Overview of blueberry diseases

Annemiek Schilder

Dept. Plant, Soil, and Microbial Sciences
Michigan State University

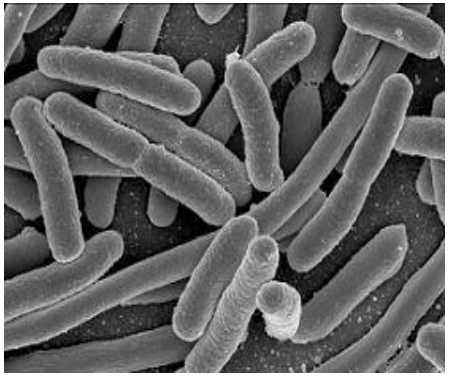

Copper Harbor
CANADA
Houghton
Lake Superior
ntonagon
Grand Marais
ONTARIO
Ironwood
Marquette
Munising
Sault Ste. Marie
Ishpeming
Newberry
Iron River
Menominee R.
Manistique
St. Ignace
Iron Mountain
Escanaba
Mackinac Island
Cheboygan
Beaver Island
SIN
Menominee
Gaylord
Alpena
Lake Huron
Traverse City
Lake Winnebago
Oscoda
Manistee
Cadillac
West Branch
Ludington
Big Rapids
Midland
Bay City
Lake Michigan
Muskegon R.
Saginaw
Muskegon
Flint
Grand Rapids
Port Huron
Lansing
Grand R.
Holland
Pontiac
Battle Creek
Dearborn
Detroit
Kalamazoo
Benton Harbor
Jackson
Ann Arbor
St. Joseph
Lake Erie
ILLINOIS
88° W
INDIANA
84° W
OHIO

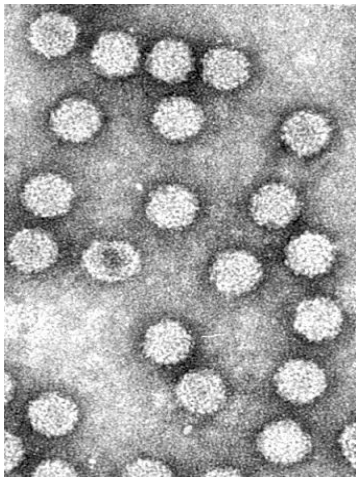
Blueberry production in Michigan

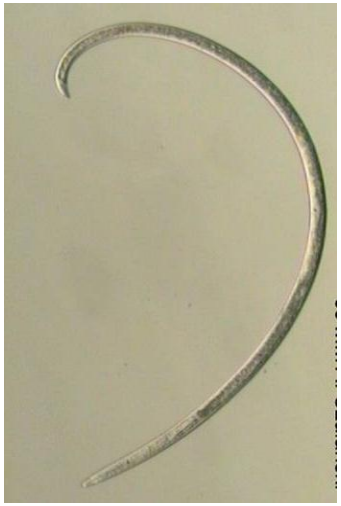
- 20,000 acres of highbush blueberry
- Average of 100 million lbs produced over past 5 years, which is 27% of total U.S. production
- Value: US$ 100-165 million
- 1/3 handpicked, 2/3 mechanically harvested

Plant pathogens

- Fungi
- Bacteria
- Viruses
- Nematodes







Mummy berry

Monilinia vaccinii-corymbosi

Mummified berries produce “trumpets” in spring

Shoot strike with “oakleaf” pattern

Spores produced on main leaf vein

P. Oudemans, Rutgers Univ.

Flower strike

Bees transfer spores to flowers

Fungus grows inside fruit

Mummy berry

Monilinia vaccinii-corymbosi

Infected berries mummify and fall to the ground where they overwinter

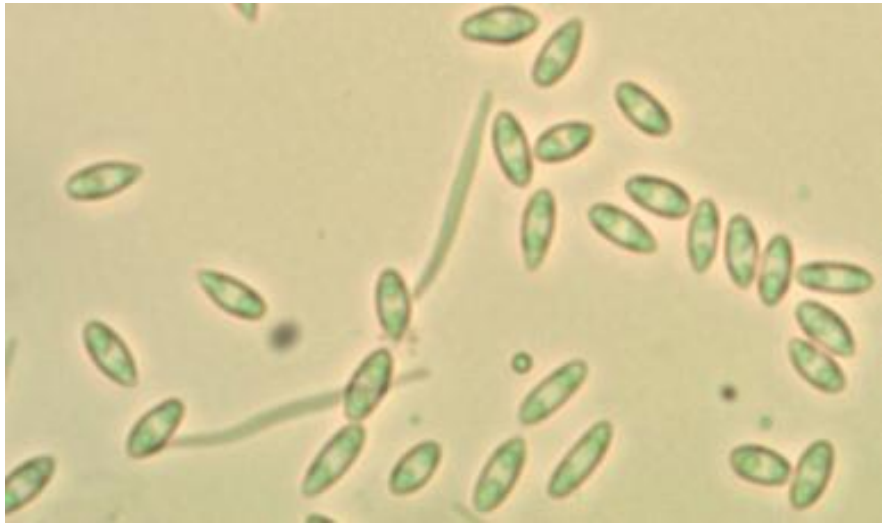
Mummy berry facts

- A problem in wet sites or near woods; the disease can spread from wild blueberries
- Up to 60% yield loss possible; there is also a zero tolerance in processed fruit
- 50-57ºF optimal for mummy germination, which is synchronized with development of host
- Spring frosts increase risk of shoot strikes
- Long bloom period and good pollinating weather increase fruit infection risk

Phomopsis twig blight

Phomopsis vaccinii

Twig and blossom blight, dying fruit clusters



Spores are produced in bleached areas and are dispersed by rain splash

Phomopsis canker

Phomopsis vaccinii

Cane collapse in mid-summer

Cankers on canes

Phomopsis leaf spot and fruit rot

Phomopsis leaf spot

Phomopsis fruit rot leads to soft berries and berry splitting

Phomopsis spore droplets on fruit postharvest

Phomopsis facts

- The disease is often introduced with the planting material
- Rainy seasons are conducive to infection and spread
- Fungus can infect young canes and twigs directly but needs wounds to enter older wood
- Most infections occur in spring and early summer, role of frost and herbicides unclear
- A hard winter or drought stress may exacerbate symptoms

Botryosphaeria stem blight

Botryosphaeria dothidea, B. ribis, and other species

Botryosphaeria stem blight facts

- Primary disease limiting establishment of blueberry plantings in SE US
- Fungus enters the plant through wounds (mechanical, insect, freeze injury)
- Disease causes rapid death of canes, especially in 1- and 2-year-old plantings
- Most infections occur early in the growing season, but infection can take place year-round
- The disease also occurs in other wild and cultivated hosts, e.g., holly, blackberry, willow

Bacterial blight/canker

Pseudomonas syringae

Facts about bacterial canker

- Cold, rainy weather and spring frosts promote disease development
- Bacteria are dispersed by rain and enter the plant via wounds
- 1-year-old canes and twigs are most susceptible
- Late-season applications of nitrogen may delay hardening off of plants and promote fall infection in the Pacific Northwest
- Bacteria can be spread via pruning shears

Botrytis blight/gray mold

Botrytis cinerea

Leaf blight

Spores on blighted blossoms are dispersed by wind

Twig blight

Botrytis Facts

- Botrytis promoted by extended cool, wet periods
- Botrytis has a wide host range and spores are common in the air

Post-harvest fruit rot

- Fungus overwinters in infected plant parts, and produces spores on dead plant material
- Botrytis also a common cause of post-harvest fruit rot

Phytophthora root rot

Phytophthora cinnamomi

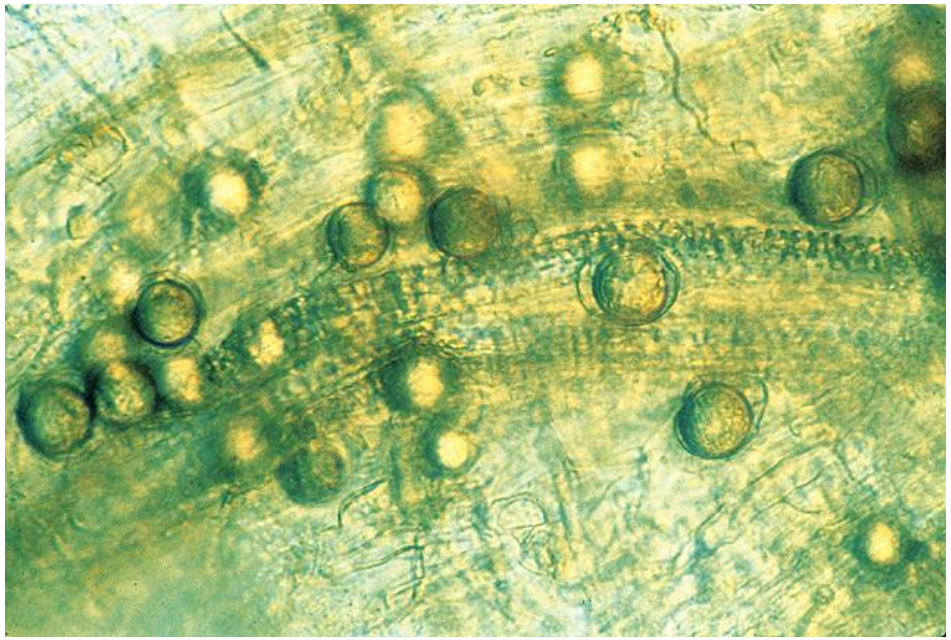
Wilting, defoliation, and plant death

Yellow/red leaves

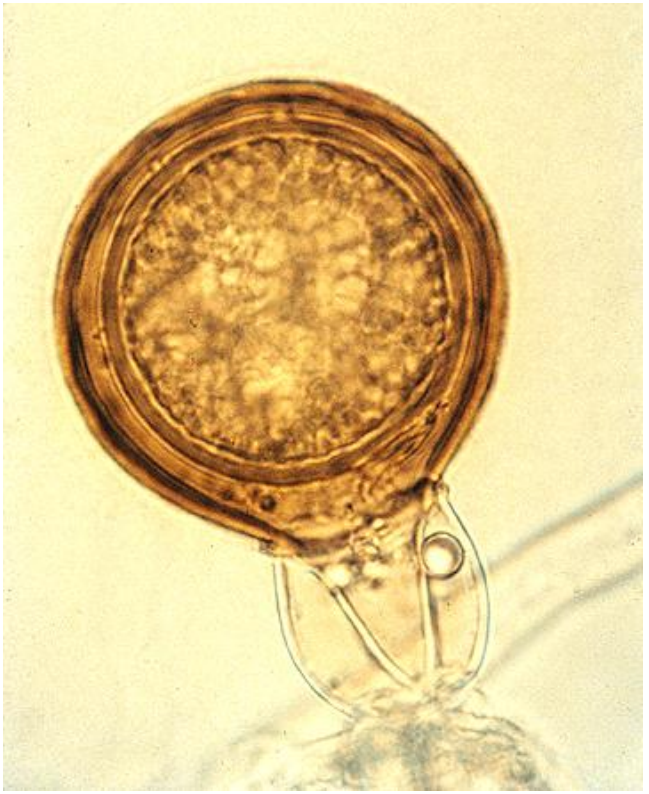
Small root system

Phytophthora root rot

Phytophthora cinnamomi



Oospores develop in infected roots and can survive in the soil for more than 10 years



Oospores release swimming spores (zoospores) which infect roots

Phytophthora root rot facts

- Disease is promoted by rainy periods resulting in standing water in the field and heavy soils with poor drainage
- Old bark beds also can harbor the disease
- Oospores can survive in the soil for more than 10 years
- The disease can spread via movement of soil from infested fields, with run-off water, on equipment and boots, and via infected planting material

Armillaria root rot *Armillaria mellea*

Cane death, stunting of bush

Black, shoelace-like strands under bark

White hyphal mats below bark at crown

Mushrooms at base

Armillaria root rot facts

- Planting at a site of a cleared orchard or oak forest with a history of the disease can lead to infection

- The fungus spreads by root-to-root contact and can survive for many years on old stumps and roots in the soil

- Armillaria root rot may also spread via wood chips from trees that died of the disease

Crown gall *Agrobacterium tumefaciens*

Galls on blueberry canes can disrupt sap flow and can weaken or kill canes

Bacteria enter the plant through wounds

Facts about crown gall

- Crown gall bacteria may be present in the soil or infected planting material
- Wounding of plants (freezing injury, mechanical injury) promotes the disease
- Once the plant is infected, it continues to make galls
- Usually a problem in planting beds but less so in the field

Leaf rust

Thekopsora minima

Necrotic lesions on upper leaf surface and orange pustules on lower surface

Leaf rust facts

- Alternate host for stem rust is hemlock tree (*Tsuga* spp.) which is the source of new infections in early summer
- In warm climates, leaf rust survives on evergreen blueberry leaves
- Repeating cycles of infection (from blueberry to blueberry) can lead to premature defoliation
- Infection is favored by temperatures above 68ºF prolonged leaf wetness – incubation period is 10 days

Powdery mildew *Microsphaera vaccinii*

Powdery mildew facts

- Powdery mildew is promoted by warm summers with limited rain and high relative humidity

- In blueberries, powdery mildew is mostly present on the lower leaf surface in contrast with other plants

- The fungus overwinters on infected leaves and probably in bark

- Powdery mildew usually is of no concern and growers do not spray for it

Leaf spots of blueberries

Septoria leaf spot
(*S. albopunctata*)

Gloeosporium leaf spot *(G. minus*)

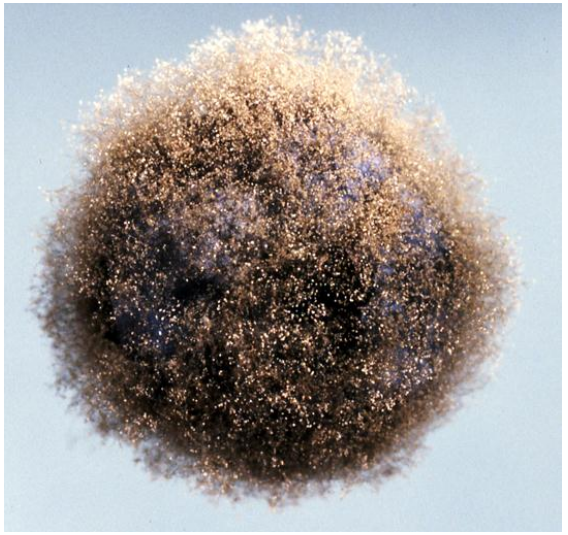
Leaf spot facts

- Leaf spot diseases are widespread in the southern United states
- Infections occur mostly on immature leaves and may take up to 4 weeks to become visible
- Most leaf spots appear mid- to late season and are favored by wet weather
- Spores are rain-splash dispersed and the fungi overwinter in infected leaves
- Don’t confuse with spray injury

Post-harvest fruit rots of blueberries

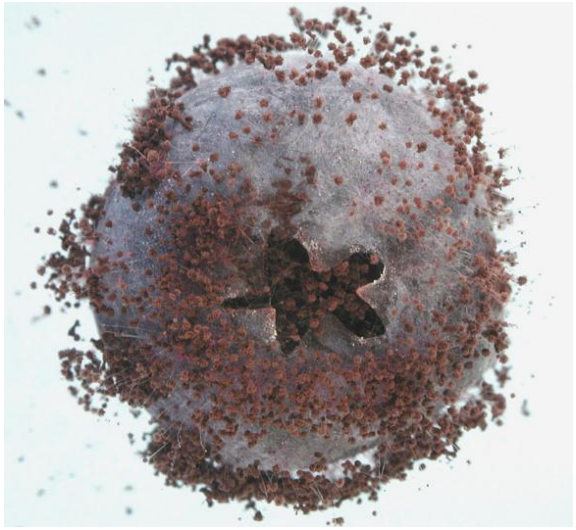
Colletotrichum

Alternaria

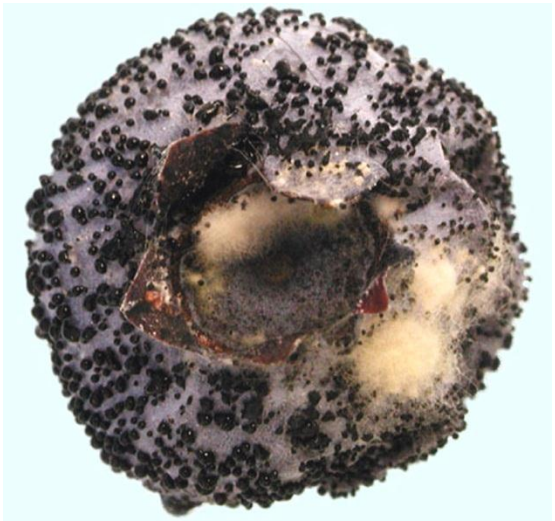


Botrytis

Phomopsis



Aspergillus

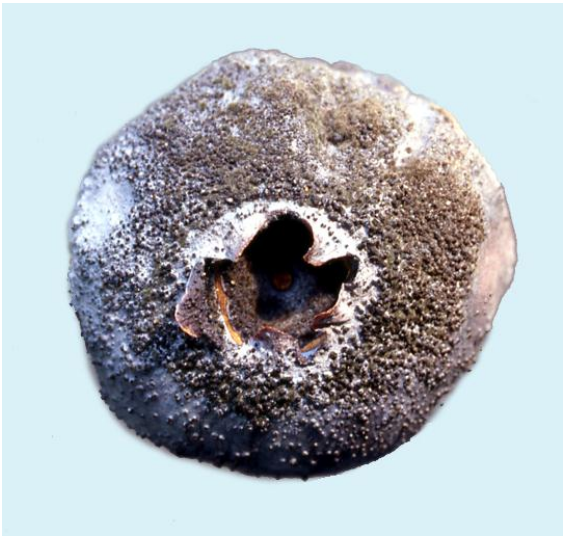


Pestalotia

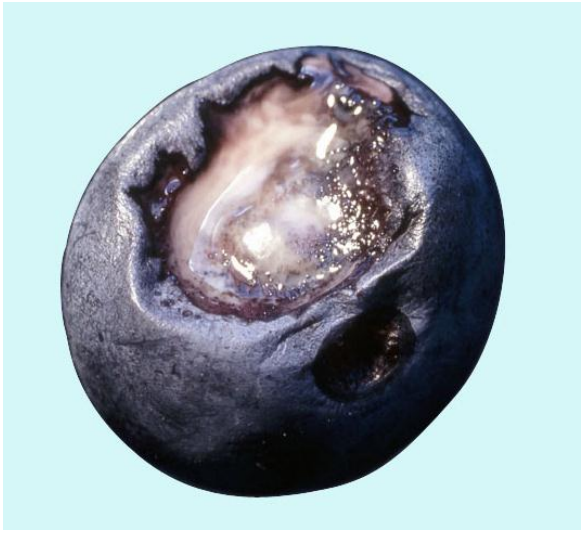
Post-harvest fruit rots of blueberries

Epicoccum

Hainesia

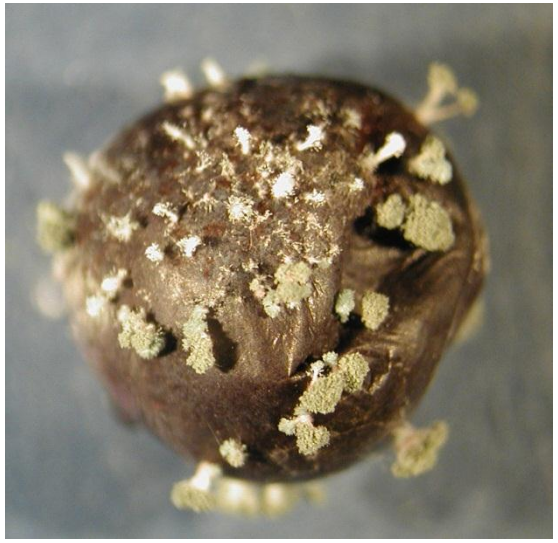


Sphaeropsis



Aureobasidium (yeast)

Rhizopus



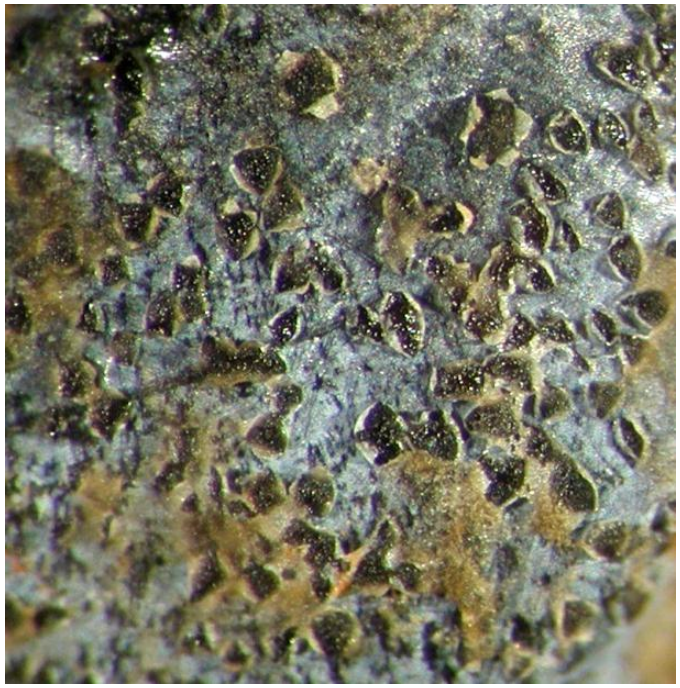
Penicillium

Anthracnose fruit rot

Colletotrichum acutatum, C. gloeosporioides

Rotting berries with orange spore masses in the field

Anthracnose fruit rot



Spores produced in blisters

Spores are dispersed by rain

Spore masses on dead twig in spring

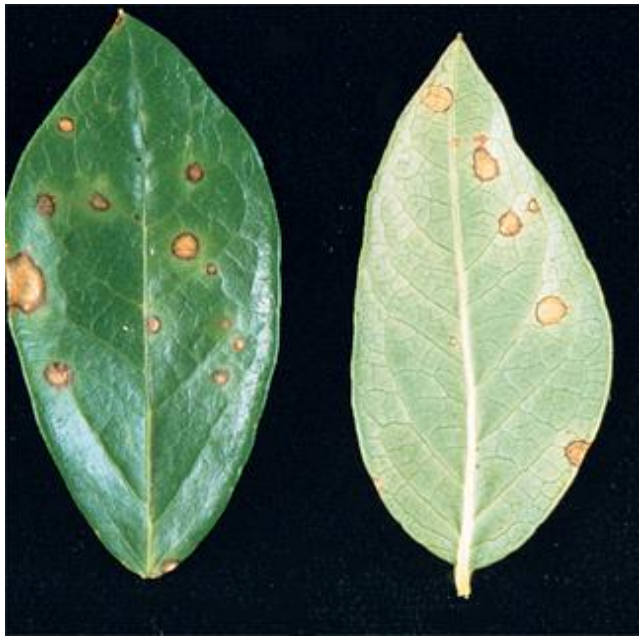
Anthracnose fruit rot facts

- Most cultivars susceptible
- Promoted by warm, rainy weather and frequent overhead irrigation
- Berries are susceptible at all stages of development
- Fungus overwinters in infected twigs and bud scales
- Berries can also be infected by contact with infected berries during harvesting and processing

Alternaria fruit rot *Alternaria tenuissima*

Spores on rotting fruit are dispersed by wind

Post-harvest fruit rot



Alternaria leaf spot (not very common)

Alternaria fruit rot facts

- Very common post-harvest rot
- Cool, rainy weather during fruit development promotes infection
- Fungus survives and produces spores on dead plant material, spores very common in air once fruit starts to ripem
- Large wet stem scars predispose berries to infection

Virus and virus-like diseases

Blueberry shoestring
(Blueberry shoestring virus)

Red ringspot
(Blueberry red ringspot virus)

Blueberry mosaic
(Blueberry mosaic virus)

Virus and virus-like diseases

Tomato ringspot
(Tomato ringspot virus)

Blueberry stunt
(Blueberry stunt phytoplasma)

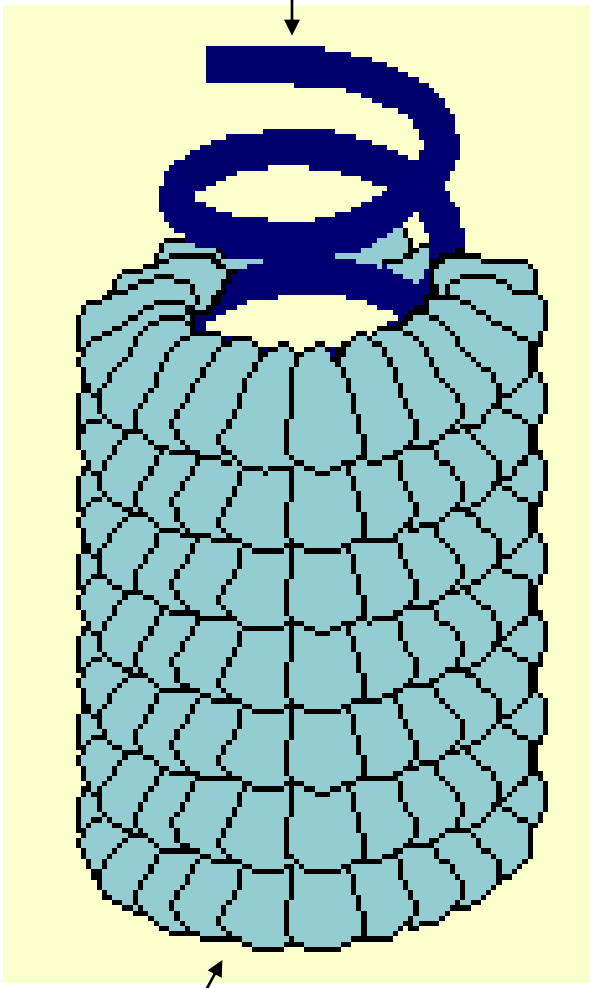
Virus and virus-like diseases

Blueberry scorch
(Blueberry scorch virus)

Blueberry shock
(Blueberry shock virus)

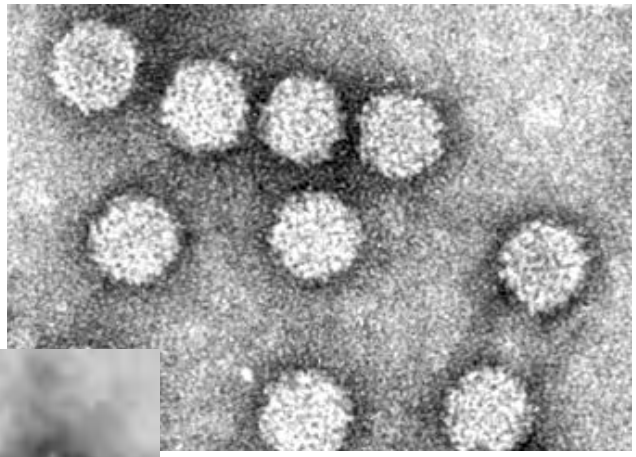
What is a virus?

Genetic material
(DNA or RNA)

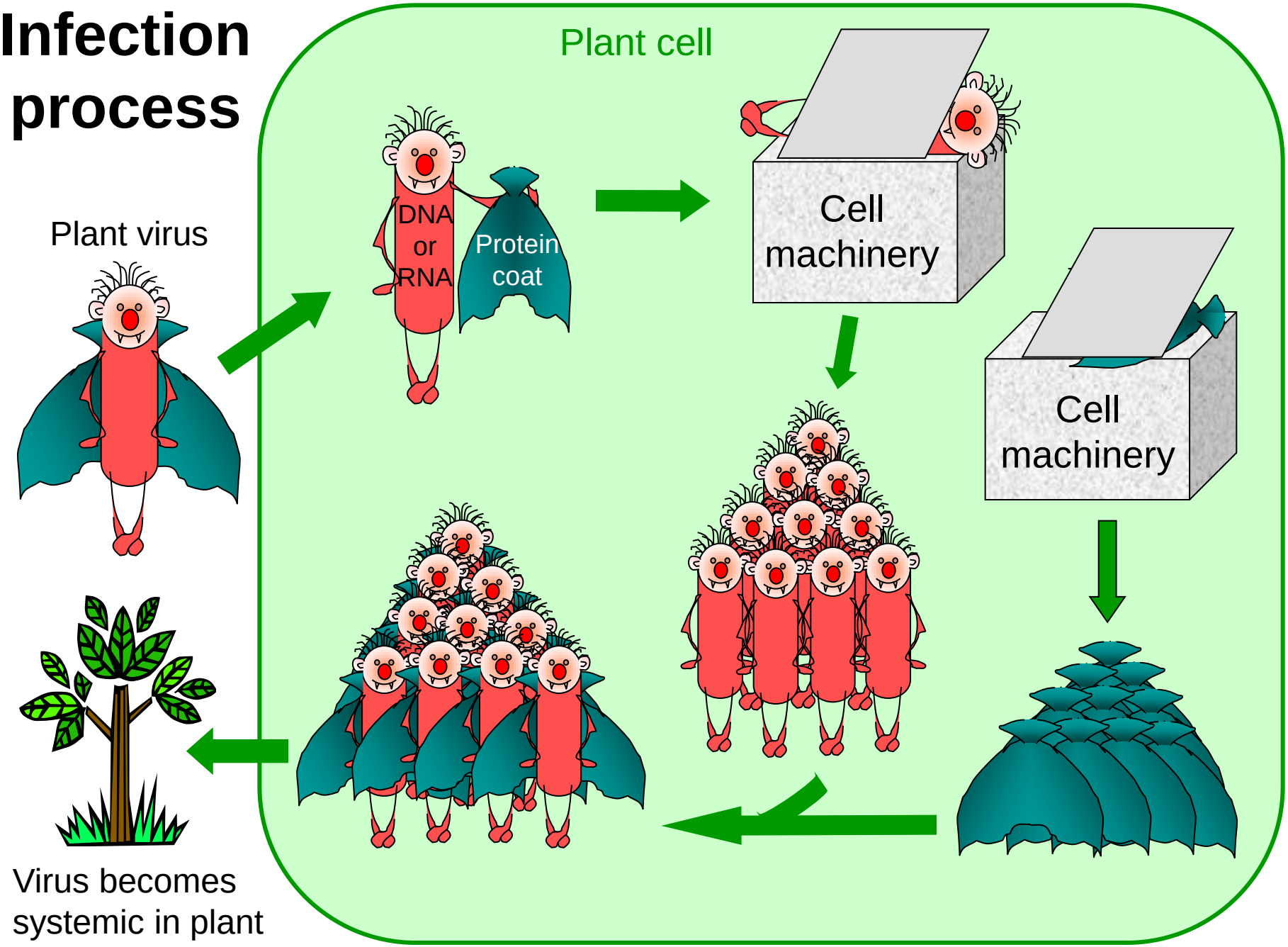


Protein coat

Virus shapes
(under electron
microscope)



Infection process



Role of vectors in transmission of viruses from plant to plant

Dagger nematode (*Xiphinema*), vector of tobacco ringspot virus

Blueberry aphid, vector of blueberry shoestring virus

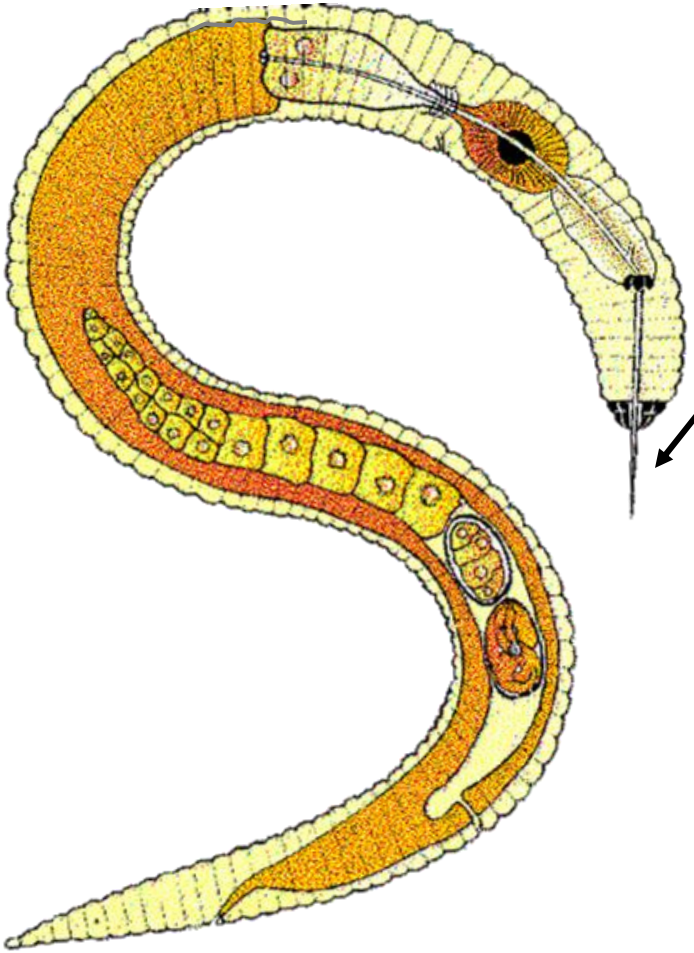
Sharpnosed leafhopper, vector of blueberry stunt phytoplasma

Virus disease facts

- Viruses are systemic in plants
- Vegetative propagation main means of virus spread!
- Over time, viruses can stunt growth, reduce yield, and kill plants
- Viruses can spread within and between fields, especially when vectors are abundant
- Cool springs often result in more symptom expression

Plant parasitic nematodes

Pratylenchus, Meloidogyne, Xiphinema, Trichodorus, etc.



Galls on roots

Nematode eggs

Facts about plant-parasitic nematodes

- Feed on roots externally or internally and cause root lesions, stunting, galls
- Can swim short distances and prefer sandy soils
- Spread via soil, water, equipment, and plant material
- Usually do not cause much damage in blueberry plantings but may be a problem in nursery beds
- Some nematodes are virus vectors (e.g., *Xiphinema* spp.) and can therefore be damaging in low numbers