

# Don't put on the virus blinders, your collection is depending on you.

You look at your orchid collection with longing and pride, knowing that the beauty before you can only be attributed to your tender loving care. You have spent hundreds maybe even thousands of dollars on this collection. You trim, water, feed and repot, but do you test?

Mention the word virus and the smell of fear overpowers the fragrance of a beautiful orchid collection. And viruses should be feared. Dare I say, most of the well known, valuable orchid collections have been infiltrated by a virus or two. Once they have made their way into a collection, the value and vigor can and will decrease equaling loss in investment, money and time.

Viral pathogens are sneaky, living in a collection for a very long time, years even, without you knowing they are there. All the while weakening the orchid and making it susceptible to secondary bacterial or fungal infections. Viral pathogens are deceptive, disguising themselves as some other, non-viral disease such as bacterial or fungal pathogens, but they can also look like physiological disorders from light intensity, fertilizer burn or water imbalance. Viral pathogens are ugly, causing all kinds of different, not so aesthetically pleasing foliar symptoms and color break in the blooms. Working together with fellow society members and taking advantage of all of today's technologies, controlling virus in your collection isn't as daunting as you think. The first step is knowledge.

I think this is a good place to stop for just a minute and clear the air, regarding virus infection in your collection. Again, viral pathogens are sneaky. They come in, make a nice home in the plant cell, hang out and take over the host's metabolism, in this case, the slowly growing orchid groups. In other hosts where reduction in plant growth and flower production is easily spotted during a growing season, growers can implement virus eradication or certification programs. In the slower growing orchid groups, where success is measured not by the quantity of the blooms but by the quality of the blooms, viral infections are not easily measured.

Each orchid clone is unique and reacts differently to viral infections. Some look normal and some exhibit distortion and necrosis. It's the normal looking clones or "carriers" that cause the real problem and are the reason that testing is very important.

## Common orchid viruses and what they may look like

Many viruses are spread by insect vectors like thrips, aphids and mites. We'll talk about these later. However, the two most common viral pathogens found in orchids, *Cymbidium mosaic virus* (CymMV) and *Odontoglossum ringspot virus* (ORSV), are not transmitted or spread by insects. Instead, you play the role of the vector with all your tender, loving care. Viruses can be spread by primping and preening with dirty tools (known as mechanical transmission), reusing dirty pots and potting media and not cleaning hands or work surfaces. Virus particles live in plant cells and are released when the leaf is cut into or wounded during any kind of orchid maintenance or division. Both CymMV and ORSV are very stable pathogens that can live outside of your orchid for very long periods of time. Let's take a closer look at both of these pathogens:

*Cymbidium mosaic virus* (CymMV) is a Potexvirus and probably the most common and widely distributed of the orchid viruses. It is generally found only in cultivated orchids, not those found in the wild. Mechanical transmission via tools and such is the way it is spread, not by seed or insects. Symptoms typically include chlorosis or necrosis on the foliage usually as a mosaic pattern, lesions or streaks (Figure 1). Sunken necrotic spots may also occur on the leaves (Figure 2). Flower symptoms consist of flower break (irregular discolored spots or streaks on the petals) or as necrotic streaks or sunken spots on the petals. Flower symptoms generally do not appear until after the bud has opened for a week or more. Freshly opened flowers rarely have symptoms. Less obvious symptoms can also occur such as slowed or stunted growth, poor flowering, or overall poor plant quality. For orchids recently infected with CymMV, it is common for the plant not to exhibit any symptoms until the first time the plant flowers or becomes stressed after infection. Some orchids never display symptoms. Even without symptoms, the virus is present, infectious and poses a risk of infecting the rest of your collection.



Figure 1 - CymMV infected *Lycaste* species.  
Photo: Dr. R. McMillan, Homestead Florida

*Odontoglossum ringspot virus* (ORSV) is a Tobamovirus and was once referred to as *Tobacco mosaic virus orchid* strain (TMV-O). It was determined that these two pathogens are very closely related but distinct enough to be considered separate viral pathogens. Tobamoviruses other than ORSV are not considered to be serious pathogens of orchids. As with CymMV, ORSV is also spread through mechanical transmission only. Foliar symptoms generally include chlorotic or necrotic rings, spots, or streaks which may or may not be sunken (Figure 3). In the case of orchid varieties with reddish or violet pigmented leaves, the symptoms could include intense red pigmentation. Flower symptoms are common with ORSV, usually as color break (Figure 4). As with other viruses, ORSV-infected orchids might not exhibit any symptoms while still serving as an infectious host.



Figure 2 - Healthy leaf (left) CymMv infected leaf (right) *Dendrobium* species.  
Photo: Dr. R. McMillan, Homestead Florida

These two viruses, CymMV and ORSV often occur individually as a single infection. However, if an orchid is exposed to both viruses, they readily occur as a dual infection. A dual infection may cause an enhancement of the symptoms that would have been otherwise expected from a single infection.

### Other common orchid viruses

CymMV and ORSV only infect orchids, and are the most documented and studied viruses of orchids. However, other viruses are known to infect orchids, many of which have a wide host range that includes house plants, garden plants, or even field crops. All of these may be transmitted mechanically with contaminated tools or media. Some of these other viruses are also spread by insects or mite vectors, which if present, must also be eradicated to prevent further spread of the virus. These vectors may transmit viruses in one of two ways: a persistent manner (mites, nematodes or thrips) which transmit the virus for weeks after last coming in contact with the virus; or non-persistent (aphids) which only transmit the virus for up to a few hours after exposure to the virus.



Figure 3 - ORSV infected *Cattleya* species.  
Photo: Dr. R. McMillan, Homestead Florida

Systemic infections are common in orchids meaning that once the virus has infected its host, the virus may be found throughout the plant.



For some viruses, especially the Tospovirus group, the virus may infect its host locally, meaning that the virus is limited to localized parts of the plant. This usually manifests as lesions or chlorotic spots, and the virus is present only in the immediate vicinity of the symptoms. Both infection types are equally contagious. Described below are some of the other viruses for which growers and hobbyists have been known to test and how they infect orchids.

*Orchid fleck virus* (OFV) is a Rhabdovirus which may also be spread by the false spider mite (*Brevipalpus californicus*), a pest of orchids. Symptoms associated with OFV infection include chlorotic or necrotic speck or spots on foliage.

*Tomato spotted wilt virus* (TSWV) is a Tospovirus which may also be transmitted by thrips, a common greenhouse pest. For systemic infections, symptoms usually occur as ring or spot patterns on the foliage, which can be sunken into the leaf surface.

*Impatiens necrotic spot virus* (INSV) is a Tospovirus related to TSWV, but is distinct enough such that it is a separate virus. Symptoms and methods of transmission are similar to TSWV.

*Capsicum chlorosis virus - phalaenopsis isolate* (CaCV) is also a Tospovirus like TSWV and INSV. CaCV was originally found in pepper, but was found to infect orchids, originally *Phalaenopsis* from Taiwan, where it may or may not have truly originated. It had once been known as “Taiwan *phalaenopsis virus*” until proven as an isolate of CaCV.

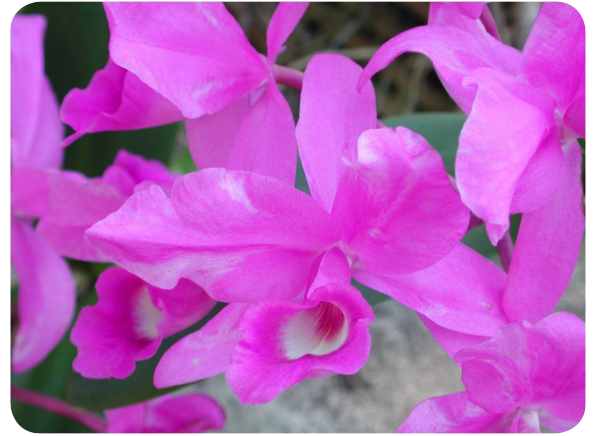


Figure 4 - ORSV infected *Cattleya* species.  
Photo: Dr. R. McMillan, Homestead Florida

*Cucumber mosaic virus* (CMV) is a Bromovirus which can be spread by aphids. Orchid symptoms include yellow streaks occurring lengthwise on the foliage with mild color break on the flowers. Leaves may be distorted in a long “shoe-string” manner.

*Bean yellow mosaic virus* (BYMV) is a Potyvirus with a wide host range and can be aphid transmitted.

*Masdevallia* and *calanthe* are believed highly susceptible to some strains. Symptoms include patterns of chlorotic spots or flecks on the foliage. Flower symptoms may include color break or distortion. Other Potyvirus-group viruses related to BYMV known to infect orchids include:

- Clover yellow vein virus* (CIYVV)
- Dendrobium mosaic virus* (DeMV)
- Phalaenopsis chlorotic spot virus* (PhCSV)
- Turnip mosaic virus* (TuMV)

*Vanilla mosaic virus* (VanMV) is a similar Potyvirus. This virus was originally found in vanilla orchids cultivated for vanilla beans which remain the only known hosts. However, with the increasing interest amongst hobbyists to grow vanilla orchids, so increases the possibility of VanMV finding its way into a collection. Symptoms on foliage often include a chlorotic or necrotic mosaic pattern.

*Carnation mottle virus* (CarMV) is a Carmovirus spread by mechanical transmission and notorious for remaining infectious on tools or workbenches for long periods of time. Symptoms appear on foliage as chlorotic spots, often in a pattern across the leaves.

*Cymbidium ringspot virus* (CymRSV) is a Tombusvirus. Symptoms that appear are generally a chlorotic ring mottle pattern on the leaves. CymRSV can occur as a dual or triple infection with CymMV and/or ORSV causing an intensification of symptoms.

*Tomato ringspot virus* (ToRSV) is a Nepovirus often spread by nematodes, though usually not for orchids. The culprit nematodes generally inhabit soil only and are unlikely to inhabit epiphytic media used for most orchids. Nematode transmission is more of a risk for terrestrial orchids grown in soil and mechanical transmission is the more likely threat to most orchids. Symptoms occurring on foliage include chlorotic spots or rings with possible leaf deformation.

*Tobacco rattle virus* (TRV) is a Tobravirus also associated with nematode transmission. As described with ToRSV, nematodes should only be a threat to terrestrial orchids and contaminated tools are the primary threat of TRV amongst orchid hobbyists. Symptoms generally occur on foliage as yellow line patterns, ringspots, necrotic specks, or misshaped perhaps dry leaves.

There are many more viruses that have been found to make orchids their host, and probably many more to be discovered in the future.

**Don't make assumptions. You have testing options:**

**Laboratory Based Testing:** There are about thirty documented orchid viruses, seventeen are confirmed. With the exception of *Orchid fleck virus* (OFV), assays for the detection of the viruses we have talked about are readily found in the US. Some are laboratory based assays offered by agricultural diagnostic facilities such as university diagnostic clinics or private companies such as Agdia, Inc/Agdia Testing Services. This option is a way to screen your orchids for a large number of viral pathogens. Samples submitted to Agdia Testing Services, requesting the Orchid Screen, would be tested for:

<i>Cucumber mosaic virus</i>	CMV
<i>Cymbidium mosaic virus</i>	CymMV
<i>Cymbidium ringspot virus</i>	CymRSV
<i>Impatiens necrotic spot virus</i>	INSV
<i>Odontoglossum ringspot virus</i>	ORSV
Potyvirus group test	POTY
<i>Tomato ringspot virus</i>	ToRSV
<i>Tomato spotted wilt virus</i>	TSWV

As you can see, this screening represents a large number of the viral pathogens previously talked about. Pathogens not listed in the Orchid Screen can be tested by other laboratory based assays.

**At home test kits:** This option allows you to test your orchids in your kitchen, greenhouse or even at the time of purchase, if you choose. These test kits all use the same basic technology but are marketed under different names. Test kits offered by Agdia, Inc. are called ImmunoStrip® Kits. Many of the viral pathogens listed in this article are available in the ImmunoStrip® format. The two most prevalent of these viruses, CymMV and ORSV are combined onto one ImmunoStrip®, *Cymbidium mosaic virus* and *Odontoglossum ringspot virus* ImmunoStrip® Kit or The Orchid ImmunoStrip®. Agdia's ImmunoStrip® kits come with the test strips, buffer filled mesh bags used for extracting your sample and running the test, and easy to follow instructions. All you need is a pair of scissors to cut the buffer filled mesh bag open, a blunt object to use in the extraction process and something to help keep the mesh bag in an upright position. Agdia's ImmunoStrip® tests are specific to the pathogen it is labeled for and give you an answer in no more than thirty minutes. What is that answer? In the case of the Orchid ImmunoStrip® test, the answer is whether your orchid is infected with CymMV, ORSV or both. If negative for both CymMV/ORSV, then you keep looking for the cause of the symptoms. Causes could be other viral pathogens or physiological disorders such as light intensity, fertilizer burn or water imbalance.

**What do you do if your prized orchid is found to be infected with a virus?**

This may be the most difficult question regarding orchids and viruses. Simply said, the knowledge that your orchid is infected with a virus is just that: knowledge; which is a tool to guide you in taking action. The action you take needs to be based on the value you place on the infected orchid. Is that value based on a large monetary investment, sentimental value or is your collection host to rare, one of a kind or historic orchids? Just like if your doctor said you were in need of a major surgery, you would probably get a second opinion. The same holds true for a positive ImmunoStrip® result.

Getting a positive result confirmed is important if you are going to dispose of the infected orchid, especially if it falls into one of the value categories, listed earlier. I would like to make sure all readers understand that disposing of an infected orchid is not mandatory. Steps can be taken before and after the test result that will help make sure the healthy orchids remain healthy:

- 1) Make sure to keep all new orchids separated from your current collection until you have tested them. If an orchid is labeled "Virus Free" make sure to ask what viruses it has been found free of. Make sure they can be specific with the answer. Nothing can be virus free.
- 2) If an orchid starts to exhibit symptoms, immediately separate it from your collection. If you have an at home test kit, test it immediately or send a sample to be tested.
- 3) If an orchid is found to be infected, it could live in a quarantined area created for known, infected orchids and continue to provide you with many years of beauty.
- 4) Always use good sanitation practices when tending to your collection. We will discuss these practices in the next section.

There may come a day when virused orchids can be cured but until then, you just need to know they are infected, move them away from the rest of the collection and follow the steps outlined in the next section.

### **How to keep your tender loving care from spreading virus throughout your collection**

One way to help control the spread of virus is to keep insect populations, under control. Viruses that are not stable outside of the host are usually spread by insects such as aphids and thrips. The viruses that are very stable outside of the host are the ones that you spread through your collection with your tender loving care. Here are the sanitation practices you need to implement:

- 1) Always work on known healthy orchids first. Taking this one step further, you should have a separate work area for your healthy orchids and a separate work area for your infected orchids.
- 2) Your hands can spread viruses so using disposable gloves is useful, making sure to change your gloves between orchids. If you choose not to use disposable gloves, then you need to make sure you are cleaning your hands between each orchid, including under your nails with a 10% bleach solution.
- 3) Always make sure your work surface is cleaned after every orchid. One of the easiest ways to make sure this happens is to use news paper or brown paper that can be thrown away with the completion of each orchid. If you choose not to use a paper barrier, clean up and dispose of all debris then spray the surface down with a 10% bleach solution and let sit on the surface no less than 5 minutes, but 10 to 15 minutes is better.
- 4) Never reuse potting media.
- 5) If reusing pots, rinse the pot, making sure it is free of any debris. Then soak the pot for at least an hour in a 10% bleach solution making sure to rinse thoroughly before using. Bleach residue can be a problem for your orchids. The best practice is to use a new pot.
- 6) Between each orchid, make sure you rinse all visible plant material and sap off the cutting tool. Pay close attention to the area where the scissors are held together. Once the tool is rinsed off, submerge into 10% bleach solution for no less than 5 minutes, but 10 to 15 minutes is better. Be sure to change the bleach solution when it becomes green, rinsing thoroughly in clean water, after each soak. Having more than one set of cutting/trimming/dividing tools is a great way to make sure you are always working with clean tools. As one is soaking, you can use the next clean tool. Disposable razor blades are another option. This allows you to use a new blade for each orchid.



7) Make sure your orchids are not crowded together. Orchid leaves are pretty tough, and it's not likely that they can wound each other just by touching. However, if there is a wound, sap to sap transmission can occur. Better to be safe than sorry.

8) Make sure any orchids that are hanging or on a shelf are positioned so they are not dripping on the orchids below.

Please remember to thoroughly rinse tools, pots and surfaces after they have been dipped or sprayed down with the 10% bleach solution. There are dip/spray products, other than bleach, that are not as corrosive to metal but are more expensive. Bleach is a common household product and is less expensive. The choice is yours, but please make a choice.

If these sanitation steps are not already part of your routine, they may sound like a lot of extra work, but your collection is worth it, right? Just like any new routine, it takes time to figure out the schedule and the best flow, for you. It will become an effortless part of that tender loving care, you so readily give. Healthy, robust orchids with lots of beautiful blooms will be the payoff of your new sanitation routine.

### Old story, new technologies

The viruses are the same. The means of transmission are the same. The effects of a virus infection are the same. Sanitation practices are the same. Why write this article? The technologies available for virus detection and control are different. These new technologies are what connect all this knowledge. Whether you send your orchid samples to a lab or use the many in-home test kits available, you can know if your orchid has a virus and which virus it is, sometimes in as little as thirty minutes.

Hopefully, the virus blinders have been removed and you can clearly see that it is possible to have a flourishing orchid collection.



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Janet Lamborn has been involved in the plant diagnostic industry for over thirteen years at Agdia, Inc. Starting in Agdia's Testing Services Laboratory, she gained considerable knowledge of the crops received in the lab, including orchids. After several years in Testing Services, Janet moved into the Sales and Marketing department. She works closely with Agdia's customers, including specialty crop groups such as orchid societies, making sure members and hobbyists understand what they should be testing for and the options that are available.

#### **Matthew Chambers**

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Matthew Chambers has worked in the plant diagnostic industry for nearly thirteen year at Agdia, Inc. having earlier received a bachelor's degree from Valparaiso University in Chemistry. As a professional, Matthew has worked in developing multiple rapid diagnostic tests for plant pathogens in various hosts including orchids. In his personal life, he is an avid orchid hobbyist.