e-GRO Alert

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Volume 11 Number 21 March 2022

It's the Pictures that Got Big:

Choosing a Microscope for Business (or Pleasure)

Think what you could do with a microscope! Microscopes pick up where hand lenses and hands-free visor magnifiers leave off. There are more questions every year from growers and landscape professionals interested in equipment for examining specimens up close: for identifying symptoms, insects, mites and plant diseases, or taking photos to send in to a Diagnostic Lab. Often critical distinguishing features are apparent or the pest itself is revealed only under high magnification. For example, just this past week we have received inquiries about possible broad mite infestations that could easily be confirmed by the growers themselves under the microscope. Checking beneficial nematodes for viability might be another good use – under higher magnification it's easy to verify the nematodes are moving and estimate the proportion living for determining application rates. Buying a microscope doesn't need to be difficult or expensive (surprise!). Dealers of used equipment may have units remaindered from schools or labs at a large discount and suppliers are often very glad to assist with selecting something appropriate for your needs. For purposes of this article, I'll assume most are interested in a stereomicroscope (also called a stereoscope or dissecting microscope) for examining leaf samples or plant parts, insects or mites, or biocontrol organisms (like beneficial nematodes). Following are some points to consider when purchasing a conventional microscope for use in the business. There are also many digital devices for magnification that can be useful as well but these won't be considered in this discussion.

Older AO stereoscope, one of our lab workhorses, ranges 7x to 42X, with a fiber optic gooseneck light. Note the black focus adjustment knob and the small silver continuous zoom knob. This one has a light reflector built into the base for pathology work.

Cost

We've been using an inexpensive Wolfe stereomicroscope in our Diagnostic Lab for decades. Basic used models are often available through dealers and on-line for under $100 and a recent check found one for $250 that included a light source. Higher-end acceptable used models can run $500 - $1000 (without illuminators). These are all fine for most diagnostic uses in horticultural production or landscape maintenance businesses. Of course, cost can increase sharply from there for new models with added features, but one doesn't need to spend thousands of dollars to get something useful.

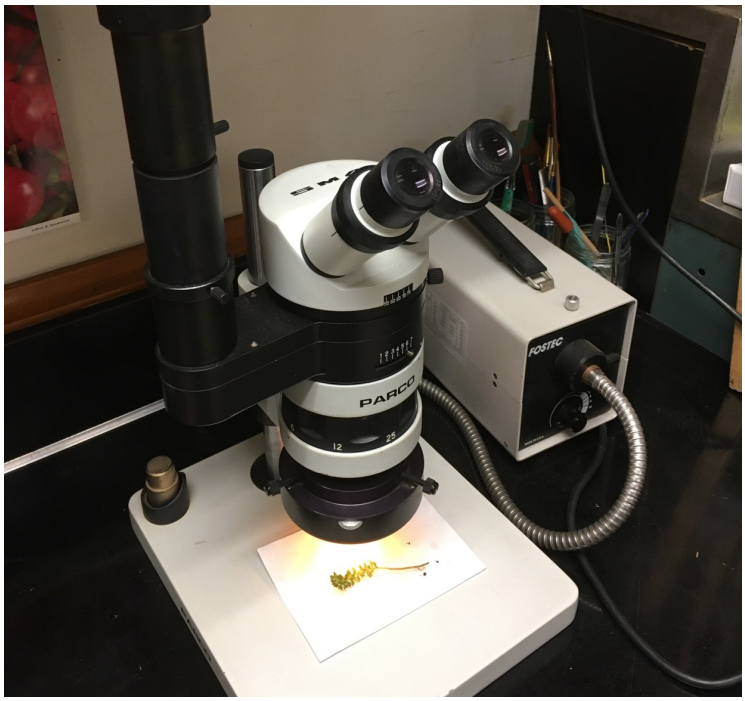
Head

The body of the magnifier itself may have one, two or three tubes including one or two eyepieces (the parts you look through). Most will find two eyepieces ('binocular') easiest to use than one with just a single eyepiece, but a third (trinocular head) tube is sometimes present for a camera. At least one company sells adapters for fitting a camera in place of an eyepiece on binocular models. Eyepieces lenses usually provide 10x magnification but occasionally will be 5x or 20x. Usually one or both of the eyepieces can be rotated to adjust for different eyes and may include a rubber eye cup or ring to allow use when wearing eyeglasses. The distance between the eyepieces is normally adjustable for different users.

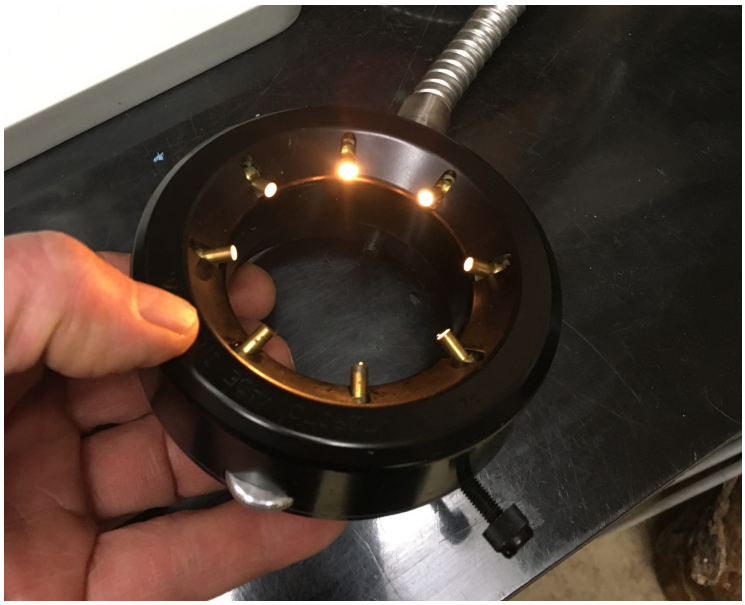
Objective Lens

The lens at the bottom of the head, combined with the eyepiece lens will determine the overall magnification capability. For many a magnification of 20x to 45x – 50x is sufficient; our Home Home Horticulture Lab's model for routine work reaches 55x. In a few cases higher magnification is helpful; we use magnifications up to 120x to look at very small features like antennal segments on bark beetles. Most will not need anything close to this level of magnification. The quality (and price) of objective lenses varies, with higher-end lenses providing less aberration or distortion around the edges, but we've used lower-end optics in our lab for years and found them satisfactory.

Older Wolfe stereoscope with ring zoom (around objective lens) and both incident and transmitted light sources built in. Note the individual adjustment on one eyepiece



This is an inexpensive Parco stereoscope copied after a higher end Wild instrument. IT has a step zoom ring above the objective and a photo tube with camera adapter on the side. There is a fiber optic ring light attached around the objective lens.



Close-up of the fiber optic ring light, removed and inverted. The light direction is easily adjustable.

Older Leica light source for stereoscope. Light level is adjustable. We used these years ago until fiber optic and LED units were available.

Stage or Base

The platform at the base of the computer is where specimens are placed to be examined build-in light sources (and a glass center in the base) that can transmit light through the sample from the base. Most of the time we are not interested in looking at objects with transmitted light (one exception might be looking at beneficial nematodes suspended in water, though you can also see them easily with reflected light) and a higher base (with incorporated lighting) makes it just a little less convenient for handling specimens. Some bases come with clips to hold samples down, which we almost never use. I often place insects and plant material on a piece of paper to keep the platform clean and to make it easy to slide the sample around.

Arm or Post

This part, rising vertically from the base, supports the head and optics. Most stereoscopes have a post where the head itself can be moved up and down (or focused over a long distance). I sometimes find a taller post helpful when placing larger objects like twigs or root balls on the stage, but for flatter samples like leaves or individual insects it's not necessary.

Focus and Zoom

The simplest stereoscopes have only a single magnification with a knob for adjusting the magnification (as noted, eyepieces typically offer correction for individual differences in eyes), but ones most useful offer a range of magnifications, say, from 5x to 50x. A zoom feature may be continuous (any magnification in the range) or step-wise (e.g., 6x, 12x, 25x, 50x), controlled by a separate knob or a ring above the objective. While I personally prefer a continuous zoom, we have models with step zooms that work fine. An added feature with some is a knob for fine magnification to improve the image resolution beyond what the coarse magnification knob provides. To get the clearest image when taking photos its helpful to zoom in on a part of interest and adjust the fine magnification so the image is clear, then back off the zoom to show all the desired part of the image in the frame.

Working Distance

Often expressed in millimeters, this is the distance between the bottom of the objective lens and the specimen – including the space where the specimen and hands can work. I find the working distance of my primary stereoscope (63 mm, around 2 ½") to be rather tight for larger leaf and branch samples, so I may go to another scope that has a larger working distance. Our other lab stereoscope has a working distance of around 4 ¾", but even 3 ½" works well.

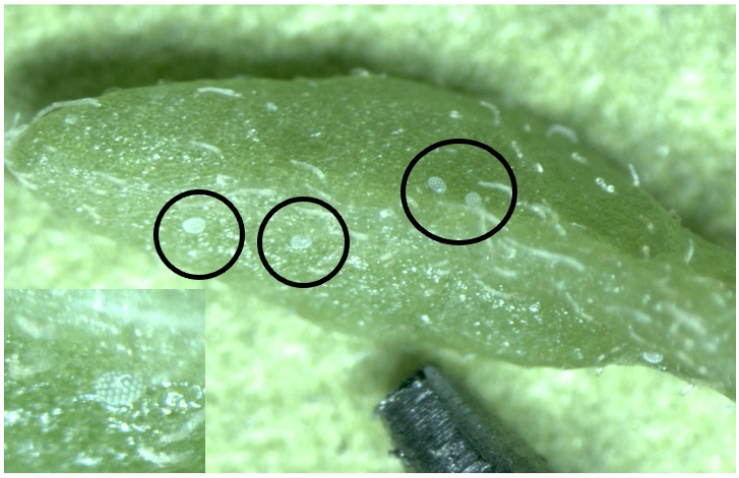
Illuminators

Examining samples under a stereoscope depends upon good reflected light, so a strong focused light source projecting onto the specimen is important, given that the objective lens limits the amount of light that enters. Some stereoscopes have a light source built into the head or mounted as a ring around the objective lens. Older ones may use a small incandescent bulb or fluorescent ring, newer models may have fiber optic or LED sources (which also don't heat the specimen appreciably). Usually the light levels can be adjusted. Most of our stereoscopes don't have integrated lighting; for these we have fiber optic lights on two goosenecks that direct light were needed. The cost for such units tends to be rather high but there are other kinds of illuminators including halogen lamps that work well at much lower cost.

Taking photos

As noted, some microscopes have a built-in third tube to accept adapters for cameras; some even have integrated cameras. A less expensive option might be an adapter (sold by some microscope retailers or available through other on-line sources) for use with certain cameras that fit into one of the eyepiece tubes on a standard binocular stereoscope. Some microscope cameras are solely designed for this particular use, to slip into one of the eyepiece tubes and connect directly to a computer for viewing images and taking photos. These options may be worth the added cost for businesses located far from diagnostic labs.

Looks like broad mite damage - is it? or did the treatment work? A microscope can reveal the answers!



Broad mite eggs are distinctively dotted and fairly easy to see with high magnification.

Be sure photos are clear and of sufficient resolution to see details. While good photos can spare time and expense of submitting samples, they are not always a perfect substitute and the lab may need to examine plant and/or media samples to make a confident determination.

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