Beth Scheckelhoff
scheckelhoff.11@osu.edu

Traditional and Digital Diagnostic Tools of the Trade

This alert covers commonly used tools used to examine and identify insect pests and disease organisms of horticultural crops.

E-Gro alerts highlight many plant and pest problems encountered in the greenhouse. Alerts are one of many resources and tools you can use to help accurately diagnose plant and pest problems – with the goal of reducing losses and maximizing production. *How adept are you and your staff at accurately identifying plant problems and pest issues?* Can you determine what causes the leaf damage in Figure 1?

Figure 1. *Nepeta* x'Walker's Low' with white stippling on leaves. Images taken by Beth Scheckelhoff with a Nikon Coolpix P950 digital camera.

Reprint with permission from the author(s) of this e-GRO Alert.

Many plant and pest problems can be accurately diagnosed with the naked eye. Others are more elusive and must be confirmed with additional diagnostic tools and/or assistance. What tools are in your diagnostic toolbox? Following are a few basic tools to consider including in your toolbox.

Please note: the use of brand names or specific products is solely for educational purposes and does not imply endorsement by e-Gro or our partners, nor discrimination against similar brands, products or services not mentioned.

www.e-gro.org

Magnifiers. One of the most essential diagnostic tools is the loupe or magnifier. This simple tool can be carried in your pocket or around your neck. Loupes are designed to be held or worn close to your eye and are used for reading small print, examining jewelry, and viewing plants and insects.

Magnification commonly varies from 3 to 15x but can be as high as 30x. Modern loupes may include one or more LED lights to assist in viewing objects. These are helpful in identifying small pests such as spider mites and thrips. Smaller pests like eriophyid mites and broad mites must be identified with a magnification of 20x or greater. Loupes vary in price from approximately $10 to $60.

Traditional Microscopes. For general diagnostics such as insect or disease identification, a dissecting (also called stereo) microscope is often used. Dissecting scopes are versatile and offer three-dimensional images at low magnification (usually 5 to 45x).

Figure 2. A TOMLOV D602 digital microscope (top) was used to capture this high-resolution image of a sage leafhopper (*Eupteryx melissae*) nymph causing stippling on catmint (*Nepeta* x'Walker's Low') leaves (bottom). Images taken by Beth Scheckelhoff.

A compound microscope with two or more lenses is used for greater magnification (40x to 1000x+). Compound microscopes are commonly used in biological research for viewing bacteria and cells on slides or plates. Most newer microscopes are also equipped with digital screens and/or digital cameras. These traditional microscopes cost from as little as $75 for student models to well over $1000.

Digital Microscopes. The digital microscope is one of the best tools I have come across to aid in pest identification (Figure 2). Digital scopes with varying magnification, portability, and image properties are readily available online – and are often marketed for jewelry, coin, or electronics inspection. Magnification can vary from 2x to 2000x with prices from $75 to $350 for higher end models. Overall, these provide a cost-effective tool for those working in the green industry.
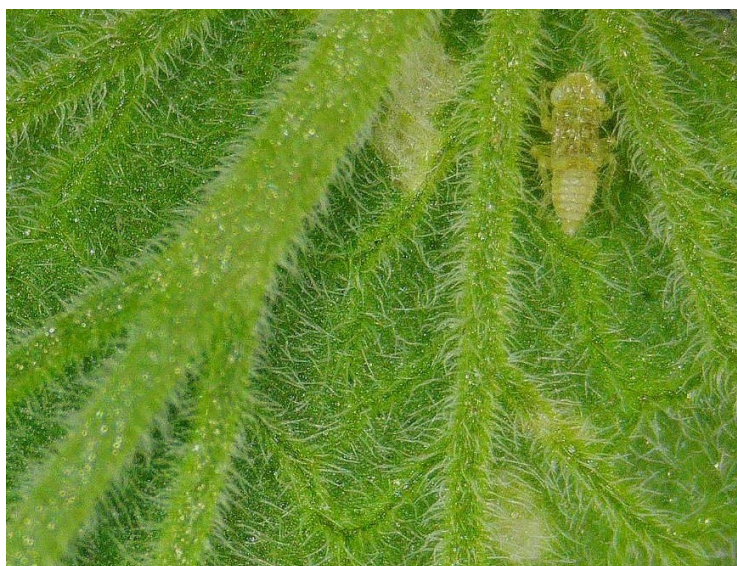
Figure 3. The digital microscope captures clear images of a newly hatched sage leafhopper nymph on underside of a catmint leaf. Feeding damage on this newly unfolded leaf can be seen along the leaf veins. Image taken by Beth Scheckelhoff.

Digital microscopes are generally small and compact, making them easily portable. They may come with multiple lenses to vary magnification levels and often have an attached digital screen or ability to connect to a television, projector, or computer. Some models also capture images and video (Figure 3).

Digital microscopes are a valuable tool for both diagnostics, demonstrations, and teaching. They can be used with staff or peers to view samples and specimens either in-person or remotely. These tools allow images, video, or real-time viewing to be shared with others including extension, university, or industry professionals for timely diagnostics and recommendations.

Handheld Electronic Devices. Nearly everyone has access to a digital camera or tablet, or mobile device equipped with a camera and video capabilities. Image quality and the ability to take close-up images with these devices has improved tremendously over the years. In fact, many people forgo owning a digital camera and simply use their phone for capturing images. These devices are important for documenting and sharing images of issues found in the greenhouse or field. I often use my phone to zoom in on images and observe greater detail than what is visible to the naked eye.

Diagnostic Labs. I would be remiss if I did not mention that not all plant pests or plant problems can be diagnosed on-site. In many cases, samples must be collected and sent to a diagnostic lab for analysis. All US states have at least one plant and pest diagnostic lab associated with a land-grant university. To find a diagnostic lab near you, please visit the National Plant Diagnostic Network at http://www.npdn.org. There are private labs that also provide fee-based sample evaluation and diagnostics. It is a good idea to identify a diagnostic lab you can contact or send samples to when needed.

e-GRO Alert
www.e-gro.org
CONTRIBUTORS

Dr. Nora Catlin
Floriculture Specialist
Cornell Cooperative Extension
Suffolk County
nora.catlin@cornell.edu

Dr. Chris Currey
Assistant Professor of Floriculture
Iowa State University
ccurrey@iastate.edu

Dr. Ryan Dickson
Greenhouse Horticulture and
Controlled-Environment Agriculture
University of Arkansas
ryand@uark.edu

Thomas Ford
Commercial Horticulture Educator
Penn State Extension
tgf2@psu.edu

Dan Gilrein
Entomology Specialist
Cornell Cooperative Extension
Suffolk County
dog1@cornell.edu

Dr. Chieri Kubota
Controlled Environments Agriculture
The Ohio State University
kubota.10@osu.edu

Heidi Lindberg
Floriculture Extension Educator
Michigan State University
wolleage@anr.msu.edu

Dr. Roberto Lopez
Floriculture Extension & Research
Michigan State University
rglopez@msu.edu

Dr. Neil Mattson
Greenhouse Research & Extension
Cornell University
neil.mattson@cornell.edu

Dr. W. Garrett Owen
Sustainable Greenhouse & Nursery
Systems Extension & Research
The Ohio State University
owen.367@osu.edu

Dr. Rosa E. Raudales
Greenhouse Extension Specialist
University of Connecticut
rosa.raudales@uconn.edu

Dr. Alicia Rihn
Agricultural & Resource Economics
University of Tennessee-Knoxville
arihn@utk.edu

Dr. Debalina Saha
Horticulture Weed Science
Michigan State University
sahadeb2@msu.edu

Dr. Beth Scheckelhoff
Extension Educator – Greenhouse Systems
The Ohio State University
scheckelhoff.11@osu.edu

Dr. Ariana Torres-Bravo
Horticulture/ Ag. Economics
Purdue University
torres2@purdue.edu

Dr. Brian Whipker
Floriculture Extension & Research
NC State University
bwhipker@ncsu.edu

Dr. Jean Williams-Woodward
Ornamental Extension Plant Pathologist
University of Georgia
jwoodwar@uga.edu

Copyright ©2023

Cooperating Universities

CornellCALS — College of Agriculture and Life Sciences

Cornell Cooperative Extension — Suffolk County

PennState Extension

IOWA STATE UNIVERSITY

UTIA INSTITUTE OF AGRICULTURE — THE UNIVERSITY OF TENNESSEE

UCONN

College of Agricultural & Environmental Sciences — UNIVERSITY OF GEORGIA

MICHIGAN STATE UNIVERSITY

UofA DIVISION OF AGRICULTURE RESEARCH & EXTENSION — University of Arkansas System

PURDUE UNIVERSITY

THE OHIO STATE UNIVERSITY

NC STATE UNIVERSITY

In cooperation with our local and state greenhouse organizations

MAUMEE VALLEY GROWERS — Choose the Very Best.

Metro Detroit Flower Growers Association

NC FLOWER POWER

Western Michigan Greenhouse Association

CONNECTICUT GREENHOUSE GROWERS ASSOCIATION

Indiana FLOWER GROWERS Association

LIFGA

CINCINNATI Flower Growers ASSOCIATION

Michigan Greenhouse Growers Council

NYSFI — NEW YORK STATE FLOWER INDUSTRIES, INC.