

## Aster Yellows



Aster yellows infected purple coneflowers.



Aster yellows symptoms on marigolds.



Vein clearing on China aster.

Aster yellows is a plant disease that occurs throughout North America, affecting a wide range of plants, including many important crops and ornamental plants. Home gardeners are most likely to notice its effects on purple coneflower and some other daisy-like flowers, as the symptoms on those flowers tend to be more dramatic than on other types of flowers or the foliar symptoms.

This disease is caused by a phytoplasma, a bacterium-like organism similar to a mycoplasma (so formerly called a mycoplasma-like organism or MLO), but which infects plants, and causes virus-like symptoms. In plants it is found only in phloem sieve cells. Its host range includes more than 300 plant species in 38 plant families of broad-leaved herbaceous plants as well as a number of grain crops such as wheat and barley.

Some of the most important vegetable crops it can infect are lettuce, carrots, and celery (and this disease was partially responsible for the demise of the commercial production of those vegetable crops in Wisconsin), and its symptoms are commonly seen in many ornamental plants in the aster or sunflower family (Asteraceae / Compositae) such as purple coneflower, China aster (*Callistephus chinensis*), marigolds, and zinnias. Some weeds commonly affected include ragweed, marestail, thistles, and pineappleweed. It overwinters in many species of perennial hosts (both native and introduced) or in annuals growing in mild climates in the southern part of the continent.



Aster yellows on ragweed.



Reddened foliage of aster yellows infected carrots.





Healthy carrot root (L) and aster yellows infected root showing typical root hair growth (R).

or purple tinges. On potatoes the disease is often called “purple top” as the leaves of this crop frequently turn purple. On many plants the leaves are twisted or curled – resembling herbicide damage – or witches brooms (abnormally numerous shoots) develop. In carrots, the tops can become bunched with lots of short shoots and the foliage may be yellow, reddish or stunted, while underground numerous hairy rootlets develop in characteristic bunches on the taproot and the root has an unpleasant flavor and is more susceptible to rotting.

The most dramatic symptoms occur on reproductive parts of the plant. The flowers are frequently deformed, with underdeveloped petals or weird, extra growths, or a change of color. Plants exhibiting virescence don't develop the normal color

of the petals, but are green (but don't confuse this with the normal green color of some newer cultivars, such as 'Green Envy'!). Plants with phyllody have tufts of pale, deformed leaves, often inside the



Virescence caused by aster yellows.



Phyllody caused by aster yellows.



The symptoms of aster yellows varies from affecting only part of the flower (L), to changing the color of the petals (C), to causing abnormal growth (R).

flower or in place of the petals. On coneflowers secondary flower heads are often produced on top of the primary flowers. The pathogen induces sterility, so seeds often are not produced, and those that are produced are generally not viable.

There is another problem only on *Echinacea* that might be confused with aster yellows because of its similar symptoms, caused by eriophyid mites. These nearly microscopic spindle-shaped mites (see next page) have only 4 legs at one end of the body (all other mites have 8 legs as adults). The feeding damage of these coneflower rosette mites – which don't have a scientific name yet – results in tufts of small, distorted flower parts sprouting from the cone, but doesn't affect the ray flowers. The plant otherwise grows normally, but the mite damage can reduce



Abnormal growths caused by coneflower rosette mite on *Echinacea*. Note that the petals remain normal in shape and color.





Arrows point to the barely visible coneflower rosette mites (L) in the flower head. Microscopic view of the mites (R) at 100x. Photos by P.J. Liesch.

seed production. Cut off and dispose of any affected flower heads to limit infestation on other flowers and the following year.

Aster yellows can be fatal to young plants, but typically does not kill perennial host plants. There is no cure for aster yellows, so the only thing that can be done once a plant is infected is to

rogue out the symptomatic plant so that it cannot serve as inoculum to infect other plants.



Unlike most pathogens that infect plants directly, the aster yellows phytoplasma requires an insect vector to move it from plant to plant (it can also be transmitted through grafting). The aster leafhopper, *Macrostelus quadrilineatus* (=fascifrons), is the only significant vector for this disease. This insect and phytoplasma have evolved together with a very specialized relationship. The phloem-feeding leafhopper acquires the pathogen while feeding on infected plants, but instead of being able to transmit the phytoplasma immediately to another plant, there is an incubation period during which the pathogen multiplies within the leafhopper and then moves to the salivary glands of the insect. Only then is the leafhopper capable of transmitting the pathogen to another plant when it is feeding. This means there is a length of time – the latent period – during which an insect can be infected with the pathogen, yet not able to transmit it to cause disease. This latent period lasts 2-3 weeks, depending on temperature. It takes another 10 days to three weeks or more (depending on temperature and plant species) for symptoms to show on the plant. High temperatures (88°F for 10 to 12 days) inactivate the pathogen in insect vectors and plants, so the disease is rare or absent in hot areas of the world, and is reduced during hot spells.



Aster leafhopper nymph.

Aster yellows cannot be cured, so infected plants should be removed to prevent transmission to other plants.

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Aster leafhopper adult (greatly magnified) feeding on a plant.

The aster leafhopper can move around a lot as an adult – including vast distances across North America under just the right weather conditions. The aster leafhopper does overwinter (in the egg stage) in the upper Midwest, but frequently adults are found far before the local populations have hatched and developed. This insect also overwinters in the southern parts of the US, particularly the Gulf States.

It begins developing down south early in the spring, often building up large populations in the grain fields of Missouri, Arkansas and other states. The adults will migrate on the prevailing winds and jet streams that frequently move northward in the spring, flying into the upper atmosphere to be blown hundreds of miles north before falling out onto new host plants in an area far from where they took off. These insects have the potential to have already acquired the pathogen along the migration route or while still in the South and completed the latent period, so in some springs they show up in Wisconsin and adjacent states ready to transmit the disease before the local leafhoppers have even hatched! But in other years, weather patterns are not conducive for their movement into our area, and only the local populations are important in disease transmission.



**Aster yellows on *Rudbeckia*.**

This ability to move long distances, the relatively long latent period during which they are not infective, and their wide host range of both pathogen and vector complicates control of aster yellows. In commercial vegetable production control is focused on managing the insect vector to prevent infection, usually by spraying insecticides when infective insects are present (based on monitoring leafhopper numbers and infectivity levels of migrants and local populations). This isn't a practical approach for most gardeners, and in the home garden control is focused on recognizing symptoms and eliminating infected plants, including weeds which can harbor the disease. When buying perennials that are susceptible to the aster yellows, inspect the plants carefully to be sure they don't have any symptoms at the time of purchase. Monitor garden plants frequently for symptoms and destroy any that appear to be diseased. Early detection and prompt removal of infected plants may help reduce the spread of the disease. (But remember that not all abnormal or distorted plant growth is a symptom of this disease; damage from herbicides (including Weed 'n' Feed) can be mistaken for aster yellows.) If aster yellows is a consistent problem, try planting things that are not as susceptible, such as celosia, geraniums (*Pelargonium*), salvias, and verbena, as well as most woody ornamentals. There are differences in susceptibility of many vegetable cultivars, but there are no resistant cultivars. Susceptible vegetables, such as lettuce plants, can be grown under floating row cover to exclude the vector leafhopper.

– Susan Mahr, University of Wisconsin - Madison

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### Additional Information:

- Aster Yellows – on the Wisconsin Horticulture website at [hort.uwex.edu/articles/aster-yellows/](http://hort.uwex.edu/articles/aster-yellows/)
- Aster Yellows – on the University of Minnesota Extension website at [www.extension.umn.edu/garden/yard-garden/flowers/aster-yellows/](http://www.extension.umn.edu/garden/yard-garden/flowers/aster-yellows/)
- Aster Yellows – University of Illinois report on plant disease No. 903 at [ipm.illinois.edu/diseases/rpds/903.pdf](http://ipm.illinois.edu/diseases/rpds/903.pdf)
- Aster Yellows – on the Missouri Botanic Garden's Kemper Center for Home Gardening website at [www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/pests-and-problems/diseases/viruses/aster-yellows.aspx](http://www.missouribotanicalgarden.org/gardens-gardening/your-garden/help-for-the-home-gardener/advice-tips-resources/pests-and-problems/diseases/viruses/aster-yellows.aspx)

A partial list of plants susceptible to the aster yellows (from University of Illinois Report on Plant Disease No. 903 at <https://ipm.illinois.edu/diseases/rpds/903.pdf>).

Vegetables and Herbs	Ornamentals		Field Crops and Weeds
anise broccoli cabbage carrot cauliflower celeriac celery celtuce chicory cucumber dandelion dill endive escarole lettuce mustard, white New Zealand spinach onion parsley parsnip pea potato pumpkin radish salsify shallot spinach squash tomato	alkanet or bugloss amaranthus anemone asters babys breath begonias black-eyed Susan boneset browallia bur-marigold buttercup butterfly-flower calendula California-bluebell California-poppy camomile, yellow campanula canna cape-marigold catchfly catchfly, German centaureas centranth China-aster chrysanthemums cineraria clarkia clockvine collinsia coltsfoot, sweet coreopsis cosmos daisies delphiniums dragonhead English daisy erigerons everlasting, yellow fall-dandelion false-dragonhead forget-me-not gaillardia gillias gladiolus gloxinia godetia golden-glow	goldentuft hydrangea jacobs-ladder Japanese hop Joe-pye-weed larkspur lavender, dwarf linarias lobelia marigolds mignonette monkeyflower mullein-pink nasturtium nemesia nemophila pansies periwinkle petunias phlox pimpernel pink, dwarf piqueria or stevia poppy primroses pyrethrum safflower salpiglossis salvia scabiosa sea-lavender sea-pink or thrift slipperwort snakeroot, white strawflower sunflower sunrose Swan River daisy sweet pea tasselflower thistle, decorative tobacco, Indian veronica violets Virginia stock wallflowers zinnias	dandelion feverfew, American fieldcress, yellow flax fleabane, daisy galinsoga globethistle goatsbeard bumweed hawkweed heliopsis henbane horseweed lettuce, wild matricary milkweed mullein oxslip parthenium pineappleweed plantains purslane ragweed sandverbena scorpionweed senecio sowthistles tarweed thistles