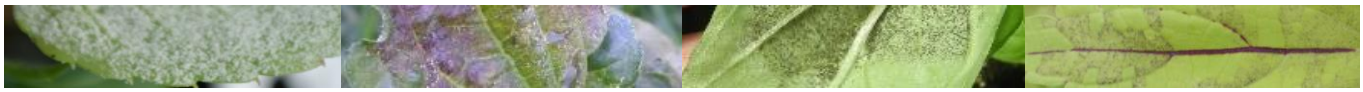

Dossier: Viburnum Downy Mildew

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Introduction and Importance

Viburnums are widely used as ornamental evergreen shrubs and small trees [1] and native species are understory plants in forests. According to the 2014 Census of Horticultural Specialties (https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Census_of_Horticulture_Specialties/), among the broadleaf evergreen industry, viburnums have a total sale value of approximately $25 million. Among the few diseases having a significant impact on viburnum is downy mildew. There is an ongoing outbreak of viburnum downy mildew disease throughout Florida [2].

Plant Description

Genus *Viburnum*

Viburnum is a genus of approximately 170 species of deciduous and evergreen shrubs and small trees. The viburnum native range includes North America and Asia. Members of this genus are mainly found in temperate forests throughout the Northern Hemisphere, but can also extend into tropical regions in southeast Asia and South America [3]. *Viburnum* species are a valued horticultural crop due to their ornamental features, including showy and highly fragrant flowers, brightly colored fruit, and attractive evergreen and deciduous foliage [1,4]. Viburnums display relatively little variability in flower and fruit morphology, but conspicuous diversity in numerous other characters such as variation in endocarp shape, fruit color, leaf and bud morphology, and inflorescence form [5]. Viburnums are moderate to fast-growing plants, growing up to 2 feet per year. Most viburnums grow well in moist, nutrition rich and slightly acidic soils. Viburnums bloom best in full sun, however light preferences can vary according to the species. Viburnums are widely used as hedge, screen plants or foundations shrubs [1].

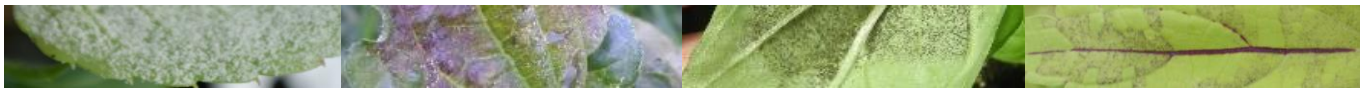


Figure 1. Viburnums


Photos taken from: https://upload.wikimedia.org/wikipedia/commons/f/fe/Viburnum_opulus_C.jpg and https://s-media-cache-ak0.pinimg.com/originals/b7/0a/46/b70a46fdeab7b74da2275b32c766b2b9.jpg

Pathogen Description

Downy mildew disease of viburnum is caused by the oomycete *Plasmopara viburni* Peck. This pathogen species was first described in 1890 on *Viburnum dentatum* in the Northeastern U.S. [6]. Updated pathogen microscopic description and images are lacking.

Pathogen Biology and Disease Cycle

Information about the ability of *P. viburni* to produce oospores is lacking. Zoospores are motile spores that are the result of asexual reproduction and are produced in the abaxial surface of infected leaves. Sporangia are sac-like structures that contain spores and are the location where the zoospores are formed. As with other downy mildew diseases, the viburnum downy mildew pathogen spreads mainly through the propagation of infected plants, by wind or water currents that move infective propagules or by transplanting healthy plants into soil infected with the pathogen. In an infected viburnum, sporangiophores and sporangia will form during cool and very humid conditions and emerge from the internal tissue of the underside of the leaf. If water is present in the surface of the leaves, sporangia can germinate and produce massive quantities of zoospores that can cause secondary infections within the same plant, or being spread by wind or water splash. Sporangia can also be dislodged from the leaf tissue and fall in the ground where the zoospores can be released and spread short distances by water splash, or longer distances by wind currents to nearby plants. Once in a new plant, zoospores encyst, then form germ tubes that enter stomata and from there invade inner tissues of the plant by growing between the cells. The sporangia and zoospores can serve as the source of inoculum for new infections in nearby plants in landscape settings.

Epidemiology

High environmental moisture, overcrowding and cool temperatures characteristic of spring and fall seasons have been correlated with the development of the viburnum downy mildew disease [2]. No information is available about the overwintering structures for *P. viburni*.

Disease Symptoms

The initial symptoms of viburnum downy mildew include yellowish or speckled leaves. As the disease progresses, reddish-brown spots appear on the upper leaf surface and grow together forming angular patches often bordered by leaf veins. A whitish-gray downy-like growth can be seen on the underside of leaves. As the disease progresses, leaf spots dry and shrivel and leaves begin to drop off. Large portions of the canopy can become defoliated [2,7].

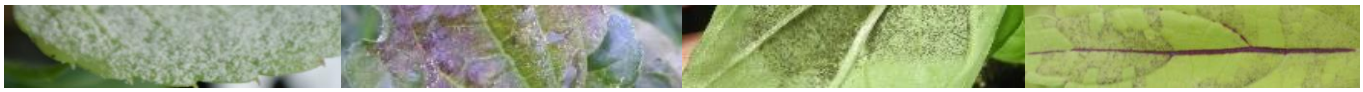


Figure 2. Viburnum downy mildew disease symptoms

Photos taken from: Sandra Jensen, Cornell University, Bugwood.org

Host Range

Plasmopara viburni has been observed affecting several species of *Viburnum*, such as *V. acerifolium*, *V. dentatum*, *V. opulus*, *V. pubescens*, *V. odoratissimum*, *V. suspensus*, *V. tinus* and *V. trilobium* [2,8].

Geographic Distribution

Plasmopara viburni is mainly distributed in Eastern U.S. and is currently a serious concern throughout the state of Florida [2,8].

Cultural Practices

- Inspect plant material upon arrival for any sign of disease problems.
- Ensure good air circulation and water drainage with well-spaced plants.
- Scout frequently for detection of early symptoms and remove infected plants to prevent disease spreading.
- Practice good sanitation, removing fallen leaves and debris.
- Do not compost infected material onsite.

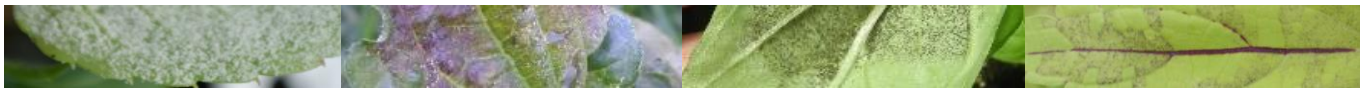
Cultivar Disease Resistance

Currently, there is no information about disease resistance in *Viburnum* species or cultivars.

Fungicide Management

Current recommendations for rose downy mildew management rely on protective fungicide treatments with applications as soon as environmental conditions are favorable for disease development and before noticeable symptoms and inoculum are present. For outbreaks that occur annually under favorable conditions, it is possible to time for preventive applications. Contact fungicide treatments, such as Protect (manoczeb) and Daconil (chlorothalonil), combined with systemic active ingredients, such as Heritage (azoxystrobin) and Adorn (fluopicolide) provide multiple options. For additional options, please review the IR-4 Downy Mildew Efficacy Summary and Literature Review (https://www.ir4project.org/ehc/environmental-horticulture-research-summaries/) [9]. Disease management is more effective when full coverage of the underside of the leaves is achieved during contact fungicide treatments or when systemic products such as those in FRAC groups 4 (mefenoxam), 33 (phosphorus acid generators) and 49 (oxathiapiprolin) are employed in rotation.

To slow the development of resistance, it is highly recommended that label directions are followed closely and that rotations occur among different modes of action as established by the Fungicide Resistance Action Committee (FRAC).



Genetics and Genomics

No information is available about *P. viburnum* – *Viburnum* spp. plant-pathogen systems.

Knowledge Gaps

- **Biology:** No information is available on whether *P. viburni* is homothallic or heterothallic.
- **Epidemiology:** Nothing is known about the disease cycle of the downy mildew diseases of viburnums. It is unknown whether there is seed transmission. How and where *P. viburni* overwinters is not known.
- **Host Range:** downy mildew susceptibility in the many other *Viburnum* species is unknown
- **Genomics:** To the best of our knowledge, the genomes of the pathogen and host plant have not been sequenced.
- **Diagnostics:** Currently, there is no diagnostic assay for this downy mildew pathogen.

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