ROOT-PARASITIC NEMATODE HOST RANGE AND DAMAGE LEVELS

ON OREGON VEGETABLE CROPS:

A LITERATURE SURVEY.

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Damage Levels: An Introduction

How many plant-parasitic nematodes will damage a particular plant species? This is the most frequently asked question of the Nematode Testing Service at Oregon State University. This literature survey is an attempt to answer that question for vegetable crops grown in the Pacific northwest. Non-quantitative host range information is also included to facilitate control through crop rotation: if remaining volunteers are hosts to a plant-parasitic nematode species, the nematode population can be maintained in the volunteers even if the crop itself is not a host.

Host plants are listed alphabetically by host genus. If you don't know the Latin name of the plant you are looking for, use the translation list below, which is alphabetized by common name. To search this unadorned yet informative text file on the computer, use the "search" or "find" function on your word processor or the "find in file" function on your web browser to find the plant by Latin or common name.

Most information listed below is from replicated studies or systematic surveys. Studies conducted in pots are indicated. Study conditions may deviate from local conditions in soil type, climate, moisture, and other factors. Cultivars often vary in susceptibility to parasitic nematode damage and in the number of plant-parasitic nematodes they will support.

Numbers of most plant-parasitic nematodes vary seasonally. In many of these studies, the season at which samples were taken is not indicated. In some, however, nematode numbers are designated as initial or final levels.

These studies report levels at which damage has occurred rather than predict damage that will occur. Therefore, these data are presented only as statements of nematode levels at which damage occured.

If a particular crop is not included in the list, no information has been found for that crop. If a nematode species of concern is not listed under a particular crop, no information has been found on the species for that crop. A lack of information does not imply a lack of damage.

Nematode damage numbers in this survey are expressed in this survey as nematodes/100 grams (g) soil or number of nematodes/100 cubic centimeters (cm3 or cc) soil. Numbers/100 g soil may be multiplied by 20 to give the number of nematodes/2000 g soil (traditionally designated by the OSU Nematode Testing Lab as one "quart"). Nematode numbers from the OSU Nematology Lab are reported as number/100 g and are corrected for soil moisture.

Nematode numbers/100 cm3 soil can provide a rough estimate of numbers/100 g soil corrected for dry weight but should be divided by the soil bulk density for accuracy. Bulk densities of clay, clay loam, and silt loam surface soils range from about 1.0 to 1.6 g/cm3, and those of sands and sandy loams range from about 1.2 to 1.8 g/cm3 (Buckman and Brady 1969). However, the bulk density of the sample actually processed is dependent upon packing density during measurement. Since bulk densities are not frequently reported in studies in which nematode numbers are expressed on a volume basis, accurate conversion of numbers/100 cm3 to numbers/100 grams soil is not usually possible. Nevertheless, since the variation associated with bulk density conversions is generally less than the

variation associated with field sampling, numbers/100 cm3 soil provide an acceptable approximation of numbers/100 g soil for making management decisions.

Host designations based on gall ratings: These designations apply only to *Meloidogyne.* A rating of "1" = no galls (resistant); "2" = 1 to 10 galls; "3" = 11 to 100 galls; "4" = more than 100 galls (susceptibile) (LaMondia 1995, LaMondia 1996).

Host designations based on Reproductive factor (Rf). Rf = final population/initial population. An Rf of over 10 indicates an excellent host; an Rf of 1 to 10 indicates a good host; an Rf of about 1 indicates a maintenance host; and an Rf of between 1 and 0 indicates a poor host or nonhost (Ferris et al. 1993).

Host designations based on number of plants infected compared to number of plants inoculated. This is expressed as a fraction. If 10 plants were inoculated and 5 were infected, then 5/10 inoculated plants were infected (Faulkner and McElroy 1964).

COMMON TO LATIN NAME TRANSLATION LIST:

VEGETABLE SPECIES LISTED BY COMMON NAME

FOLLOWED BY LATIN BINOMIAL

Asparagus: ***Asparagus officianalis***

Bean: broad, common, field, or faba**:** ***Vicia faba***

Bean, green or snap: ***Phaseolus vulgaris***

Bean, Lima: ***Phaseolus limensis***

Bean, scarlet runner: ***Phaseolus coccineus***

Beet, fodder: ***Beta vulgaris*** ssp**.** ***vulgaris***

Beet, table: ***Beta vulgaris*** ssp**.** ***vulgaris***

Broccoli: ***Brassica oloracea*** var**.** ***botrytis***

Broccoli, sprouting: ***Brassica oloracea var. italica***

Brussels sprouts: ***Brassica oloracea*** var**.** ***gemmifera***

Cabbage: ***Brassica oloracea*** var**.** ***capitata***

Cabbage, chinese: ***Brassica*** *chinensis,* pekinensis group; = *B. pekinensis.*

Calabrese: ***Brassica oloracea*** var**.** ***italica***

Cantaloupe: ***Cucumis melo***

Carrot: ***Daucus carota***

Cauliflower: ***Brassica oleracea*** var. ***botrytis***

Celery: ***Apium graviolens***

Chard: ***Beta vulgaris ssp. cicla***

Chinese cabbage: ***Brassica*** *chinensis*, pekinensis group; = *B. pekinensis*.

Cole crops: ***Brassica oloracea****;* cultivar unspecified**; *Brassica oloracea*:** all varieties.

Corn, sweet: ***Zea mays***

Cucumber: ***Cucumis sativus***

Dandelion: ***Taraxacum officianale***

Dill: ***Anethum graveolens***

Eggplant: ***Solanum melongena***

Garlic: ***Allium sativum***; see also *Allium* spp.

Kale: ***Brassica oloracea*** var. ***acephala***

Kohlrabi: ***Brassica oloracea*** var. ***gongylodes***

Leek: ***Allium ampeloprasum***, ***Porro*** group; see also *Allium* spp.

Lettuce: ***Lactuca sativa***

Melon, musk: ***Cucumis melo***

Melon, water: ***Citrellus vulgaris***

Muskmelon: ***Cucumis melo***

Onion: ***Allium cepa***; see also *Allium* spp.

Parsley: ***Petroselinum crispum***

Parsnip: ***Pastinaca sativa***

Pea, edible pod: ***Pisum sativum*** var. ***macrocarpum***

Pea, garden: ***Pisum sativum***

Pea, unspecified: ***Pisum*** spp.

Pepper: ***Capsicum annuum*** var. ***annuum; = C. frutescens***

Potato: ***Solanum tuberosum***

Pumpkin (taxonomy unclear): ***Cucurbita pepo; C. maxima***

Pumpkin, non-keeping: (taxonomy unclear): ***Cucurbita pepo***

Radish: ***Raphanus sativus***

Rhubarb: ***Rheum* X *cultorum* (=? *R. rhaponticum***, ancestral form**)**

Rutabaga: *Brassica napus*, *napobrassica* group (= ***Brassica rapa*** ssp ***napobrassica and B. napobrassica***

Salsify: ***Tragopogon porrifolium***

Spinach: ***Spinacea oloracea; Spinacia*** spp.

Squash, autumn (taxonomy unclear): ***Cucurbita pepo***

Squash, summer (taxonomy unclear): ***Cucurbita pepo***

Squash, winter (taxonomy unclear): ***Cucurbita maxima***

Squash, some winter varieties: (taxonomy unclear) ***Cucurbita pepo***

Sweet corn: ***Zea mays***

Tomato: ***Lycopersicon esculentum***

Turnip: ***Brassica rapa*** ssp ***rapifera***

Vegetable oyster: ***Tragopogon porrifolium***

Watermelon: ***Citrellus vulgaris***

Zucchini: (taxonomy unclear) ***Cucurbita pepo***

PLANT-PARASITIC NEMATODE

HOST RANGES AND DAMAGE LEVELS

ON VEGETABLE CROPS

***Allium ampeloprasum* Porro group (leek)**

Meloidogyne hapla

In pots, moderately susceptible (Gaskin and Crittenden 1956).

***Allium cepa* (onion)**

Meloidogyne chitwoodi

In pots, Carmen, Cima, Granada, Magnum, Rocket, Vega, Yula were non-hosts (Rf = Rf 0.0 to 0.1) for Race 2 (alfalfa race), and Snow White and Walla Walla Sweet were poor hosts (Rf = 0.2) for race 2, and all these varieties are non-hosts for race 1 (non-alfalfa race). Carmen, Cima, Granada, Magnum, Rocket, Snow White, Vega, Walla Walla Sweet, and Yula were non-hosts (Rf = 0.0 to 0.07) for race 1 (Mojtahedi et al. 1988).

In pots, cv. Rocket: trace reproduction, very poor host; cv. Walla Walla Sweet: light reproduction, poor host (O'Bannon et al. 1984).

Meloidogyne hapla

200 J2/100 g soil (Barker and Olthof 1976; Potter and Olthof 1993).

In microplots, marketable yields of Canada No 1 Copper Gem bulbs 5 cm and larger were reduced 31% by 200/100 g soil, 72% by 600/100 g soil, and 64% by 1800/100 g soil. A progressive decrease in the number of marketable bulbs and an increase in numbers of unmarketable culls was correlated with these reductions (Olthof and Potter 1972).

64% reduction by unspecified level (Williams 1974).

In organic soil, yield was reduced by 23% when percent infection of indicator plants increased from 5.1 to 93.2 (Wilson 1957, cited in Wong and Mai 1973).

Extrapolation indicated that economic loss (5% or more of marketable yield) would occur at preplant density of 100/100 g soil (Olthof and Potter 1971).

In pots, South Port White Globe was slightly susceptible, and 25/46 inoculated plants were infected. White Bunching was not susceptible, and 0/52 inoculated plants were infected (Faulkner and McElroy 1964).

Southport White Globe was infected (Raski 1957). *Meloidogyne naasi.*

Damages onion seedlings (Franklin 1973).

Sweet Spanish is a host (Radewald et al. 1970).

Meloidogyne thamsei

Host; reported in Nevada (Norton et al. 1984).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

At 7-13o C, < 100/g root caused significant root weight reduction, but > 400 were required to produce injury at 16-25o C (Ferris 1970).

Losses in marketable yields ranged from 14% at 67/100 g soil to 71% at 1800/100 g soil (Olthof and Potter 1973).

100/100 g soil (Barker *et al.* 1976; Potter and Olthof 1993).

Cultivars vary in susceptibility, and wild *Allium canadense* may be more resistant (Ferris 1970).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973) and Egypt (Fortuner 1977).

Pratylenchus thornei

Host in California and Egypt (Fortuner 1977, Siddiqui et al 1973).

Xiphinema americanum

Host in California (Siddiqui et al. 1973).

***Allium sativum* (garlic)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Meloidogyne hapla

In pot trials, garlic was not infected (Raski 1957).

Xiphinema americanum

Host in commercial crops and nursery in California (Siddiqui et al. 1973).

***Allium* spp.**

Mesocriconema xenoplax

Associated with roots (Kleynhans et al. 1996).

***Anethum graveolens* (dill)**

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 110-220/g root, 30% height reduction, and moderately severe necrosis after three weeks (Miller 1978).

***Apium graviolens* (celery)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus thornei

Found in California in plants that were weeds in nurseries (Siddiqui et al. 1973).

Meloidogyne hapla

In organic soil, yield was reducte by 20% when percent infection of indicator plants increased from 5.1 to 93.2 (Wilson 1957, cited in Wong and Mai 1973).

Seedlings inoculated with 10,000 eggs developed severe galling and root necrosis (Starr and Mai 1975).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

In pots, fresh weight was decreased 31, 48, and 83% by 61, 313, and 1565 *P. penetrans*/100 cm3 soil (Towhshend 1962).

***Asparagus officianalis* (asparagus)**

Longidorus elongatus

Associated (Norton et al. 1984). *Meloidogynechitwoodi*

In pots, Mary Washington was a non-host (Rf = 0) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

Mary Washington in pots: no reproduction: non-host (O'Bannon et al. 1984).

Meloidogyne hapla

Did not reproduce on Pedigreed Washington or Mary Washington (Dudash and Barker 1992)

In pots, Mary Washington and Washington Rust Resistant were not susceptible, and none of the three plants of each cultivar inoculated were infected (Faulkner and McElroy 1964).

In pots, not susceptible (Gaskin and Crittenden 1956).

Pratylenchus crenatus:

Asparagus is a host for *P. crenatus;* pathogenicity is unknown (Potter and Olthof 1993).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

Asparagus is a non-host for *P. penetrans* (Potter and Olthof 1993).

In pots, initial populations of 45/100 g soil resulted in 0/ g root, 0% height reduction, and very little necrosis after three weeks (Miller 1978).

Host in California (Siddiqui et al 1973).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

***Beta vulgaris* ssp. *cicla* (chard)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Meloidogynehapla

In pots, "Lucilllus" and "Rubcoa" were lightly susceptibile (Gaskin and Crittenden 1956).

***Beta vulgaris* ssp. *vulgaris* (fodder beet)**

Meloidogyne chitwoodi.

In pots, moderate reproduction: moderate host (O'Bannon et al. 1984).

***Beta vulgaris* ssp. *vulgaris* (table beet)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Heterodera trifolii

Host in California (Siddiqui et al. 1973)

Longidorus elongatus

Has been severely damaged in England (Hooper 1973).

Host (Norton et al. 1984).

Meloidogynechitwoodi.

In pots, poor host (RF = 0.4) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

Meloidogyne hapla

In microplots, marketable weight of Detroit Dark Red was significantly reduced 22% by the initial population of 1800/100g soil but not by lower populatons. Total weight of beet tops was reduced at 67 and 200/100g soil (Potter and Olthof 1974).

600 to 1800 J2/100 g soil (Barker and Olthof 1976; Potter and Olthof 1993).

In pots, Detroit Dark Red slightly susceptible and 8/10 plants infected (Faulkner and McElroy 1964).

In pots, "Early Blood" is lightly susceptibile (Gaskin and Crittenden 1956).

Meloidogyne naasi.

Damages table beets (Franklin 1973).

Pratylenchus crenatus:

Host in California (Norton et al. 1984).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Causes moderate damage (Potter and Olthof 1993).

Pratylenchus penetrans:

1800/100 cm3 soil reduced fall yield by 27%; beet is recommended as a fall-maturing crop in soils with up to 600/100 g soil (Potter and Olthof 1974).

600-1800/100 g soil (Barker *et al.* 1976).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

Xiphinema americanum

Host in commercial crops and urban areas in California (Siddiqui et al. 1973).

***Brassica chinensis,* pekinensis group (= *B.pekinensis;* Chinese cabbage)**

Meloidogyne hapla

In pots, cv. "Rhubarb moderately susceptible; 2/2 plants infected (Faulkner and McElroy 1964).

In pots, "Wong Bok" and "Chihli" were lightly susceptibile (Gaskin and Crittenden 1956).

***Brassica napobrassica (= Brassica rapa* ssp *napobrassica;* rutabaga)**

Meloidogyne hapla

In pots, American Purple was moderately susceptible, and 24/24 inoculated plants were infected (Faulkner and McElvoy 1964).

In pots, Sweet Russian and American purple top were lightly susceptible (Gaskin and Crittenden 1956).

Pratylenchus neglectus

Recovered from soil in which turnips and rutabagas had been grown (Merrifield 1998).

***Brassica oloracea* : all varieties**

Heterodera schachtii

Hosts (Franklin 1972).

***Brassica oloracea* var. *acephala* (kale)**

Heterodera schachtii

Preferred over several weeds (Bendixen et al. 1979)

Meloidogyne hapla

In pots, Tall Green Curled Scotch was severely susceptibile; Dward Siberian (sprouts) was lightly susceptibile, and Dwarf Green Scotch and Dwarf Blue Scotch were moderately susceptible (Gaskin and Crittenden 1956).

***Brassica oloracea* var. *botrytis* (Broccoli)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Associated in West Virginia (Norton et al. 1984)

Xiphinema bakeri

On cv. Rex in pots, 123/100 cm3 resulted in light damage and -85 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

***Brassica oleracea* var. *botrytis* (cauliflower)**

Meloidogyne hapla

600 J2/100 g soil (Potter and Olthof 1993).

In microplots, Igloo marketable yields were reduced 11% by 600/100g soil and 24% by 1800/100 g soil, and curd maturity was delayed 3 days by 1800/100 g soil (Potter and Olthof 1974).

Extrapolation indicated that economic loss (5% or more of marketable yield) would occur at preplant density of 5000-5500/kg soil (Olthof and Potter 1971).

600 J2/100 g soil (Barker and Olthof 1976).

In pots, Snowball and Super Snowball were lightly susceptible (Gaskin and Crittenden 1956).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

Losses in marketable yields ranged from 19% at 67/100 cm3 soil to 59% at 1800/100 cm3 soil (Olthof and Potter 1973).

200 to 600/100 g soil (Barker *et al.* 1976; Potter and Olthof 1993).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

Xiphinema americanum

Recorded as a host in California (Siddiqui et al. 1973).

Xiphinema bakeri

In pots, 123/100 cm3 resulted in light damage and -92 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

***Brassica oloracea* var. *capitata* (cabbage)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Associated in Wisconsin, Hew York, and California (Norton et al. 1984)

Meloidogyne hapla

1800 J2/100 g soil (Potter and Olthof 1993).

In microplots, marketable yields of Market Prize were reduced 9% by 1800/100g soil but not by lower populations (Potter and Olthof 1974).

Extrapolation indicated that economic loss (5% or more of marketable yield) would occur at preplant density of 1500/100 g soil (Olthof and Potter 1971).

In pots, 27 cultivars were lightly to moderately susceptible (Gaskin and Crittenden 1956).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

Losses in marketable yields ranged from 17% at 67/100 g to 25% at 1800/100 g soil (Olthof and Potter 1973).

200 to 600/100 g soil (Barker *et al.* 1976; Potter and Olthof 1993).

In pots, initial populations of 45/100 g soil resulted in 180-360 g root, 22% height reduction, and moderate necrosis after three weeks (Miller 1978).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

Xiphinema americanum

In pots, 169 days after inoculation with 72/100 g soil, the final population was 16/100 g soil (Miller 1980).

Xiphinema bakeri

In pots, 123/100 cm3 resulted in light damage and -30 % population increase (i.e., decrease) on Flat Dutch after 12 weeks (McElroy 1972).

***Brassica oloracea* var. *gemmifera* (Brussels sprouts)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Associated in California (Norton et al. 1984).

Meloidogyne hapla

In pots, Long Island Improved was moderately susceptible (Gaskin and Crittenden 1956).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 260-520/g root, 42% height reduction, and severe necrosis after three weeks (Miller 1978).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

Xiphinema americanum

Host in a commercial crop in California (Siddiqui et al. 1973).

Xiphinema bakeri

In pots, 123/100 cm3 resulted in light damage and -56 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

***Brassica oloracea* var. *gongylodes* (kohlrabi)**

Meloidogyne hapla

In pots, Purple Vienna is moderately susceptible, and White Vienna is lightly susceptible (Gaskin and Crittenden 1956).

Heterodera schachtii

Preferred over several weeds (Bendixen et al. 1979)

***Brassica oloracea var. italica* (sprouting broccoli including calabrese)**

Meloidogyne hapla

In pots, DeCicco, Grand Central and K & V were lightly susceptible. Texas 107 is moderately susceptible (Gaskin and Crittenden 1956).

***Brassica oloracea;* cultivar unspecified**

Longidorus elongatus

Associated (Norton et al. 1984).

***Brassica rapa* ssp *rapifera* (turnip)**

Meloidogyne chitwoodi

In pots, "Nerus" was a non-host (Rf = 0) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

In pots, cvs. Barive and Purpletop: moderate reproduction: moderate hosts (O'Bannon et al. 1984).

Meloidogyne hapla

In pots, Purpletop was moderately susceptible, and 4/4 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, light susceptibility: Cowhorn, Pomeranian white globe, Shogoin, white flat Dutch; moderately susceptible: amber globe, solden ball, purple top milan, purple top strap, purple top white, yellow Aberdeen purple top; severely susceptible: white Milan (Gaskin and Crittenden 1956).

Pratylenchus neglectus

Recovered from soil in which turnips and rutabagas had been grown (Merrifield 1998).

Xiphinema bakeri

On Aberdeen Yellow in pots, 123/100 cm3 resulted in light damage and -3 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

***Capsicum annuum* var. *annuum; = C. frutescens* (pepper)**

Meloidogyne chitwoodi

In pots, California Wonder was a non-host (Rf = < 0.1) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

California Wonder in pots: no reproduction, non-host (O'Bannon et al. 1984).

In pots, Rf of 0 on California Wonder from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

Meloidogyne hapla

In pots, Hungarian Purple Wax was not susceptible, and 0/2 inoculated plants were infected. California Wonder, Chili, Hungarian Yellow Wax, and World Beater were slightly susceptible, and from 60 to 100% of inoculated plants were infected. Anaheim and Mexican Chili were moderately susceptible, and all inoculated plants were infected (Faulkner and McElroy 1964).

In pots, World Beater was severely susceptible (Gaskin and Crittenden 1956).

In pots, Rf of 2.1 on California Wonder from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

In pots, 20/100 cm3 soil decreased top dry weights by 35% and root dry weights by 33% (Shafiee and Jenkins 1963).

Pratylenchus neglectusF

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

"California Wonder": In pots, 625/100 cm3 soil reduced top fresh weight by 84% and root fresh weight by 87% (Shafiee and Jenkins 1963).

In pots, initial populations of 45/100 g soil resulted in 40-80/g root, 8% height reduction, and severe necrosis after three weeks (Miller 1978).

"All Big": In pots, initial populations of 45/100 g soil resulted in 150-300/g root, 33% height reduction, and severe necrosis after three weeks (Miller 1978).

"Italian Sweet: In pots, initial populations of 45/100 g soil resulted in 40-80/g root, 8% height reduction, and severe necrosis after three weeks (Miller 1978).

"Sweet Banana": In pots, initial populations of 45/100 g soil resulted in 180-360/g root, 8% height reduction, and severe necrosis after three weeks (Miller 1978).

In pots, 1000/100 cm3 soil reduced top dry weights by 85% and roots by 91%. Foliar necrosis occurred, leaves were smaller and fewer, and fruit did not set during the 10 week trial (Shafiee and Jenkins 1963).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

Recorded (Kleynhans 1966).

Xiphinema americanum

Host in commercial crops in California (Siddiqui et al. 1973). *Xiphinema index*

Associated (Norton et al. 1984).

***Citrellus vulgaris* (watermelon)**

Meloidogyne chitwoodi

In pots, trace reproduction on cv. "Charleston Gray": very poor host (O'Bannon et al. 1984).

In pots, "Charleston Gray" was a non-host (Rf = < 0.1) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

In pots, Rf of 0 on Charleston Gray from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

Meloidogyne hapla

In pots, Dixie Queen, Klondike, Northern Sweet were slightly susceptible, and from 60 to 100% of inoculated plants were infected. New Hampshire Midget was not susceptibgle, and 5/15 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, 11 cultivars were not to lightly susceptible (Gaskin and Crittenden 1956).

In pots, Rf of 0 on Charleston Gray from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

Does not reproduce on watermelon (Sasser 1966).

In pot trials, Klondike was not infected (Raski 1957)

Meloidogyne naasi

Non-host (Radewald et al. 1970).

Xiphinema americanum

In pots, 169 days after inoculation of Dixie Hybrid Queen with 72/100 g soil, the final population was 0/100 g soil (Miller 1980).

***Cucumis melo* (cantaloupe or muskmelon)**

Meloidogyne hapla

In pots, Imperial 45 was moderately susceptible, and 3/3 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, Hale's Best was severely susceptible (Gaskin and Crittenden 1956).

Meloidogyne naasi

Non-host (Radewald et al. 1970).

Pratylenchus crenatus

Host (Norton et al. 1984).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans

Host in California (Siddiqui et al. 1973).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

***Cucumis sativus* (cucumber)**

Heterodera humulii

Cyst formation, but poor host (Stone and Rowe 1977)

H. humuli multiplied 2 times over 5 months (Sen and Jensen 1969; not yet looked up in library; from CIH Description).

Heterodera trifolii

Root systems were stunted although bearing only 8 to 15 cysts per plant (Mulvey and Anderson 1974)

Meloidogyne hapla

At 345 eggs/100 cm3 2 weeks after planting, after six weeks, five cucumber cultigens had some resistance to *M. hapla;* from 6 to 20% of roots were galled compared to 36 to 96 % by *M. arenaria* and *M. javanica*. From 5 to 305 eggs were recovered from individual root systems, compared to 700 to 69,200 *M. arenaria* and *M. javanica* eggs (Wehner et al. 1991).

Cucumber varieties vary in response to various *M. hapla* populations. In pots at 20oC, 50 times more galls were formed by 1000 *M. hapla* eggs/500 cm3 soil on Rutgers tomato than on National Pickling and Market More cucumbers by Canadian, English, and one American population. In response to a second American population, Rutgers tomato formed 8 times more galls than National Pickling and 82 times more than Market More cucumber. Responses differed at other temperatures (Stephan and Trudgill 1982).

In pots, National Pickling was slightly susceptible, and 3/3 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, Marketeer was severely susceptible, and Santtee lightly susceptible (Gaskin and Crittenden 1956).

Meloidogyne naasi

Non-host (Radewald et al. 1970).

Mesocriconema xenoplax

Densities around National Pickling were no higher than those in fallow treatment: non-host (Lownsbery 1964).

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 630-1260/g root, 40% height reduction, and severe necrosis after three weeks (Miller 1978).

Xiphinema americanum

On National Pickling in pots after 3 months, New York populations declined (Georgi 1988b)

On Burpee's Hybrid in pots, 169 days after inoculation with 72/100 g soil, the final population was 24/100 g soil (Miller 1980).

On National Pickling in pots, population was no higher than fallow check: very poor host or non-host (Lownsbery 1964).

National Pickling is a host (Teliz et al. 1967).

Xiphinema bakeri

On SMR 18 in pots, 123/100 cm3 resulted in light damage and -7 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

On National Pickling in pots, 123/100 cm3 resulted in light damage and -90 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

Xiphinema rivesi

On National Pickling in pots after 3 months, New York populations declined (Georgi 1988b)

***Cucurbita maxima* (winter squash, pumpkin; taxonomy unclear)**

Heterodera trifolii

Root systems were stunted although bearing only 8 to 15 cysts per plant (Mulvey and Anderson 1974)

Meloidogyne hapla

In pots, Hubbard was moderately susceptible (Gaskin and Crittenden 1956).

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 440-880/g root, 17% height reduction, and very severe necrosis after three weeks (Miller 1978).

***Cucurbita pepo* (summer and autumn squash and non-keeping pumpkin)**

Heterodera trifolii

Root systems were stunted although bearing only 8 to 15 cysts per plant (Mulvey and Anderson 1974)

Meloidogyne hapla

Small Suger Pumpkin and Buttercup summer squash were both slightly susceptible, and 3/3 inoculated plants of both were infected (Faulkner and McElroy 1964).

In pots, Fordhook zucchini was lightly susceptible (Gaskin and Crittenden 1956).

Meloidogyne naasi

Zucchini is a non-host (Radewald et al. 1970).

***Cucurbita pepo* (pumpkin)**

Meloidogyne hapla

In pots, Big Tom was lightly susceptible (Gaskin and Crittenden 1956).

***Cucurbita pepo* (zucchini and some winter squash varities)**

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

***Daucus carota* (carrot)**

Longidorus elongatus

Severely damaged (Hooper 1973).

Meloidogyne chitwoodi:

The basic difference between race 1 and race 2 is that race 2 reproduced on Thor alfalfa but not Red Cored Chantenay carrot, and race 2 reproduced on Red Cored Chantenay carrot but not on Thor alfalfa. Isolates from Oregon, Washington, and Idaho, including race 1 and race 2 vary, in reproductive factor (R) (final population/initial population) on Red Cored Chantenay from < 0.01 to 10.7; a crop with R >2 is considered a suitable host (Mojtahedi et al. 1988).

Race 1 (non-alfalfa race): Imperator Six Pak II (Rf = 17.9), Pak More (Rf = 14.4), Six Pak (Rf = 12.3), Imperator 58 (Rf = 11.6), and Top Pak (Rf = 2.2), Nantes Amsterdam Minicor (Rf = 10.6), Red Cored Chantenay (Rf = 4.4), and Hybrid Orlando Cold (Rf = 10.5), Hybrid Chancellor (Rf = 6.4), Hybrid Golden State (Rf = 4.7), and Hybrid A Plus (Rf = 2.1) were suitable hosts; Imperator Gold Pak (Rf = 1.3) and Imperator Trophy (Rf = 1.2) were moderate hosts; and Imperator Charger is a poor host (Rf = 0.4) (Santo et al. 1988).

Race 2 (alfalfa race): Imperator 58 (Rf = 0.01), Top Pak (Rf = 0), Gold Pak (Rf = 0), Trophy (Rf = 0), and Charger (Rf = 0.01); Nantes Amsterdam Minicor (Rf = 0.01) and Half-Long Nantes (Rf = 0); Red Cored Chantenay (Rf = 0), and Hybrid Chancellor (Rf = 0), Golden State (Rf = 0.02), and A Plus (Rf = 0) are non-hosts, and Imperator Six Pak II (Rf = 0.8), Pak More (Rf = 0.2), and Six Pak (Rf = 0.8) are poor hosts (Santo et al. 1988).

In pots, Red Cored Chantenay and Imperator 58 were poor hosts (Rf = < 0.1), and Gold Pak was a non-host (Rf = 0) for race 2 (alfalfa race). Gold Pak was a moderate host (Rf = 1.3), and Red-cored Chantenay and Imperator 58 were suitable hosts (Rf = 4.4 and 11.6) for race 1 (non-alfalfa race) (Mojtahedi et al. 1988).

In pots, cv. Gold Pak: moderate reproduction, moderate host; cv. Half Long: light reproduction, poor host; cv. Imperator: trace reproduction: very poor host (O'Bannon et al. 1984).

Meloidogyne hapla

Economic threshold is 9/100 cm3 soil (Vrain 1982- or 1980?).

Imperator Six Pak II, Pak More, Six Pak, Imperator 58, Top Pak, Gold Pak, Trophy, and Charger; Nantes Amsterdam Minicor and Half-Long Nantes, Red Cored Chantenay, and Hybrid Orlando Gold, Chancellor, Golden State, and A Plus are all good hosts (Santo et al. 1988).

Carrot is deformed by root-knot nematodes and thus unmarketable; it should be regarded as having a zero tolerance threshold (Potter and Olthof 1993).

In organic soil, yield was reducte by 50% when percent infection of indicator plants increased from 5.1 to 93.2 (Wilson 1957, cited in Wong and Mai 1973).

58% of "Spartan Premium" carrots grown in soil with 5 J2 and an unknown number of eggs/100 cm3 and 97% of "Spartan Premium" carrots grown in nematode-free soil were suitable for fresh market (Slinger and Bird 1978.)

In organic soil field microplots, marketable storage root weight was decreased 36% by 20 eggs/100 cm3 soil, 59% by 40 eggs, 75% by 80 eggs, 92% by 160 eggs, and 89% by 240 eggs. In pots, root and leaf weight and storage root length were significantly reduced at all inoculum levels, and percentage of forked roots was significantly increased (to 57 and 59%) at 160 and 240/100 cm3 soil (Vrain 1982 - or 1980?).

50% yield reduction in unspecified cultivar (Williams 1974).

Economic threshold in Canada: 9/100 cm3 soil (Potter and Olthof 1993).

In pots, Red Cored Chantenay was a suitable host (Rf = 54.9) (Mojtahedi et al. 1988).

In pots, Chantenay Red Cored was severely susceptible, adn 12/12 inoculated plants were infected (Faulkner and McElroy 1964).

Pratylenchus spp.

Threshold range is 30 to 180/100 g soil at planting, with moderate damage at about 100/100 g (Potter and Olthof 1993).

Pratylenchus crenatus:

Taproots are branched and reduced; side roots have lesions and dead tips; above-ground parts are thin and chlorotic (Potter and Olthof 1993). *Pratylenchus neglectus*

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

Recorded (Kleynhans 1996).

Pratylenchus thornei

Reproduced on carrot disk cultures: Rf 5.1 after 25 days, 3619 after 100 days (Castillo et al. 1995).

Xiphinema americanum

Host in urban areas in California (Siddiqui et al. 1973).

***Lactuca sativa* (lettuce)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Meloidogyne hapla

For cv. "Montello", threshold in pots was 700 to 800 eggs/100cm3 soil at planting, and threshold in microplots was 100 to 200 eggs/100 100cm3 soil at planting (Viaene and Abawi 1996).

Marketable weight of Great Lakes 6238 was significantly reduced 37, 70, 68, and 81% by 67, 200, 600, and 1800/100 g soil, respectively (Potter and Olthof 1974).

In pots, top weight of Minetto lettuce was reduced 32% when 2 week old lettuce plants were inoculated with 5 egg masses (626 +- 187 eggs) each in half full 10 cm clay pot (Wong and Mai 1973).

In microplots, yields of marketable lettuce heads were reduced by 67/100 g and all higher densities (Potter and Olthof 1974).

Extrapolation indicated that economic loss (5% or more of marketable yield) would occur at preplant density of 100-200/kg soil (Olthof and Potter 1971).

100 J2/100 g soil (Barker and Olthof 1976).

60-100/100 g soil (Potter and Olthof 1993).

In pots, cv. Iceberg and Grand Rapids were severely susceptible and 38/38 and 43/43 inoculated plants, respectively, were infected (Faulkner and McElroy 1964).

In pots, Iceberg was severely susceptible (Gaskin and Crittenden 1956).

Mesocriconema xenoplax

Great Lakes supported densities 6 times higher than those in fallow treatment: non-host (Lownsbery 1964).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

Losses in marketable yields ranged from 18% at 67/100 g to 33% at 1800/100 g soil (Olthof and Potter 1973)..

1800/100 g soil reduced fall yield by 43% (Potter and Olthof 1974).

200 to 600/100 g soil (Barker *et al.* 1976; Potter and Olthof 1993).

In pots, initial populations of 45/100 g soil resulted in 325-650/g root, 22% height reduction, and moderately severe necrosis after three weeks (Miller 1978).

Pratylenchus thornei

Host in California (Siddiqui et al. 1973).

Xiphinema americanum

In pots, Great Lakes maintained population 20 times higher than fallow: good host (Lownsbery 1964).

In pots, 169 days after inoculation with 72/100 g soil, the final population on lettuce as a weed was 96/100 g soil (Miller 1980).

Host in commercial crop in California (Siddiqui et al. 1973).

***Lycopersicon esculentum* (tomato)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Longidorus elongatus

Host (Norton et al. 1984).

Meloidogyne chitwoodi

In pots, Columbian was an excellent host for race 1 (Ferris et al. 1993).

In pots, Columbian was a suitable host for race 1 (non-alfalfa race) (Rf = 47.3) and for race 2 (alfalfa race) (Mojtahedi et al. 1988).

In pots, cvs. Ace, Rutgers, Saladmaster, Sunray, and Yellow Pear: high reproduction, good hosts; cvs. Beefsteak, Big Boy, Bonny Best, Patriot, and Tiny Tim: moderate reproduction, moderate hosts; and cv. Roza: very high reproduction, very good host (O'Bannon et al. 1984).

Some tomato cultivars are hosts but do not produce galls (Santo and O'Bannon 1981).

In pots, Rf of 3.8 on Rutgers from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

Meloidogyne hapla

At 612 and 2795 J2/100 g, cumulative "Veebright" fruit production (weight) was suppressed by 10 and 40%, respectively (Olthof and Potter 1977).

Initial population of 1000 J2/500 cm3 soil was required to cause a significant yield loss at high elevation. 20/500 cm3 soil caused moderate losses following soybean at low elevation in North Carolina (Barker et al. 1976).

Less than 4 J2/100 g soil in North Carolina coastal plain, 150/100 g in North Carolina mountains, and 3.6 to 20/100 g in Ontario, Canada (Barker and Olthof 1976, Potter and Olthof 1993).

In pots, Rutgers was severely susceptible, and 22/22 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, eight cultivars including Yellow Pear, Red Cherry, and Rutgers were severely susceptible (Gaskin and Crittenden 1956).

In pots, Rf of 4.4 on Rutgers from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

Meloidogyne naasi

Non-host (Golden and Taylor 1967, Radewald et al. 1970).

Host (Norton et al. 1984).

Meloidogyne thamsei

Host; reported in California (Norton et al. 1984).

Mesocriconema xenoplax

Host, in commercial crop and urban area (Siddiqui et al. 1973).

In pots, Rf = 7.5 after 3 months (Seshadri 1964).

Pratylenchus crenatus:

Host in California (Norton et al. 1984).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

Unspecified cultivars:

In pots, initial populations of 36/100 g soil appeared to stimulate fruit production, but 201, 458, and 1436/100 g suppressed fruit production by 38% and weight by 44% (Potter and Olthof 1977.)

In pots, 8 to 55 *P. penetrans*/100 g soil at planting significantly reduced subsequent growth of tomato seedlings 20 to 66% after 2 months (Miller 1975).

Beefeater: In pots, initial populations of 45/100 g soil resulted in 200-400/g root, 54% height reduction, and severe necrosis after five days (Miller 1978).

Bonny Best: In pots, initial populations of 45/100 g soil resulted in 21 in the 0.1-0.2 g root system, 22% height reduction, and very severe necrosis after five days (Miller 1978).

Fantastic: In pots, initial populations of 45/100 g soil resulted in 75-150/g root, 32% height reduction, and very severe necrosis after five days (Miller 1978).

Fireball: In pots, initial populations of 45/100 g soil resulted in 115-230/g root system, 30% height reduction, and severe necrosis after five days (Miller 1978).

Hybrid 980: In pots, initial populations of 45/100 g soil resulted in 65-130/g root, 21% height reduction, and moderate necrosis after five days (Miller 1978).

Heinz 1350: In pots, initial populations of 45/100 g soil resulted in 105-210/g root, 30% height reduction, and severe necrosis after five days (Miller 1978).

Red Plum: In pots, initial populations of 45/100 g soil resulted in 205-410/g root, 30% height reduction, and moderate necrosis after five days (Miller 1978).

Wonder Boy: In pots, initial populations of 45/100 g soil resulted in 75-150/g root system, 15% height reduction, and very severe necrosis after five days (Miller 1978). *Pratylenchus thornei*

Host in California; widespread (Siddiqui et al. 1973).

Host in Iran (Fortuner 1977).

Xiphinema americanum

In pots, 169 days after inoculation with 72/100 g soil, the final population was 56/100 g soil (Miller 1980).

Found in association with many commercial crops and urban plantings in California (Siddiqui et al. 1973).

Xiphinema bakeri

In pots, 123/100 cm3 resulted in severe damage and 186 % population increase after 12 weeks (McElroy 1972).

***Pastinaca sativa* (parsnip)**

Meloidogyne hapla

In pots, moderately susceptible (Gaskin and Crittenden 1956).

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 280-560/g root, 22% height reduction, and very severe necrosis after three weeks (Miller 1978).

***Petroselinum crispum* (parsley)**

Meloidogyne hapla

In pots, Champion Moss Curled was moderately susceptible, and 4/4 inoculated plants were infected (Faulkner and McElroy 1964).

***Phaseolus coccineus* (scarlet runner bean)**

Meloidogyne hapla:

In pots, moderately susceptible (Gaskin and Crittenden 1956).

***Phaseolus limensis* (Lima bean)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

***Phaseolus vulgaris* (green or snap bean)**

Meloidogyne chitwoodi

Apollo is a suitable host (Rf = 94.4) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

In pots, Blue Mountain (snap? fresh? dry????) was a suitable host (Rf = Blue Mountain) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

Cv. Apollo in pots: moderate reproduction, moderate host (O'Bannon et al. 1984).

Xiphinema bakeri

On Blue Lake in pots, 123/100 cm3 resulted in light damage and -49 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

***Pisum sativum* (pea)**

Heterodera gottingiana

Host (Stone and Course 1974, Winslow 1954)

Heterodera humulii

Good host (Stone and Rowe 1977)

Heterodera trifolii

Several varities are highly susceptible, but some studies found little reproduction or damage (Mulvey and Anderson 1974)

Host in New Zealand (Knight et al. 1997).

Longidorus elongatus

Host (Norton et al. 1984).

Meloidogyne chitwoodi:

In pots, "Small Sieve Alaska", "Venus", "Bolero", "Early Perfection 8221", and "Puget" were excellent hosts (Rf = 18-66) but tolerant to 125 to 1250 eggs/100 ml at planting; supported high populations so not suitable for rotation

with nematode-susceptible crop. In pots, top growth of "Dark Skin Perfection (Rf = 51-54) was significantly reduced by 125 and 1250 eggs/100 ml soil (Santo and Ponti 1985).

In field trials, population levels on Russet Burbank were significantly higher following wheat cv. Fieldwin and Austrian winter peas and fallow than following other crops. (Ferris et al. 1993). fresh or dry peas?

In pots, Dark Skin Perfection and Alaska were suitable hosts for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

Cvs. Alaska, Dark Skin Perfction, PI-189171 and PI-257593 in pots: moderate reproduction, moderate hosts; cv. PH 14-119: light reproduction: poor host (O'Bannon et al. 1984). *Meloidogyne hapla:*

In pots, "Small Sieve Alaska", "Venus", "Bolero", "Early Perfection 8221", "Dark Skin Perfection", and "Puget" were excellent hosts (Rf = 40-82) but tolerant to 125 to 1250 eggs/100 ml at planting; supported high populations so not suitable for rotation with nematode-susceptible crop (Santo and Ponti 1985).

In pots, Dark Skin Perfection and Alaska were suitable hosts for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

Cvs. Alaska, Dark Skin Perfction, PI-189171 and PI-257593 in pots: moderate reproduction, moderate hosts; cv. PH 14-119: light reproduction: poor host (O'Bannon et al. 1984).

In pots, Alaska was lightly susceptible, and Perfection Coming was severely susceptible; all inoculated plants were infected (Faulkner and McElroy 1964).

In pots, cv. "Premium Gem" is moderately susceptible (Gaskin and Crittenden 1956).

Less than 10/100 cm3 soil (Barker and Olthof 1976).

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 500-1000/g root system, 14% height reduction, and very severe necrosis after three weeks (Miller 1978).

100/100 g soil (Barker *et al.* 1976).

Pratylenchus thornei

Associated with decline of peas in the Netherlands (Thorne 1961).

Xiphinema americanum

Attacks pea (Riggs and Niblack 1993).

Xiphinema bakeri

In pots, 123/100 cm3 resulted in moderate damage and 40 % population increase after 12 weeks on cv "Progress 18) (McElroy 1972).

***Pisum sativum* var. *macrocarpum* (edible pod pea)**

Meloidogyne chitwoodi

Cv. ARS 244219-B in pots: high reproduction: good host (O'Bannon et al. 1984).

***Pisum* spp. (Pea)**

Heterodera gottingiana

Host (Stone and Course 1974, Winslow 1954)

***Raphanus sativus* (radish)**

Heterodera schachtii

Host on crop plants in California (Siddiqui et al. 1973)

Host (Franklin 1972).

Meloidogyne hapla

In pots, Round Blade was lightly susceptible, and 3/3 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, of 21 cultivars, Buccaneer and Scarlet were severely susceptible, and all others were moderately susceptible (Gaskin and Crittenden 1956).

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 300-600/g root, 57% height reduction, and very severe necrosis after three weeks (Miller 1978).

***Rheum* X *cultorum* (=? *R. rhaponticum*; rhubarb)**

Heterodera schachtii

Host (Franklin 1972)

Host in California (Siddiqui et al. 1973)

Host in Canada (Norton et al. 1984).

Mesocriconema xenoplax

Recovered from soil associated with rhubarb (Merrifield 1998).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans

Host in California (Siddiqui et al. 1973).

Xiphinema bakeri

Host (Norton et al. 1984). *Xiphinema index*

Associated (Norton et al. 1984).

***Solanum melongena* (eggplant)**

Meloidogyne chitwoodi

In pots, cv. "Ichiban" was a poor host (Rf = 0.2) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

In pots, trace reproduction, very poor host (O'Bannon et al. 1984).

Meloidogyne hapla

In pots, severely susceptible, and 2/2 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, Black Beauty was severely susceptible (Gaskin and Crittenden 1956).

Pratylenchus penetrans:

In pots, initial populations of 45/100 g soil resulted in 245-490 g root in "Black Beauty" and 150-300/g root in "Midway Hybrid", 15 to 18% height reduction, and very severe necrosis in both cultivars after three weeks (Miller 1978).

***Solanum tuberosum* (potato)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Heterodera trifolii

Host in California (Siddiqui et al. 1973)

Meloidogyne chitwoodi

Threshold: 1 egg/250 cm3 soil (Less than 1 egg/100 cm3 soil) (Brodie et al. 1993).

Singly or with *M. hapla* colonizes potato more successfully than does *M. hapla* alone. Low soil temperatures, as in the PNW, favor early *M. chitwoodi* invasion of potato roots. *M. chitwoodi* reproduction in corn (KT-626, KE-497, Jubilee) and wheat (Fielder spring, Nugaines winter) was sufficient at as low as 10 C to leave high inoculum levels in soil (O'Bannon and Santo 1984).

In pots, Cvs. Bel-rus and White Rose: moderate reproduction, moderate hosts; cvs. Lemhi and Russet Burbank: high reproduction, good hosts (O'Bannon et al. 1984).

180/100 cm3 soil caused up to 94% infected and galled tubers (Griffin 1989).

In pots, Rf of 6.1 on Russett Burbank from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

J2 densities in a commercial potato field peaked at harvest in mid-fall, declined through the winter, and were lowest in early summer (Pinkerton et al. 1991).

Meloidogyne hapla

Extrapolation indicated that economic loss (5% or more of marketable yield) would occur at preplant density of 10-20/100g soil (Olthof and Potter 1971).

46% reduction by unspecified level (Williams 1974).

100 J2/100 g soil (Barker and Olthof 1976).

In microplots, marketable yields and total weight of Sebago were severely reduced at densities from 67 to 1800/100 g soil. Initial populations as low as 67.100 g caused a decrease in the number of Canada No. 1 tubers (4.5 cm and larger) and an increase in the number of undersized culls. Many harvested from the 600 and 1800/100 g microplots were blemished by large masses of parenchymatous tissue (Olthof and Potter 1972).

20 eggs/100 cm3 soil (Brodie et al. 1993).

In pots, Netted Gem was severely susceptible, and 3/3 inoculated plants were infected (Faulkner and McElroy 1964).

In pots, Rf of 0.8 on Russett Burbank from inoculation of approximately 200/100 cm3 soil (Santo et al. 1980).

Meloidogyne thamsei

Host; reported in Oregon (Norton et al. 1984).

Mesocriconema xenoplax

In pots, Rf = 0 after 3 months (Seshadri 1964).

Pratylenchus crenatus

Host in Nevada (Norton et al. 1984).

Host in California (Norton et al. 1984). *Pratylenchus neglectus*

Initial populations of 19 to 188/100 g soil on Russet Burbank suppressed marketable and total numbers and weight of tubers by 19 to 25%. 12/100 g suppressed total number and weight (Olthof 1990).

150/100 cm3 soil significantly reduced root but not shoot or tuber weight at 15o C but not at 20o or 25o (Umesh and Ferris 1994).

Threshold may be lower than for *P. penetrans* (Brodie *et al.* 1993).

Pratylenchus penetrans:

Losses in marketable yields ranged from 35% at 67/100 g soil to 43% at 1800/100 g soil (Olthof and Potter 1973).

In field plots, initial populations over 10/100 g soil and harvest populations over 72/100 g soil significantly reduced total yield during over two years and marketable yield in one of two years (Olthof 1987)

1000 to 2000/100 g soil measurably reduce yields (Potter and Olthof 1993).

In microplots, initial populations of 38 to 211/100 cm3 soil significantly reduced tuber yields of Kennebec and Superior but not Russet Burbank; Katahdin was insignificantly reduced (Bernard and Laughlin 1976).

100, or 200 to 600,/100 g soil (different experiments) (Barker *et al.* 1976).

In microplots, 185/100 g soil significantly reduced marketable Russet Burbank tubers by 15.7%. Kennebec, Monona, Norchip, superior, and Yukon Gold did not differ significantly from control (Olthof 1983).

Pratylenchus thornei:

Found infrequently; little known about damage (Kleynhans 1996).

Associated with potato in Wisconsin and Ohio (Norton et al. 1984).

Host in California and Iran (Fortuner 1977, Siddiqui et al. 1973).

Xiphinema americanum

Kahtadin is a host (DiSanzo 1982).

Associated with crop, nursery, and urban plantings in California (Siddiqui et al. 1973).

Xiphinema bakeri

In pots, 123/100 cm3 resulted in severe damage to cv "Saco" and 285 % population increase after 12 weeks (McElroy 1972).

***Spinacea oloracea* (spinach)**

Heterodera schachtii

Host in California (Siddiqui et al. 1973)

Cultivated varieties are hosts (Franklin 1972).

Heterodera trifolii

Some varieties are hosts (Mulvey and Anderson 1974)

Meloidogyne hapla

600 to 1800 J2/100 g soil (Barker and Olthof 1976; Potter and Olthof 1993).

In microplots, Cold Resistant Savoy marketable yield was significantly reduced 28% by 200/100g soil (Potter and Olthof 1974).

In pots, American Lon Standing Savoy Leaf severely susceptible and 6/6 inoculated plants infected (Faulkner and McElroy 1964).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

1800/100 g soil reduced fall yield by 21% (Potter and Olthof 1974)

600 to 1800/100 g soil (Barker *et al.* 1976; Potter and Olthof 1993).

***Spinacia* spp. (Spinach)**

Heterodera schachtii

Cultivated varieties are hosts (Franklin 1972)

***Taraxacum officianale* (dandelion)**

Meloidogyne hapla

In pots, Italian was moderately susceptible (Gaskin and Crittenden 1956).

***Tragopogon porrifolium* (salsify or vegetable oyster)**

Meloidogyne hapla:

In pots, Mammoth Sandwich Island was lightly susceptible (Gaskin and Crittenden 1956).

***Vicia faba* (broad, common, field, or faba bean)**

Heterodera gottingiana

Host (Stone and Course 1974)

Meloidogyne hapla

In pots, lightly susceptible (Gaskin and Crittenden 1956).

Pratylenchus neglectus

Host in California (Siddiqui et al 1973).

***Zea mays* (sweet corn)**

Meloidogyne chitwoodi

In pots, Candy Bar and Style Pak were moderate hosts(Rf = 1.7, 1.4) , Jubilee, Style Sweet, and Sweet Treat were suitable hosts (Rf = 5.8, 2.1, 9.0) and Kandy Kiss and Sweet Tooth were poor hosts (Rf = 0.9, 0.8) for Race 2 (alfalfa race) (Mojtahedi et al. 1988).

In pots, Candy Bar, Jubilee, Style Pak, and Sweet Tooth were moderate hosts (Rf = 1.1, 1.9, 1.1, 2.1), and Kandy Kiss, Style Sweet, and Sweet Treat were suitable hosts (Rf = 6.4, 2.1, 16.9) for Race 1 (non-alfalfa race) (Mojtahedi et al. 1988).

In pots, Jubilee: moderate reproduction: moderate host (O'Bannon et al. 1984).

Meloidogyne hapla

In pots, Barbeque, Golden Bantam, and Facmief were not susceptible, and no inoculated plants were infected (Faulkner and McElroy 1964).

Mesocriconema xenoplax

Densities around Improved Golden Bantam were no higher than those in fallow treatment: non-host (Lownsbery 1964).

In pots, Rf = 0 after 3 months (Seshadri 1964).

Pratylenchus neglectus:

Recovered from soil in which sweet corn was growing (Merrifield 1998).

Host in California (Siddiqui et al 1973).

Pratylenchus penetrans:

Losses in marketable yields ranged from 30% at 67/100 g to 49% at 1800/100 g soil (Olthof and Potter 1973).

100/100 g soil (Barker *et al.* 1976).

In pots, 25/100 cm^3 soil significantly reduced root growth at 20 and 24 but not 16 and 28^o C and top growth at 20^o C only; stem diameter was not reduced (Dickerson 1964).

In pots, initial populations of 33/100 g soil resulted in 70/g root and little necrosis on "Butter and Eggs" after 3 months (Miller 1978).

***Zea mays* (sweet corn)**

Xiphinema americanum

Supported densities 11 times higher than in fallow treatment: good host (Lownsbery 1964).

Xiphinema bakeri

On Jubilee in pots, 123/100 cm^3 resulted in light damage and -20 % population increase (i.e., decrease) after 12 weeks (McElroy 1972).

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