



The Emerging Viruses in Cucurbits Working Group: expanding stakeholder knowledge and awareness of cucurbit viruses in the United States



Rebecca A. Melanson^{1*}, William M. Wintermantel^{2*}, Kassie Conner^{3†}, and Jan Byrne^{4†}

¹Mississippi State University, Central MS Research and Extension Center, Raymond, MS, rebecca.melanson@msstate.edu;

²USDA-ARS, Salinas, CA, bill.wintermantel@usda.gov; ³Auburn University, Auburn, AL, connekn@auburn.edu;

⁴Michigan State University, East Lansing, MI, byrnejm@msu.edu; *EVCWG Co-chairs; †EVCWG members

Problem

Numerous viruses impact cucurbit production in the U.S. by reducing marketable yields and producer profits. Many of these viruses have been present for decades and are endemic in various regions of the U.S.; others were introduced and have rapidly spread throughout U.S. cucurbit production areas (Figures 1 – 5). Symptom similarity as well as the abundance of mixed infections creates challenges for virus disease identification and management; knowledge about the epidemiology of many cucurbit viruses remains limited; appropriate diagnostic methods may not be available or universally practiced for every virus; and limited communication within the industry slows the identification of viruses and implementation of effective management measures that can reduce spread.

Solution

Improved communication and increased stakeholder knowledge of virus threats and their management is necessary to reduce the rate of virus spread and successfully mitigate virus impacts for sustainable cucurbit production in the U.S. The Emerging Viruses in Cucurbits Working Group (EVCWG), which includes members from all sectors of the cucurbit industry, including academia, government, and private industry, involved with research, production, Extension/outreach, and regulation, representing various areas of expertise and geographic regions was established in 2022, with funding support from the Southern IPM Center (Project S22-026), with the mission "to improve communication and knowledge about viruses across the cucurbit industry and develop strategies to successfully identify and mitigate virus threats to cucurbit production in the United States."

EVCWG Activities

To achieve its mission, the EVCWG holds quarterly meetings; identifies and discusses priorities for virus mitigation; delivers presentations to various stakeholder groups; develops educational resources on cucurbit viruses (images of examples below); and hosts open meeting sessions and webinars/discussions to increase opportunities for stakeholder participation and education.

All developed resources, including fact sheets, educational postcards (in both English and Spanish), a photo gallery, and videos, are available on the EVCWG website, along with a list of references to protocols for diagnostic methods for key cucurbit viruses.

Through these activities, the EVCWG has, thus far, reached over 6,000 stakeholders, and additional activities and resources are currently in development.

Website: <https://eCucurbitviruses.org>

Emerging Cucurbit Viruses in the United States



Figure 1. Symptoms on a melon plant infected with cucurbit chlorotic yellows virus (CCYV). Photo: W. M. Wintermantel, USDA-ARS.



Figure 2. Symptoms on a pumpkin plant infected with melon severe mosaic virus (MSMV). Photo: R. A. Melanson, MSU Extension, Bugwood.org.



Figure 3. Symptoms on a watermelon plant infected with watermelon chlorotic stunt virus (WmCSV). Photo: S. Gurung, Sakata Seed America, Inc.

Whitefly-transmitted cucurbit virus identification or introduction and spread in the United States



Figure 4. Since the late 1970s, several whitefly-transmitted viruses have been introduced or identified in cucurbits in various cucurbit-producing regions of the U.S., and many, within a few years, have spread to other cucurbit-producing regions of the U.S. An asterisk (*) indicates the first report of a virus in the U.S. The year listed indicates the year of the first identification in the state. Viruses: CCYV = cucurbit chlorotic yellows virus; CuLCrV = cucurbit leaf crumple virus; CYSVDV = cucurbit yellow stunting disorder virus; LIYV = lettuce infectious yellows virus; SLCuV or SLCV = squash leaf curl virus; SqYV = squash vein yellowing virus; WmCSV = watermelon chlorotic stunt virus. Map image © Mapchart.net.

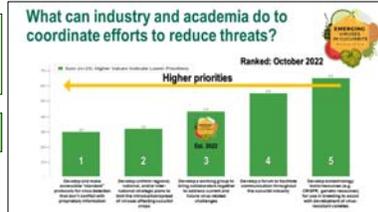
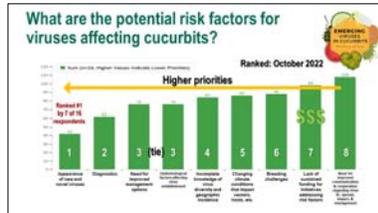
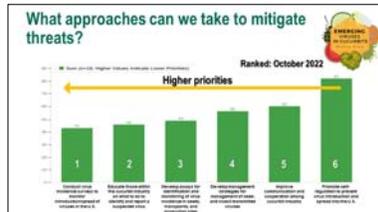
Cucurbit Viruses in the United States

Insect		
Whiteflies Vector: Sweetpotato whitefly (<i>Bemisia tabaci</i>) Begomovirus Cucurbit leaf crumple virus (CuLCrV) Squash leaf curl virus (SLCuV) Watermelon chlorotic stunt virus (WmCSV) Crinivirus Cucurbit chlorotic yellows virus (CCYV) Cucurbit yellow stunting disorder virus (CYSVDV) [historic] Lettuce infectious yellows virus (LIYV) Ipotovirus Squash vein yellowing virus (SqYV) Vector: Greenhouse whitefly (<i>Trialeurodes vaporariorum</i>) Crinivirus Beet pseudoyellows virus (BPYV)	Aphids Vectors: Multiple aphid species, including melon (cotton) aphid (<i>Aphis gossypii</i>) and green peach aphid (<i>Myzus persicae</i>) Cucumovirus Cucurbit mosaic virus (CMV) Polevirus Cucurbit aphid-borne yellows virus (CABYV) Potyvirus Papaya ringspot virus (PRSV) Watermelon mosaic virus (WMV) Zucchini yellow mosaic virus (ZYMV)	Beetles Vectors: Cucurbit beetles, including the spotted cucumber beetle (<i>Dibrotica undecimpunctata howardi</i>) and striped cucumber beetle (<i>Acalymma vittatum</i>) Comovirus Squash mosaic virus (SqMV) Beet Leafhopper Vector: Beet leafhopper, <i>Neotilanus tenellus</i> (formerly <i>Circulifer tenellus</i>) Curtovirus Beet curly top virus (BCTV)
Nematode Vector: Dagger nematode (<i>Xiphinema americanum</i>) Nepovirus Tobacco ringspot virus (TRSV) Tomato ringspot virus (ToRSV)	Fungus Vector: <i>Leioptidium bornovanum</i> (formerly <i>Opidium bornovanum</i>) Carmovirus Melon necrotic spot virus (MNSV)	Not Identified/Confirmed Coguvirus Watermelon crinkle leaf-associated virus 1 (WCLAV-1) Watermelon crinkle leaf-associated virus 2 (WCLAV-2) Orthotospovirus Melon severe mosaic virus (MSMV) [suspected thrips vector]
Seed Comovirus SqMV Tobamovirus Cucurbit green mottle mosaic virus (CGMMV) [transient] Watermelon green mottle mosaic virus (WGMMV) [transient]	Mechanical Comovirus SqMV Cucumovirus CMV Ipotovirus SqYV Potyvirus PRSV, WMV, ZYMV Tobamovirus CGMMV [transient] WGMMV [transient]	Figure 5. Numerous viruses that impact cucurbit production or for which cucurbits are a primary host have been identified in one or more cucurbit-producing regions of the U.S. Some of these viruses have been present for decades while others have only recently been introduced, and some are yearly production concerns while others have not been detected in years (historic) or are under official control in the United States (transient). These viruses, outlined in this figure, according to mode of transmission and genus, are primarily transmitted by insect vectors. In some cases, the mode(s) of transmission have not yet been identified. Virus prevalence and impact varies by region and is influenced by crop, reservoir host, and vector presence and prevalence. Virus identification by symptoms alone is not possible due to symptom similarity and mixed infections. An ❶ indicates there is an EVCWG fact sheet available on this virus.

Priorities

In 2022, the EVCWG addressed three key discussion topics/questions (see graphs below) during its quarterly meetings. Responses to each question were discussed in detail and then grouped into categories. EVCWG members then voted through an online system to prioritize categorized responses (results below; final report available on the EVCWG website). Priorities will be reevaluated in Fall 2024 to account for evolving virus dynamics.

We hope these priorities will be used by others to expand research and Extension efforts focused on emerging viruses in cucurbits to help ensure sustainable cucurbit production in the U.S.



YOU CAN HELP!!

- Learn!** Visit the EVCWG website to learn about viruses that threaten cucurbit production in the U.S.
- Participate!** Attend EVCWG-hosted meetings and webinars to join in the discussion on emerging viruses in cucurbits.
- Spread the word!** Share EVCWG resources and information about virus identification and management in cucurbits with your stakeholders and colleagues!
- Provide feedback!** Visit the EVCWG website or scan the QR code to let us know how this presentation increased your knowledge of the EVCWG and emerging viruses in cucurbits and what topics you would like the EVCWG to address!
- Sign up!** Visit the EVCWG website or scan the QR code to sign up for the EVCWG mailing list to be notified of upcoming EVCWG events, new EVCWG resources, and other EVCWG announcements!



EVCWG Website



Presentation Evaluation



Mailing List

Funding

Funded by the Southern IPM Center (Project S24-048) as part of USDA NIFA CPPM RCP (Agreement No. 2022-70006-38002).

