a Pacific Northwest Cooperative Extension Publication -PNW Bulletin 190).
