Produce Safety ALLIANCE

Educators' Call

Produce Safety Educators' Call #79

November 5, 2026

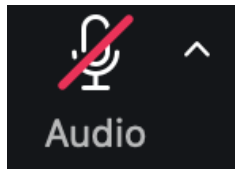
Cyclospora cayetanensis in Produce: What We Know, What We Don't, and... Where We Might Go Next

with Dr. Kali Kniel
University of Delaware

Instructions

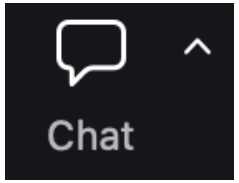
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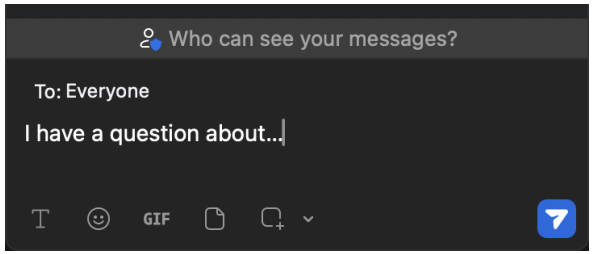
- All participants are muted
- There will be time for questions and discussion at the end of the presentation



2

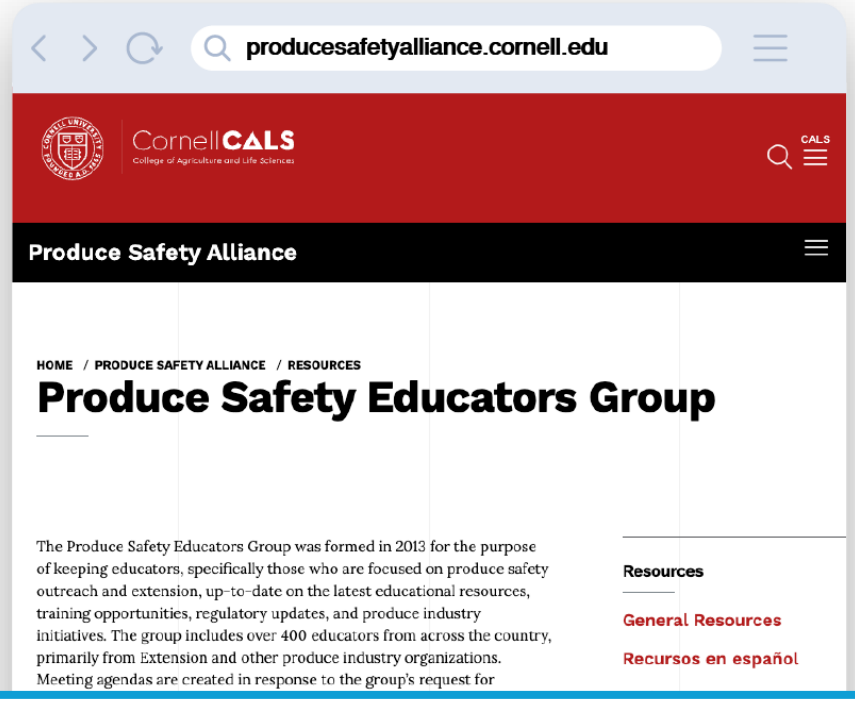
- Feel free to use the chat box to ask questions as well





3

- We are recording this session and will share the presentation via the email list and our website after the call



Agenda

- Introductions
- Presentation. ***Cyclospora cayetanensis*** **in Produce: What We Know, What We Don't, and... Where We Might Go Next**
- Q&A session
- PSA updates and upcoming events

Welcome Back!

- We are very excited to be able to continue these webinars in both English and Spanish!
- Funding for this series of Educators Calls is provided through the PSA Cooperative Agreement
- We really appreciate all your engagement AND the participation of content experts so we can discuss topics important to you



Today's Presentation

- A request to return to the topic of *Cyclospora*
  - Thank you. We always love suggestions!
- Anticipate grower meetings this winter will be have discussions about *Cyclospora* and the outbreak this past summer
  - Important for both understanding and application of food safety practices
- Asked Dr. Kali Kneil to return to expand the discussion
  - She presented an earlier webinar; it is recorded if you did not see it!
- You might have heard some of this before but important for us to have common information to facilitate discussion at the end of the presentation

Kali Kniel, PhD



- Professor, Microbial Food Safety
  - Dept. Animal and Food Sciences, University of Delaware
- Research
  - Survival and transmission of pathogens in different food systems
  - Assessing risks in RAC through water and soil amendments at pre-harvest
  - Correlations between microorganisms and environmental conditions including viral surrogates
  - Transmission mechanisms of viruses and parasites through fresh and frozen berries or lettuce
  - Food safety education through a "One Health" approach
- Education
  - B.S. in Biology, Virginia Tech
  - M.S. in Molecular Cell Biology, Virginia Tech
  - Ph.D. in Food Science and Technology, Food Microbiology and Parasitology, Virginia Tech
  - Postdoctoral Microbiologist. U.S. ARS, Laboratory of Animal Parasitic Diseases

Cyclospora cayetanensis in Produce: What We Know, What We Don't, and... Where We Might Go Next

Kali Kniel, Ph.D.

Unidel S. Hallock du Pont Chair, Microbial Food Safety

Interim Chair and Professor, Department of Animal and Food Sciences

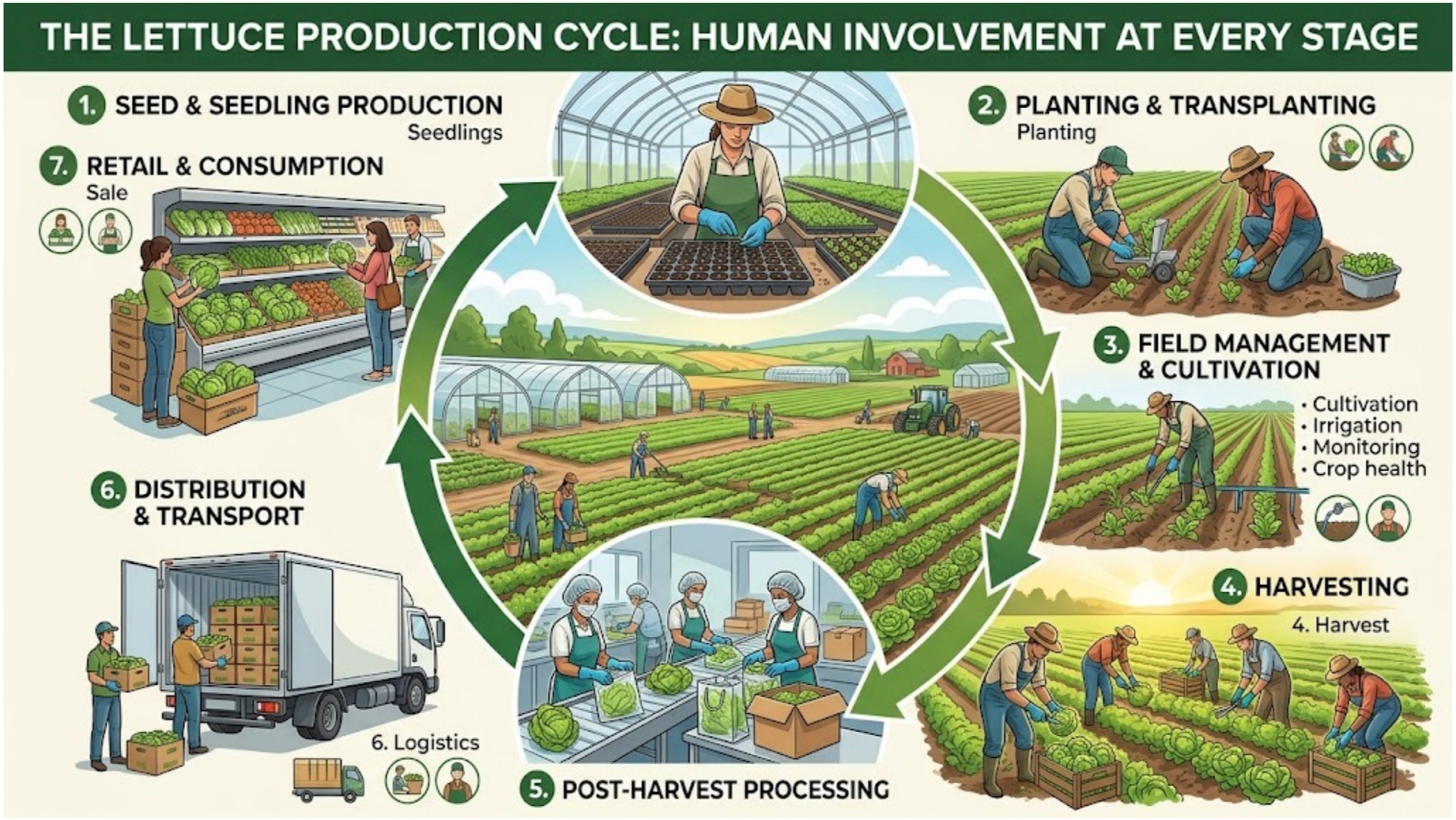
College of Agriculture and Natural Resources

University of Delaware

Today…

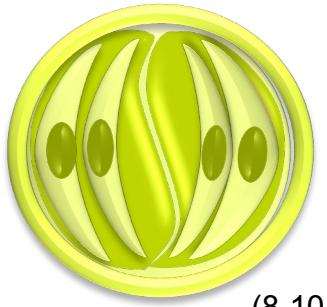
- Brief background on *Cyclospora*
- *What we know and What we don't…*from the past
- Summer 2026 outbreaks and *Where we might go next*

THE LETTUCE PRODUCTION CYCLE: HUMAN INVOLVEMENT AT EVERY STAGE



Cyclospora is not a bacterium

- It is a protozoan parasite
- Unlike bacteria, protozoa can **not** grow outside a host
- Transmitted by ingestion of a **mature** oocysts (sporulated)



(8-10 µm)

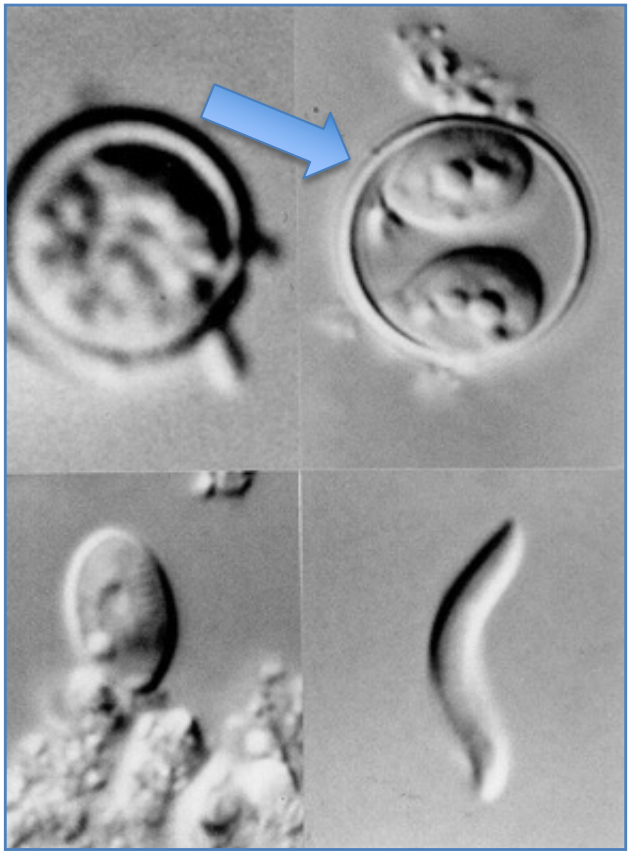
There are still numerous remaining questions, challenges, and work needed to better understand and manage this pathogen.

Difficult to study without an animal or cell-culture laboratory model.


THE RELATIVE SIZE
OF PARTICLES
From the COVID-19 pandemic to the U.S. West Coast wildfires, some of the biggest threats now are also the most microscopic.
A particle needs to be 10 microns (µm) or less before it can be inhaled into your respiratory tract. But just how small are these specks?
Here's a look at the relative sizes of some familiar particles ↘
HUMAN HAIR 50-180µm ›
FOR SCALE
FINE BEACH SAND 90µm ›
GRAIN OF SALT 60µm ›
WHITE BLOOD CELL 25µm ›
GRAIN OF POLLEN 15µm ›
DUST PARTICLE (PM10) <10µm ›
RED BLOOD CELL 7-8µm ›
RESPIRATORY DROPLETS 5-10µm ›
DUST PARTICLE (PM2.5) 2.5µm ›
BACTERIUM 1-3µm ›
WILDFIRE SMOKE 0.4-0.7µm ›
CORONAVIRUS 0.1-0.5µm ›
T4 BACTERIOPHAGE 0.225µm ›
ZIKA VIRUS 0.045µm ›
Pollen can trigger allergic reactions and hay fever—which 1 in 5 Americans experience every year.
The visibility limits for what the naked eye can see hovers around 10-40µm.
Respiratory droplets have the potential to carry smaller particles within them, such as dust or coronavirus.
Wildfire smoke can persist in the air for several days, and even months.
VISUAL CAPITALIST
/visualcapitalist @visualcap visualcapitalist.com

Cyclosporiasis

- *Cyclospora cayetanensis* infects the human intestine
- Spread by people ingesting contaminated produce or water
- *Cyclospora* needs time (typically at least 10-14 days) after being passed in feces to become infectious for another person
  - Sporulated oocysts are infectious
  - So it is unlikely that *Cyclospora* is passed directly from one person to another
- Time from ingestion to illness ranges ~2-14 days

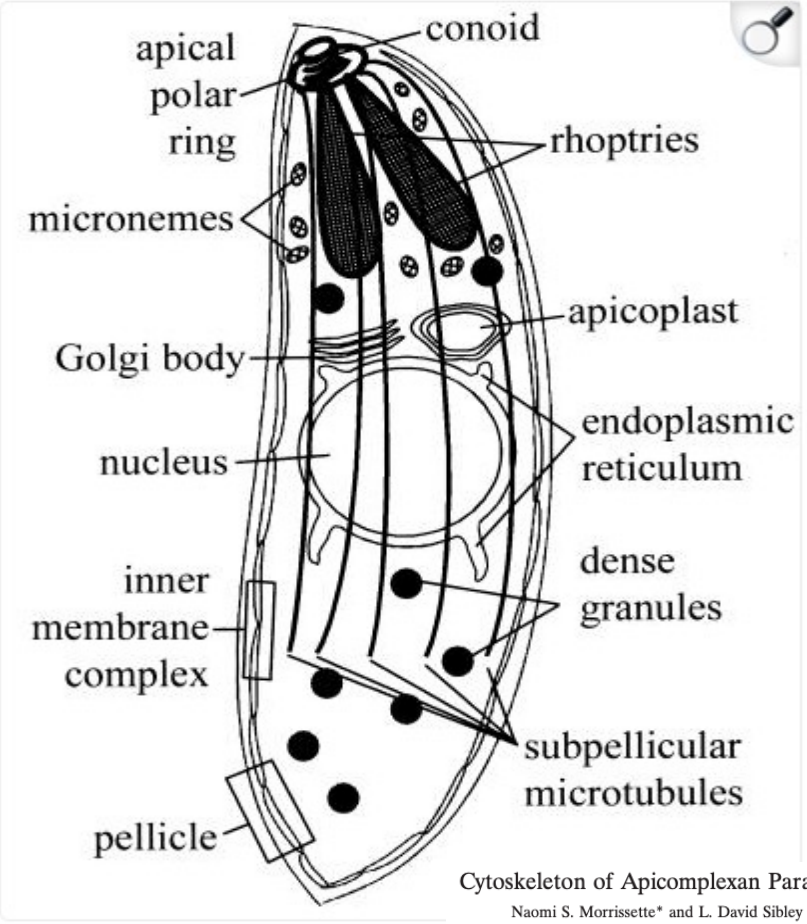




Cyclospora cayetanensis oocyst
(8-10 µm)

Apicomplexa Parasites

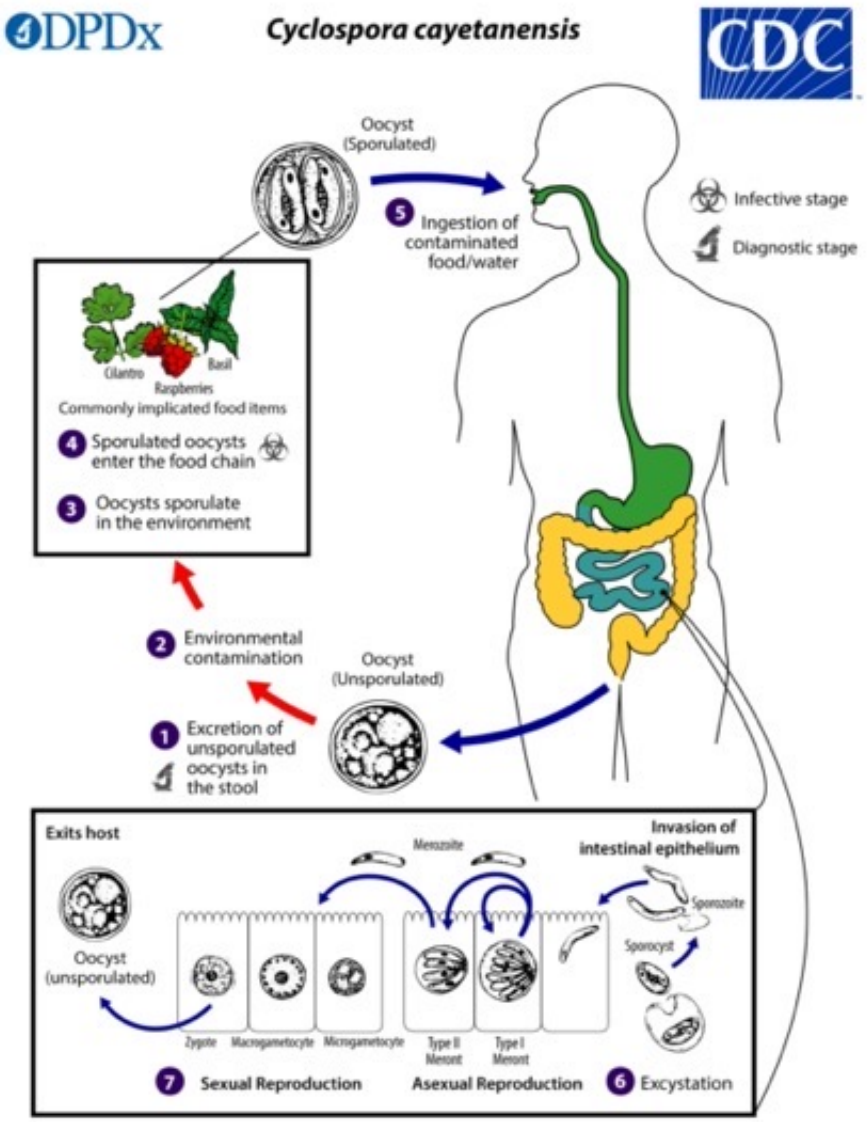
- Large and diverse group of single-celled obligate intracellular protozoa
- Possess a unique structure called the apical complex, which enables them to actively invade host cells
- Cause major diseases with public health and economic impact

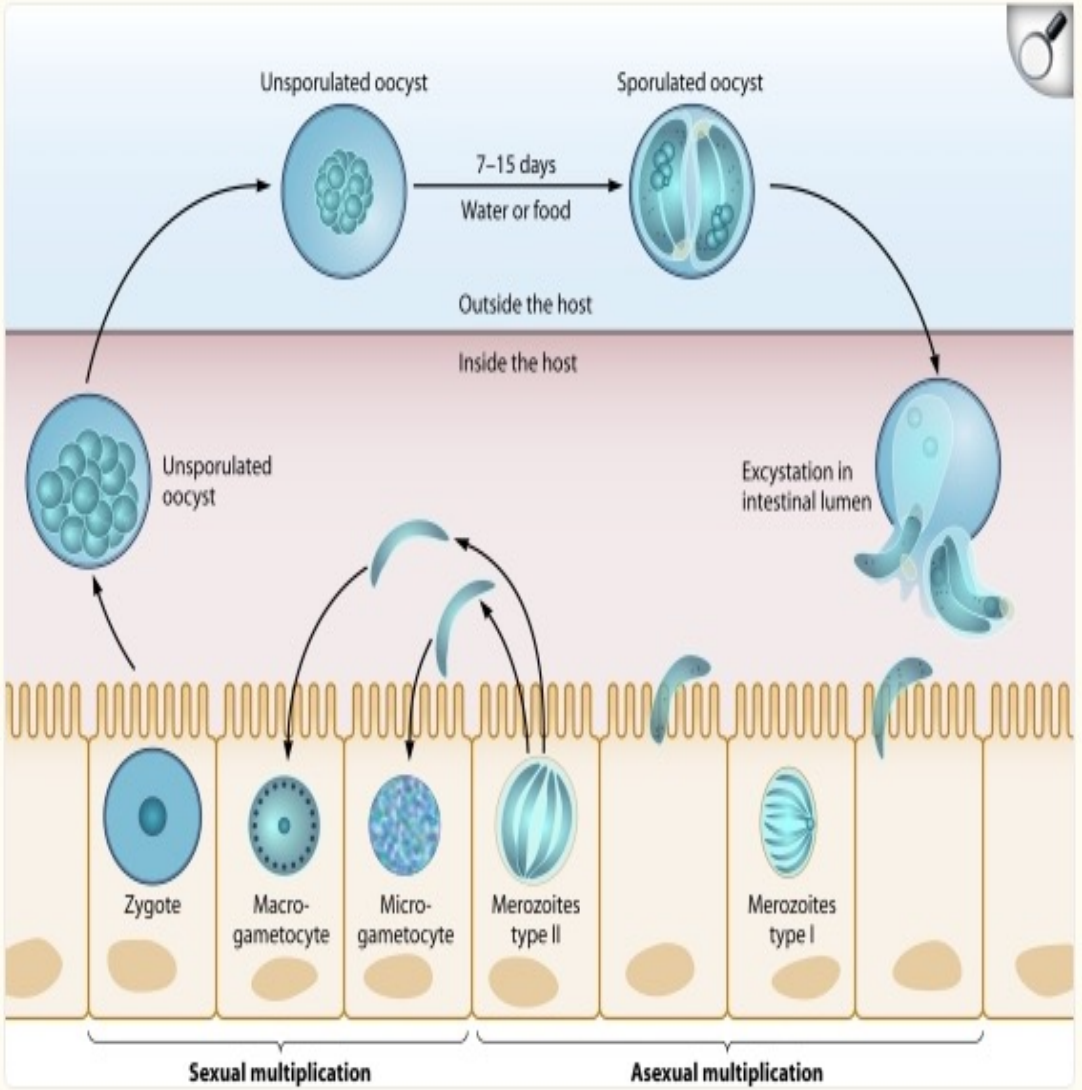


Cytoskeleton of Apicomplexan Parasites

Naomi S. Morrissette* and L. David Sibley

Microbiol Mol Biol Rev. 2002 Mar;66(1):21–38. doi: 10.1128/MMBR.66.1.21-38.2002





Ortega and Sanchez, 2010 ASM Clinical Microbiol Reviews

Symptoms of cyclosporiasis

May last 5-10 days or up to 6 weeks or more

Watery diarrhea (most common)

Loss of appetite

Weight loss

Cramping

Bloating

Increased gas

Nausea

Fatigue

May include vomiting, low-grade fever



- Both immunocompetent and immunocompromised individuals can become sick
- Some people who are infected will be asymptomatic

- Treatment with Trimethoprim/sulfamethoxazole (TMP/SMX)
- *Sold under the trade names Bactrim, Septra, and Cotrim*

cdc.gov

The NEW ENGLAND JOURNAL of MEDICINE

CURRENT ISSUE SPECIALTIES TOPICS

ORIGINAL ARTICLE

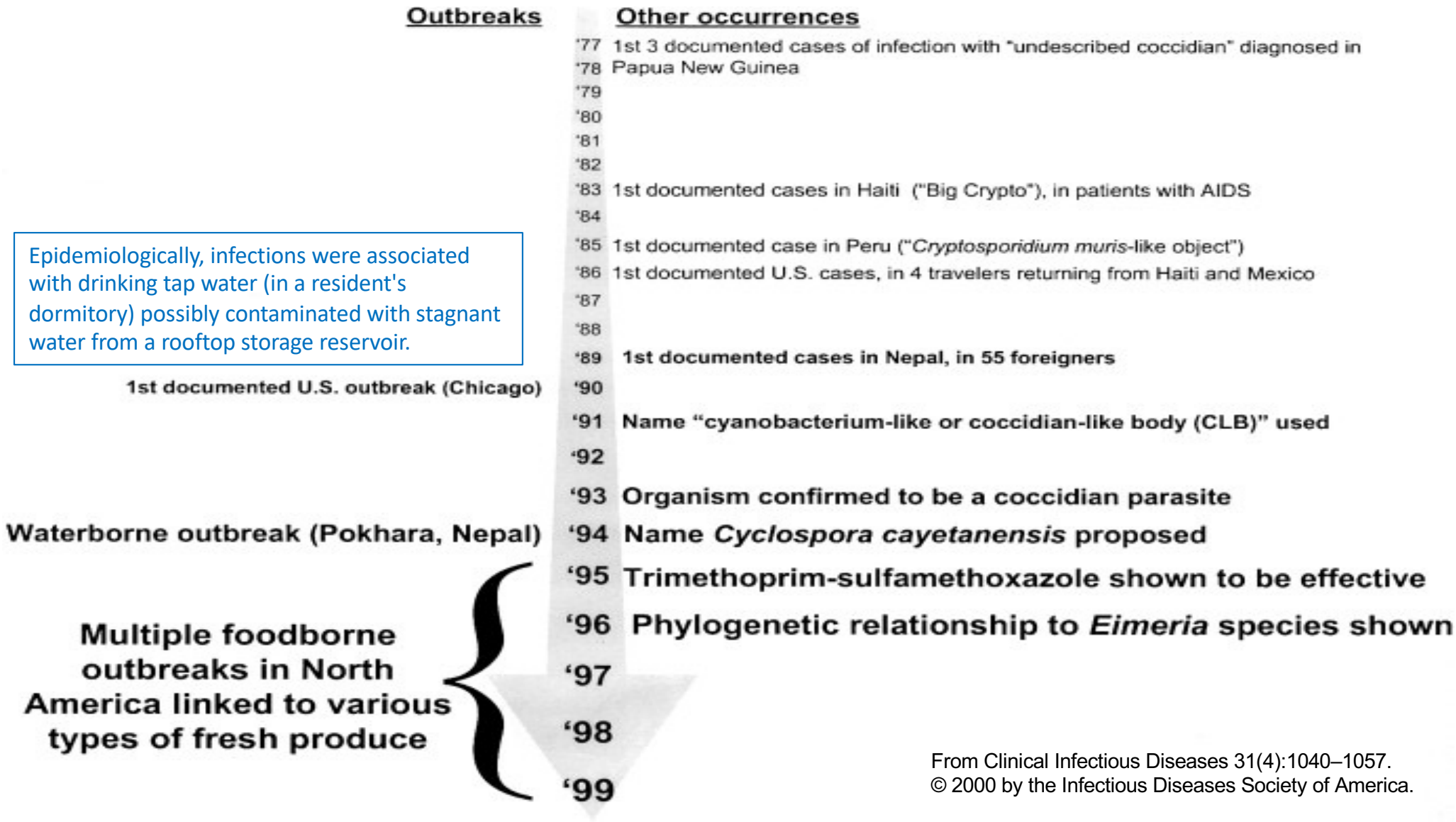
Cyclospora Species -- A New Protozoan Pathogen of Humans

Authors: Ynes R. Ortega, Charles R. Sterling, Robert H. Gilman, Vitaliano A. Cama, and Fernando Diaz Author Info & Affiliations

Published May 6, 1993 | N Engl J Med 1993;328:1308-1312 | DOI: 10.1056/NEJM199305063281804

VOL. 328 NO. 18 | Copyright © 1993

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From Clinical Infectious Diseases 31(4):1040–1057.
© 2000 by the Infectious Diseases Society of America.

Testing for *Cyclospora*? Detection and Genotyping?

Testing methods are primarily restricted to research purposes and for clinical typing in epidemiology of outbreak investigations.



Methodology continues to evolve, including the validation of different food and environmental matrices, reagent variability, and inclusion of appropriate positive and negative controls.

Molecular detection of
18S rRNA
and
Mitochondrial target (Mit1C)



From Clinical Infectious Diseases 31(4):1040–1057.
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Clinical Detection – Syndromic Testing

BIOMÉRIEUX

Performance
Overall 98.5% sensitivity and 99.2% specificity[1]
Sample Type: Stool in Cary Blair medium

BIOFIRE® FILMARRAY® Gastrointestinal (GI) Panel

1 Test. 22 Targets. ~1 Hour.

VIRUSES	BACTERIA	*DIARRHEAGENIC ESCHERICHIA COLI/SHIGELLA*	PARASITES
• Adenovirus F40/41	*Campylobacter (C. jejuni / C. coli / C. upsaliensis)*	*Enteroaggregative E. coli* (EAEC)	*Cryptosporidium*
• Astrovirus	*Clostridioides (Clostridium) difficile* (toxin A/B)	*Enteropathogenic E. coli* (EPEC)	*Cyclospora cayetanensis*
• Norovirus GI/GII	*Plesiomonas shigelloides*	*Enterotoxigenic E. coli* (ETEC) *lt/st*	*Entamoeba histolytica*
• Rotavirus A	*Salmonella*	*Shiga-like toxin-producing E. coli* (STEC) *stx1/stx2*	*Giardia lamblia*
• Sapovirus (I, II, IV, and V)	*Yersinia enterocolitica*	• *E. coli* O157	
	Vibrio (V. parahaemolyticus / V. vulnificus / V. cholerae)	*Shigella/Enteroinvasive E. coli* (EIEC)	
	• *Vibrio cholerae*		

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Detection in produce, soil, water



3 published methods summarized in the
FDA's Bacteriological Analytical Manual (BAM)

(2004) BAM Chapter 19a: Detection of *Cyclospora* and *Cryptosporidium* from Fresh Produce: Isolation and Identification by Polymerase Chain Reaction (PCR) and Microscopic analysis

(2017, 2019, 2020, 2022, 2024, May 2026) Chapter 19b: Detection of *Cyclospora cayetanensis* in Fresh Produce using real-time PCR

(2020) BAM 19c: Dead-end Ultrafiltration for the Detection of *Cyclospora cayetanensis* from Agricultural Water



Detection of *Cyclospora* DNA…needs other information to be meaningful

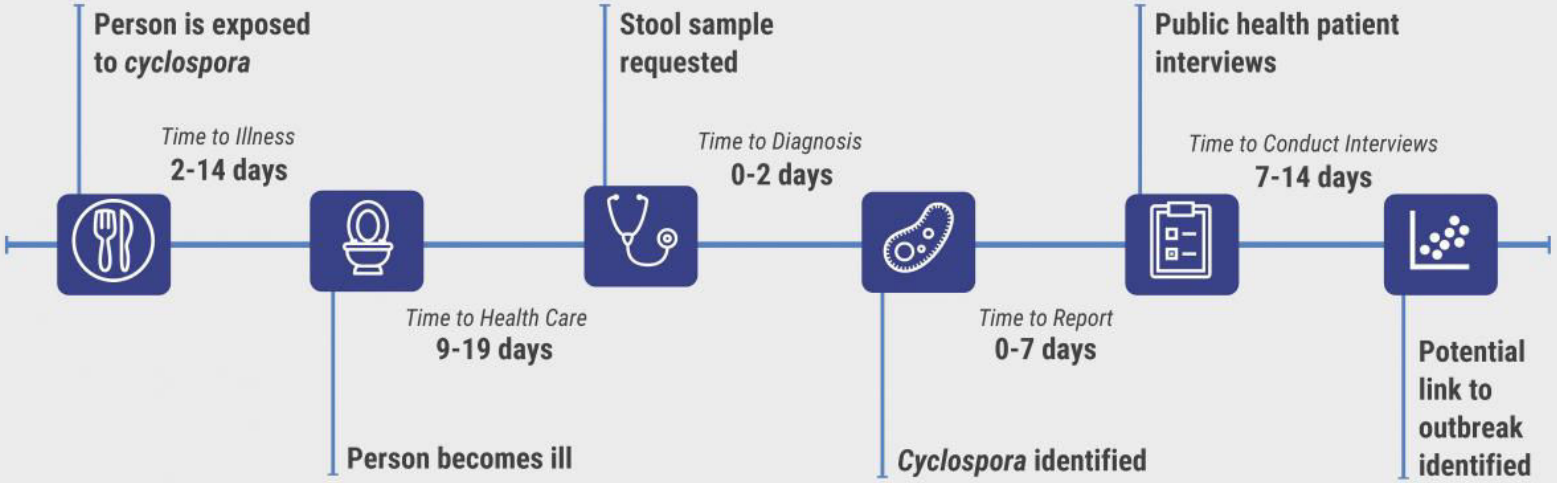
- Epidemiological information
- Geographical information
- Seasonality



OUTBREAK INVESTIGATION TIMELINE

Cyclospora Infection

The time from when a person is exposed to *Cyclospora* from contaminated food or water to the confirmation that he or she is part of an outbreak is typically about three to six weeks.



IDPH

Average Time: 3-6 weeks

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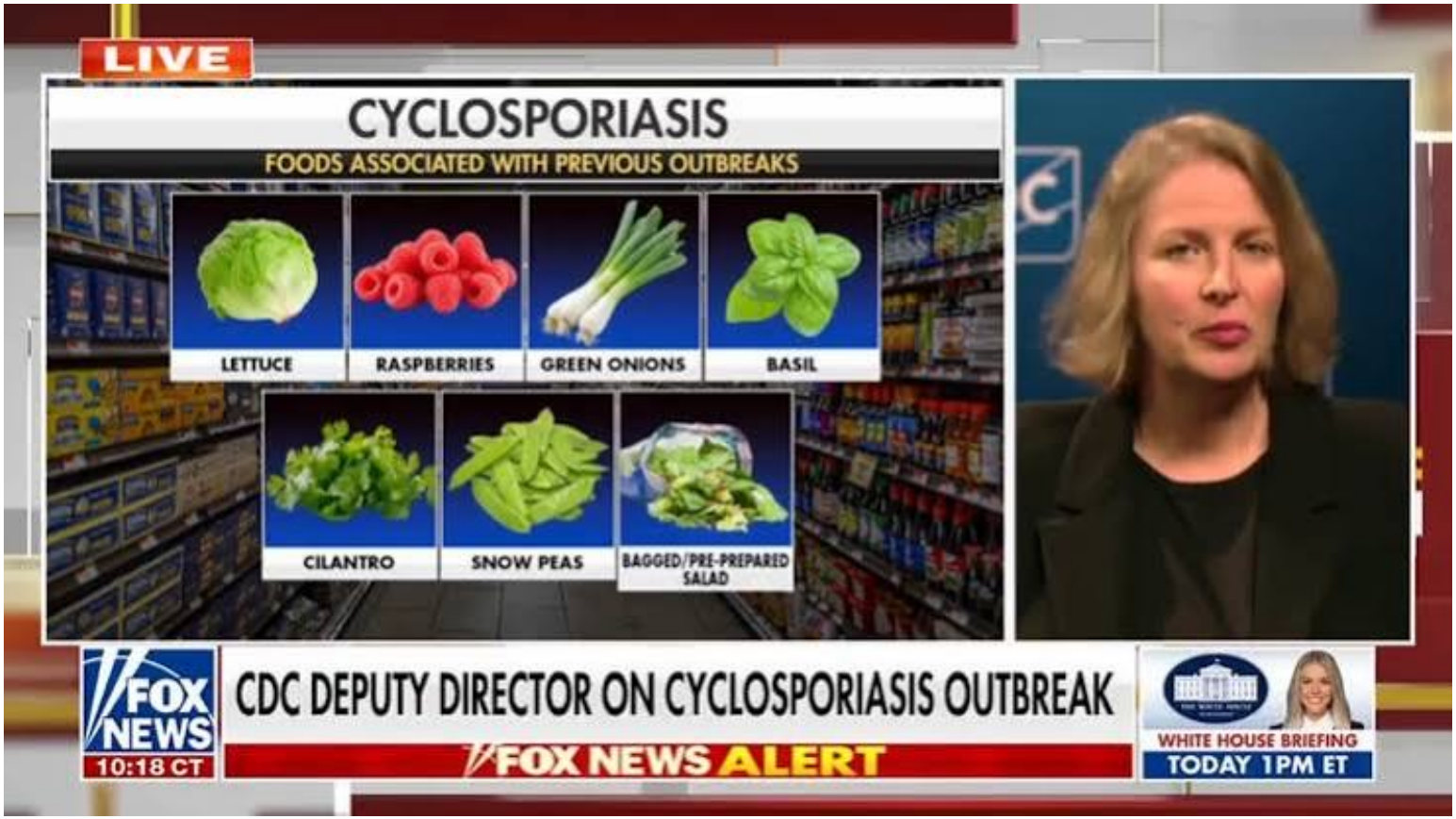
Outbreaks in the 1990s - early 2000s

- Imported produce
- Berries, snow peas, herbs, lettuce
- Sometimes “stealth” ingredients
  - Raspberry coulis
  - Basil in the vinaigrette dressing
- Traceback was often difficult
- Molecular diagnostics varied

Table: Summary of U.S. foodborne outbreaks of cyclosporiasis, 2000–2017

Year(s)*	Month(s)*	Jurisdiction(s)*	No. of cases†	Food vehicle and source, if identified‡
2000	May	Georgia	19	Raspberries and/or blackberries (suspected)
2000	June	Pennsylvania	54	Raspberries
2001	January–February	Florida	39	
2001	January	New York City	3	
2001–02	December–January	Vermont	22	Raspberries (likely)
2002	April–May	Massachusetts	8	
2002	June	New York	14	
2004	February	Texas	38	
2004	February	Illinois	57	Basil (likely)
2004	May	Tennessee	12	
2004	May–June	Pennsylvania	96	Snow peas from Guatemala ∴
2005	March–May	Florida	582 ¶	Basil from Peru
2005	May	South Carolina	6	
2005	April	Massachusetts	58	
2005	May	Massachusetts	16	
2005	June	Connecticut	30	Basil (suspected)
2006	June	Minnesota	14	
2006	June	New York	20	
2006	July	Georgia	3	
2008	March	Wisconsin	4	Sugar snap peas (likely) ∴
2008	July	California	45 ¶	Raspberries and/or blackberries (likely)
2009	June	District of Columbia	34	
2011	June	Florida	12	
2011	July	Georgia	88**	
2012	June–July	Texas	16	

2026: Historically relevant information misunderstood



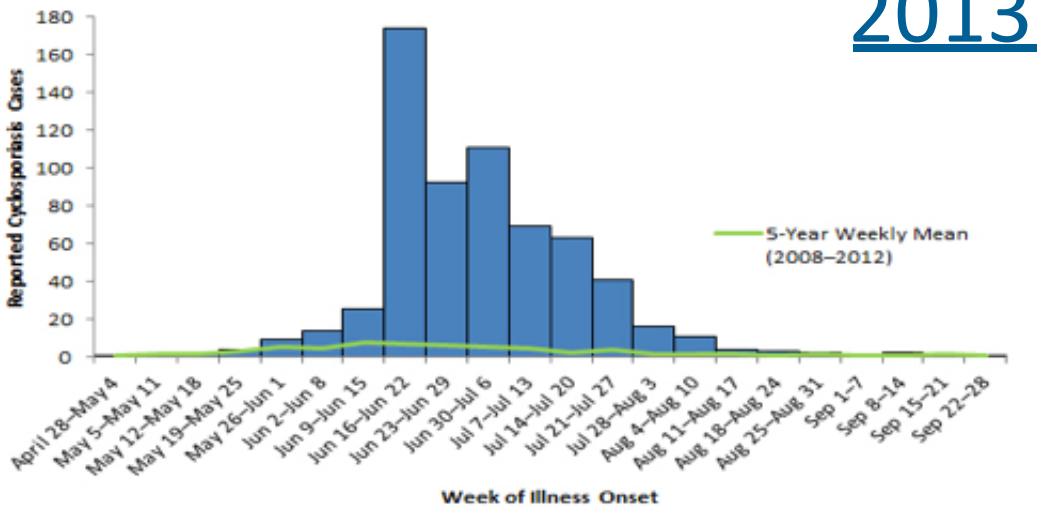
2013- Present

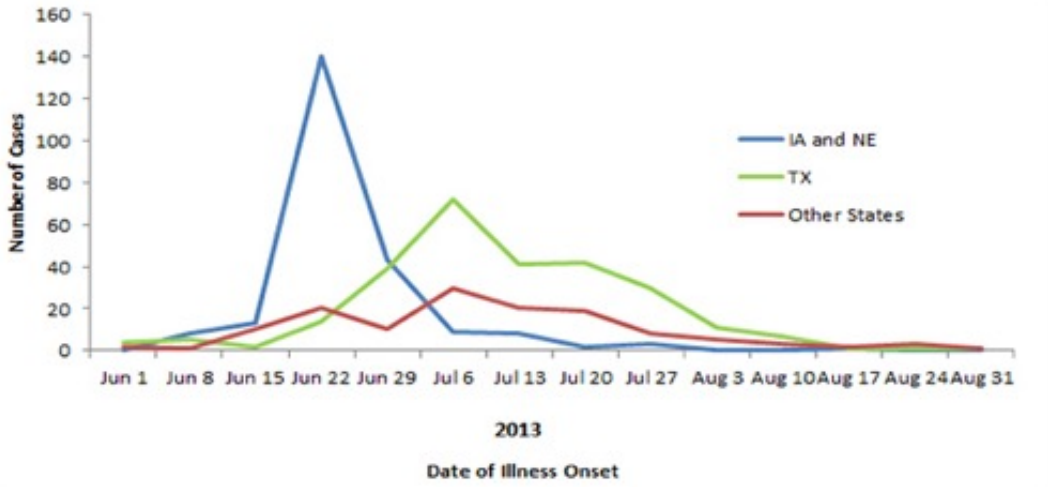
2013

- A total of 631 persons infected with cyclosporiasis were reported from 25 states.
- Most persons became ill between mid-June and mid-July.
- Eight percent (8%) of ill persons were hospitalized, and no deaths reported.
- 2 outbreaks identified: IA and NE linked to salad mix and TX linked to cilantro; both grown in Mexico





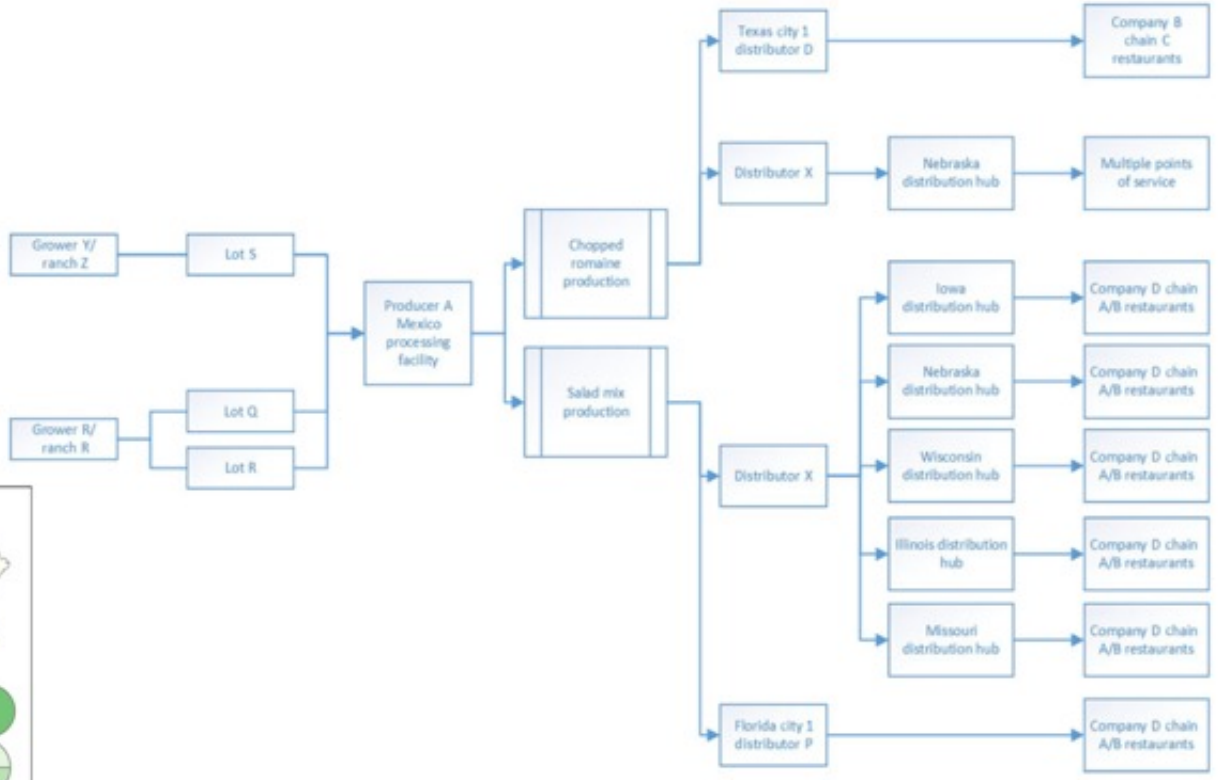


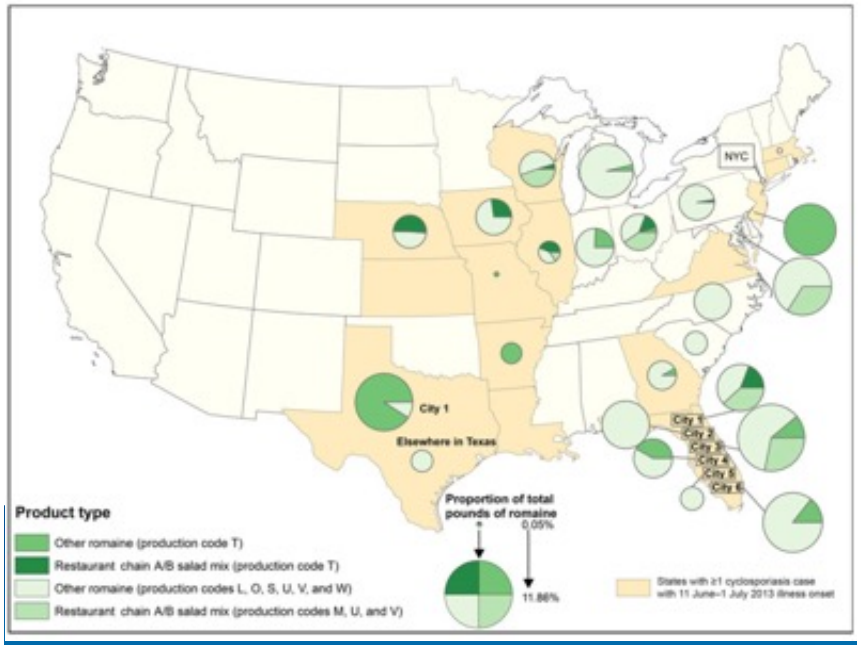


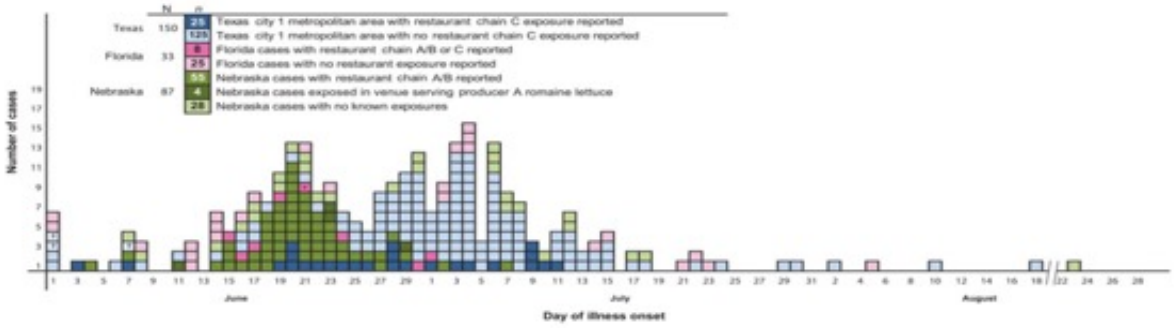
Epidemiol. Infect. (2016), **144**, 2709–2718. © Cambridge University Press 2015
doi:10.1017/S0950268815002320

Multistate product traceforward investigation to link imported romaine lettuce to a US cyclosporiasis outbreak – Nebraska, Texas, and Florida, June–August 2013

B. F. BUSS[1,2]*, M. V. JOSHI[1,3], J. L. DEMENT[4], V. CANTU[5] AND T. J. SAFRANEK[1]







U.S. Food and Drug Administration
Protecting and Promoting *Your* Health

A to Z Index | Follo

ENVIRONMENTAL ASSESSMENT:
2013 Cyclosporiasis outbreak in Iowa and Nebraska – Findings and Recommendations

November 2013



Taylor Farms de Mexico provides medical care to all of their employees. Ill employees are sent home, and a company nurse performs home visits to confirm the employee's recovery and that no other household member exhibits symptoms prior to the employee returning to work. The table below provides a synopsis of individual harvest crew member medical care within the outbreak time of interest. No diagnosis was recorded by the firm as to the probable cause of the employee illnesses.

TFM HARVEST CREW INDIVIDUAL PRESCRIPTIONS

Date of Visit	Medication provided	Crew
3/6/2013	trimetropin sulfa metazol	C
4/24/2013	dicloxacillin	A
4/24/2013	dicloxacillin	A
5/8/2013	ampicillin	E
5/22/2013	dicloxacillin	T
5/29/2013	dicloxacillin	Driver
6/26/2013	*loperamide*	*E*
7/3/2013	*loperamide*	*O*
7/10/2013	*loperamide*	*S*
7/10/2013	ampicillin	T
7/24/2013	*loperamide*	*X*
7/31/2013	dicloxacillin	T
8/7/2013	trimetropin sulfa metazol	O*
8/7/2013	trimetropin sulfa metazol	O*

Colors indicate patients of the same crew.

Medications were provided based on availability.

2014-2017

*Laboratory-confirmed cases of cyclosporiasis reported by CDC



- 2014: 304 cases, 64% cases in Texas, associated with cilantro
- 2015: 646 cases across 31 states, association with cilantro
- 2016: 384 across 25 states, no reported connection or outbreak
- 2017: 1,065 cases across 40 states, no specific vehicle of interest or potential source

2018

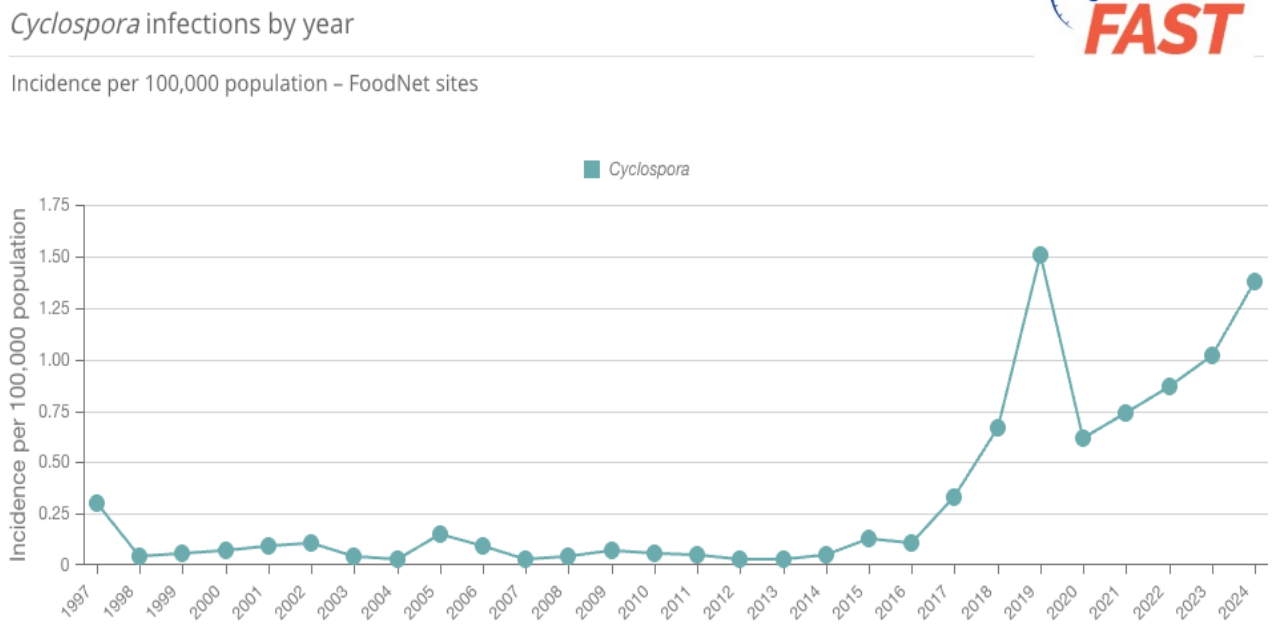
- 250 laboratory-confirmed cases form 4 states linked to consumption of pre-packaged Del Monte Fresh Produce vegetable trays (broccoli, cauliflower, carrots, dill dip).
- 511 laboratory-confirmed cases from 15 states reported consuming salads from McDonald's restaurants in the Midwest
- All illnesses reported May-August

- 2, 299 laboratory-confirmed cases by 33 states (no history of international travel)
- All illnesses reported May-August

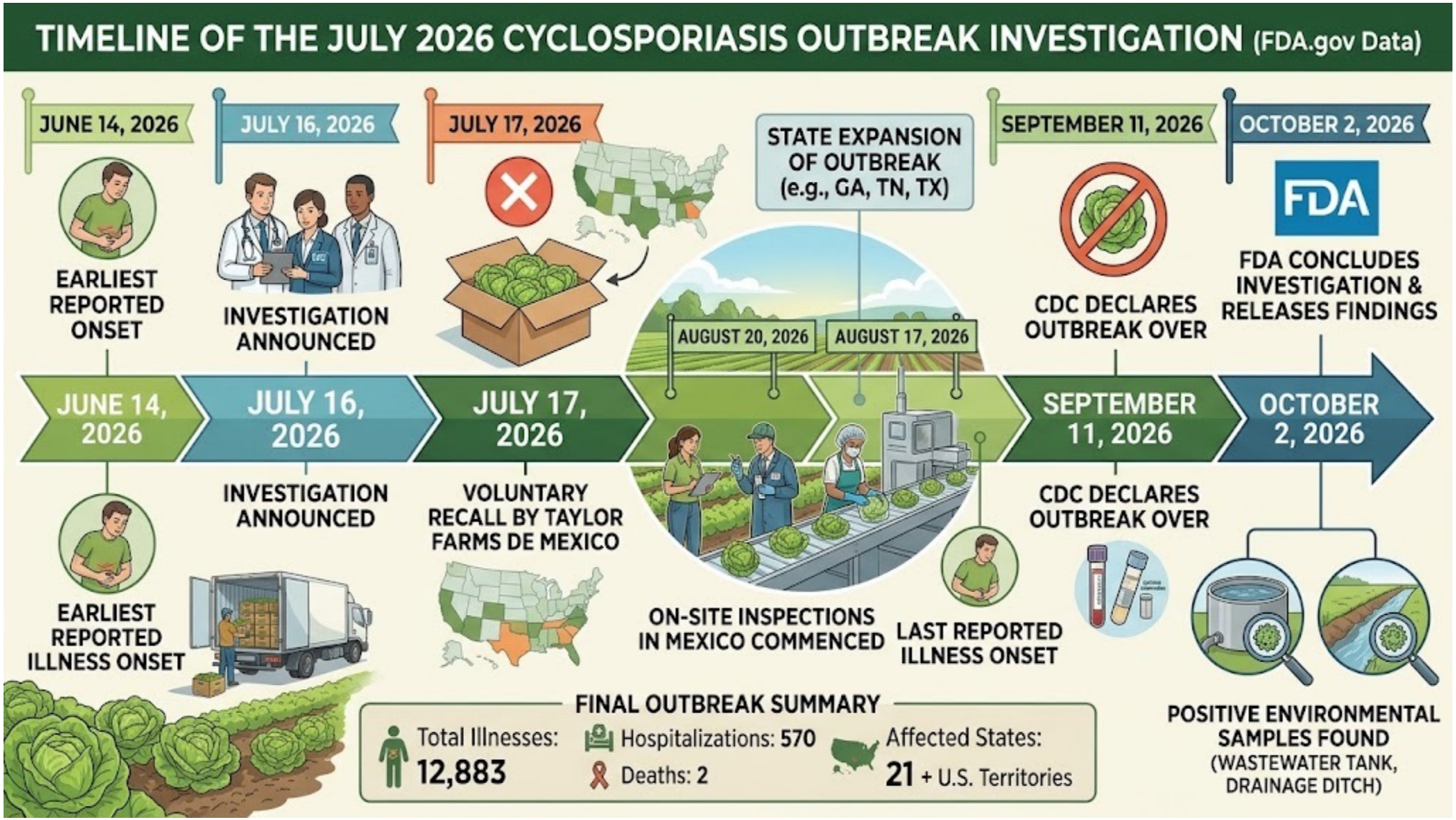
Domestically Acquired

2019-2025

- ~1000-2000 cases each year
- Domestically acquired cases
- No history of international travel
- Hospitalization rates generally increased over time
- No deaths



TIMELINE OF THE JULY 2026 CYCLOSPORIASIS OUTBREAK INVESTIGATION (FDA.gov Data)



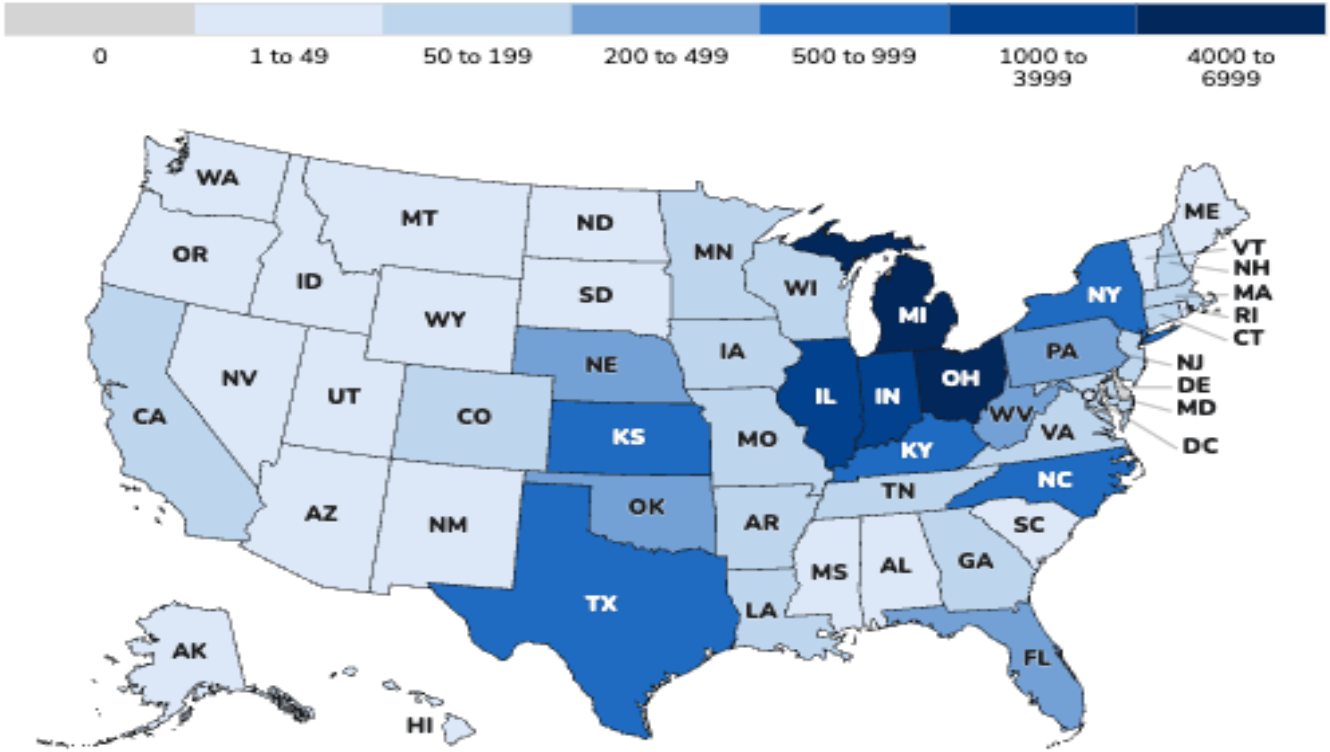
May 1 - August 31, 2026:

Laboratory-confirmed cases	19,883
Hospitalizations	1,064
Deaths	2
States reporting cases	49 plus the District of Columbia
Median age of cases	46 years (range 1 to 99 years)
Sex of cases	56% female 44% male
Median date symptoms started for cases	July 8, 2026 (range May 1 to August 30, 2026)

Cyclosporiasis season

The U.S. cyclosporiasis season is May 1 through August 31. Since it takes about six weeks to receive reports of new cases, CDC continues to investigate additional cases beyond this date. Due to the unprecedented number of cases that occurred this season, cases that occurred earlier in the season may continue to be reported to CDC.

Number of cases

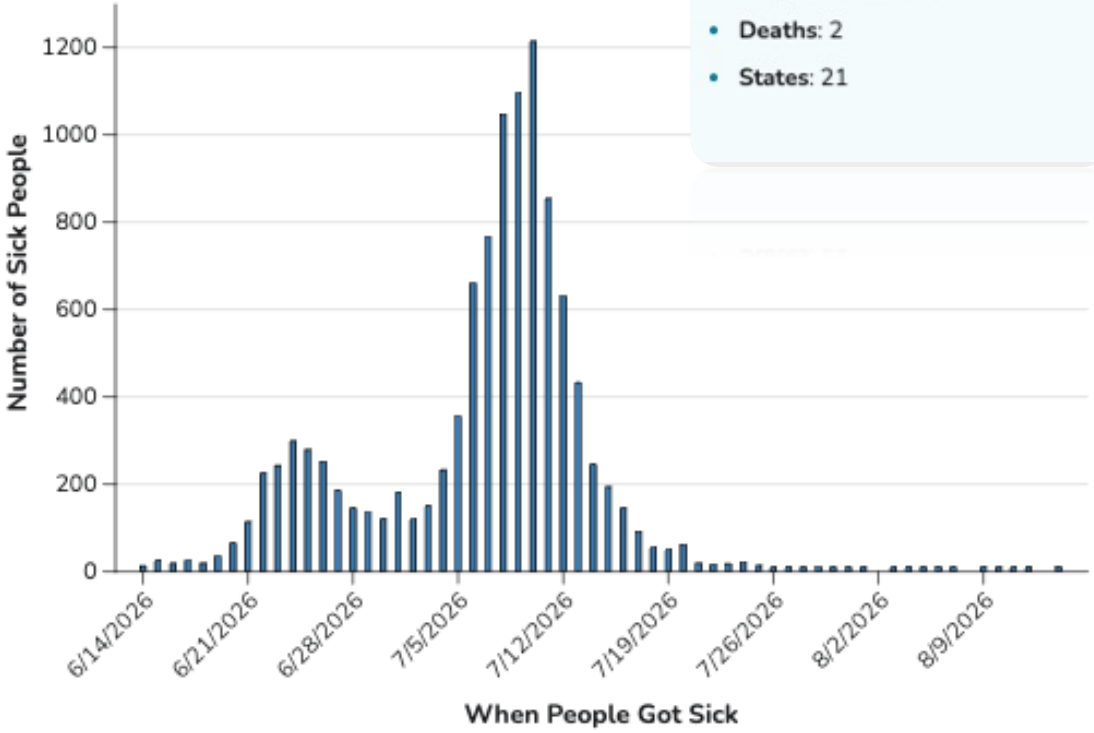


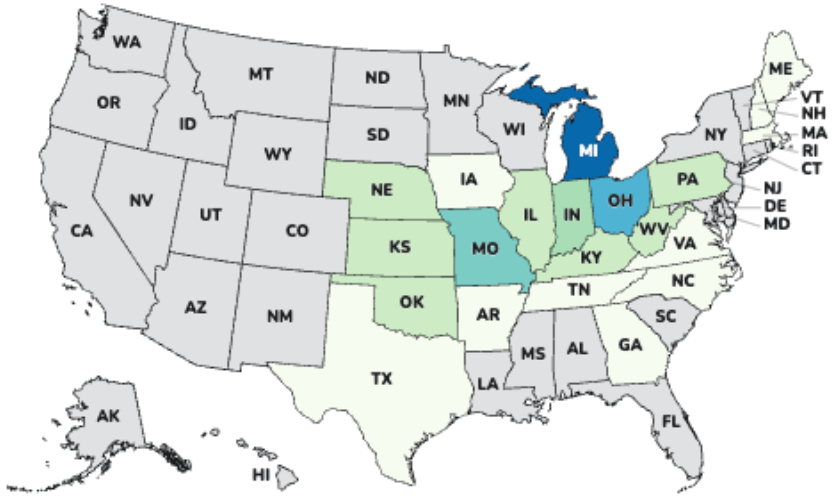
Updated on September 15, 2026. The map shows data for 19,883 confirmed *Cyclospora* cases reported to CDC as of September 14, 2026.



FAST FACTS

- **Cases**: 12,883
- **Hospitalizations**: 570
- **Deaths**: 2
- **States**: 21

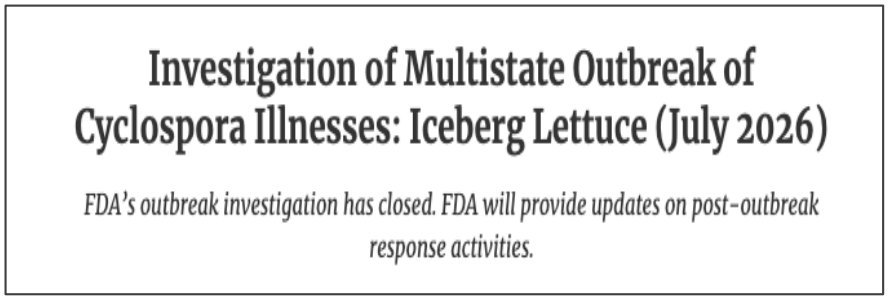




Number of Sick People

- 1 to 150
- 151 to 450
- 451 to 1000
- 1001 to 2500
- 2501 to 5000
- 5001 to 7500

FDA environmental investigation of the *Cyclospora* Iceberg lettuce outbreak found two positive samples in a lettuce-growing environment



Sample	Description
Cyclospora cayetanensis – positive sample # 1	"was from a tank that held outgoing wastewater from the Taylor Farms de Mexico processing facility."
Cyclospora cayetanensis – positive sample # 2	"was collected from a drainage ditch of an iceberg lettuce grower identified in the FDA's traceback investigation."

"…the positive samples show that *Cyclospora* was present in the environment where lettuce was grown and processed. This adds to the strong epidemiological data and traceback convergence supporting the link between this outbreak and recalled shredded iceberg lettuce from Taylor Farms de Mexico."

FDA U.S. FOOD & DRUG ADMINISTRATION

Investigations of Foodborne Illness Outbreaks

Active Investigations

Date Posted	Reference #	Pathogen or Cause of Illness	Product(s) Linked to Illnesses (if any)	Total Case Count	Investigation Status	Outbreak/ Event Status	Recall Initiated	FDA Traceback Initiated	FDA Inspection Initiated	FDA Sampling Initiated
8/5/2026	1398	*Cyclospora*	Not Yet Identified	22	Active	Ended See Advice		✔		✔
7/22/2026	1392	*Cyclospora*	Not Yet Identified	241	Active	Ended See Advice		✔		✔
7/15/2026	1390	*Cyclospora*	Iceberg Lettuce	See Advisory	Active	Ended See Advisory	See Advisory	✔	✔	✔
7/8/2026	1385	*Cyclospora*	Not Yet Identified	38	Active	Ended See Advice		✔		✔

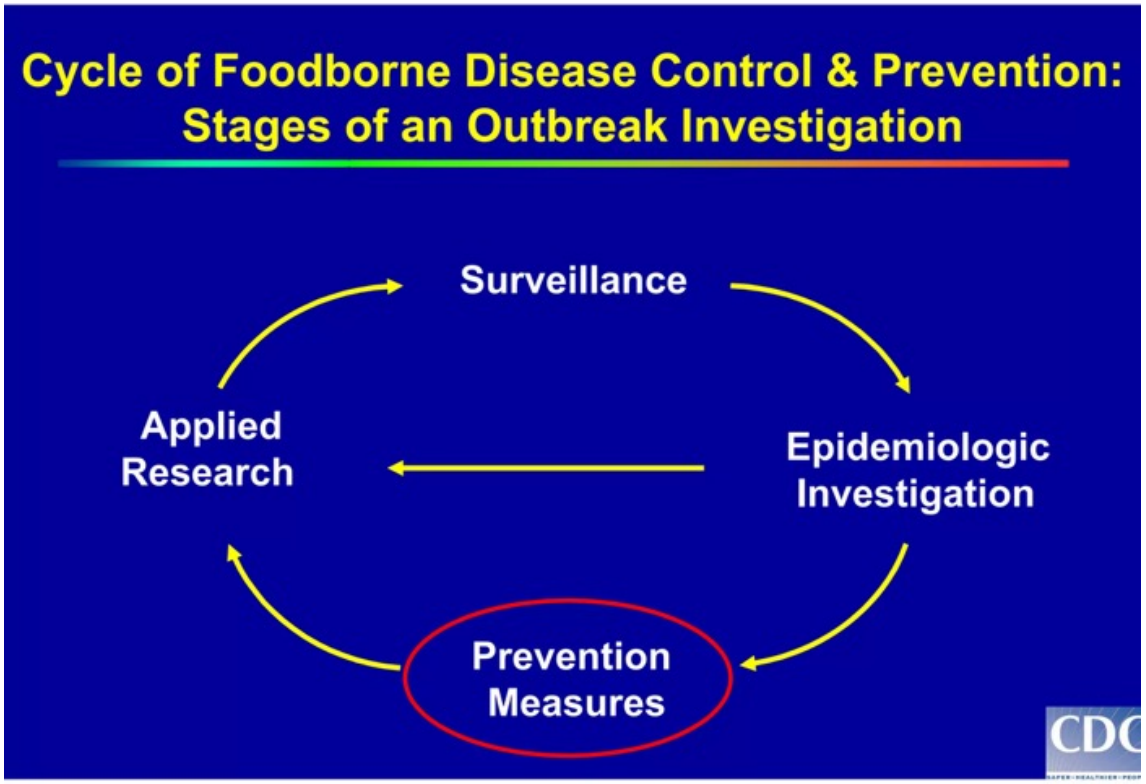
Research



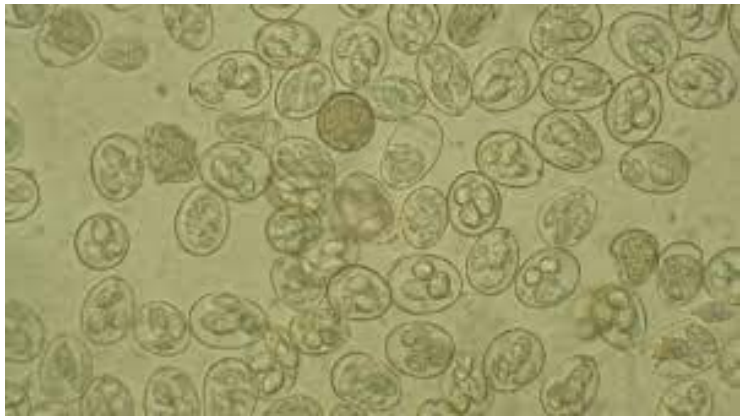
Applied Research!

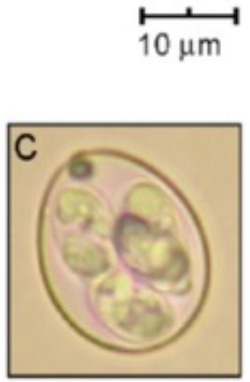


And Outreach & Education!

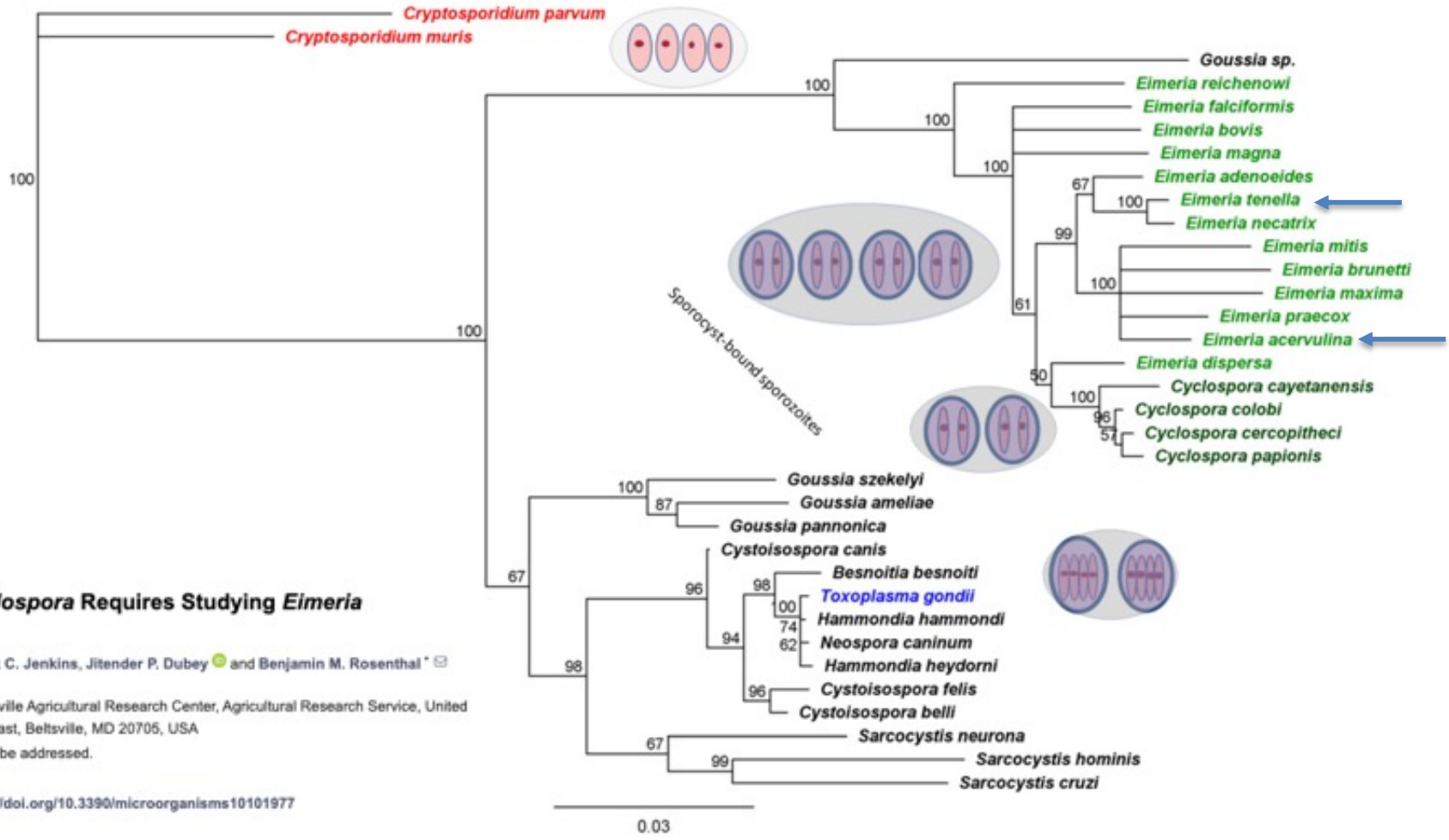


Surrogate of choice





- The genus *Eimeria* are apicomplexan parasites which affect domestic mammals and birds. All *Eimeria* are species-specific. In chickens, infection with one or more species of *Eimeria* can cause the enteric disease, coccidiosis.
- Sporulated *Eimeria* oocysts are resistant to adverse environmental conditions and can survive as long as one year in moist, protected environments if they are not exposed to freezing or extremely high temperatures.
- Critical to poultry welfare and food security costs poultry industry billions



Hastening Progress in *Cyclospora* Requires Studying *Eimeria* Surrogates

by Matthew S. Tucker, Asis Khan, Mark C. Jenkins, Jitender P. Dubey and Benjamin M. Rosenthal *

Animal Parasitic Disease Laboratory, Beltsville Agricultural Research Center, Agricultural Research Service, United States Department of Agriculture, BARC-East, Beltsville, MD 20705, USA

* Author to whom correspondence should be addressed.

Microorganisms **2022**, *10*(10), 1977; https://doi.org/10.3390/microorganisms10101977

Filtration

- Sand filtration (and sand with zero-valent iron) technology may offer advantages to small and mid-sized growers including adaption to existing filtration systems, feasibility, effective filtration and broad neutralization of numerous biological and chemical hazards with minimal environmental impacts.



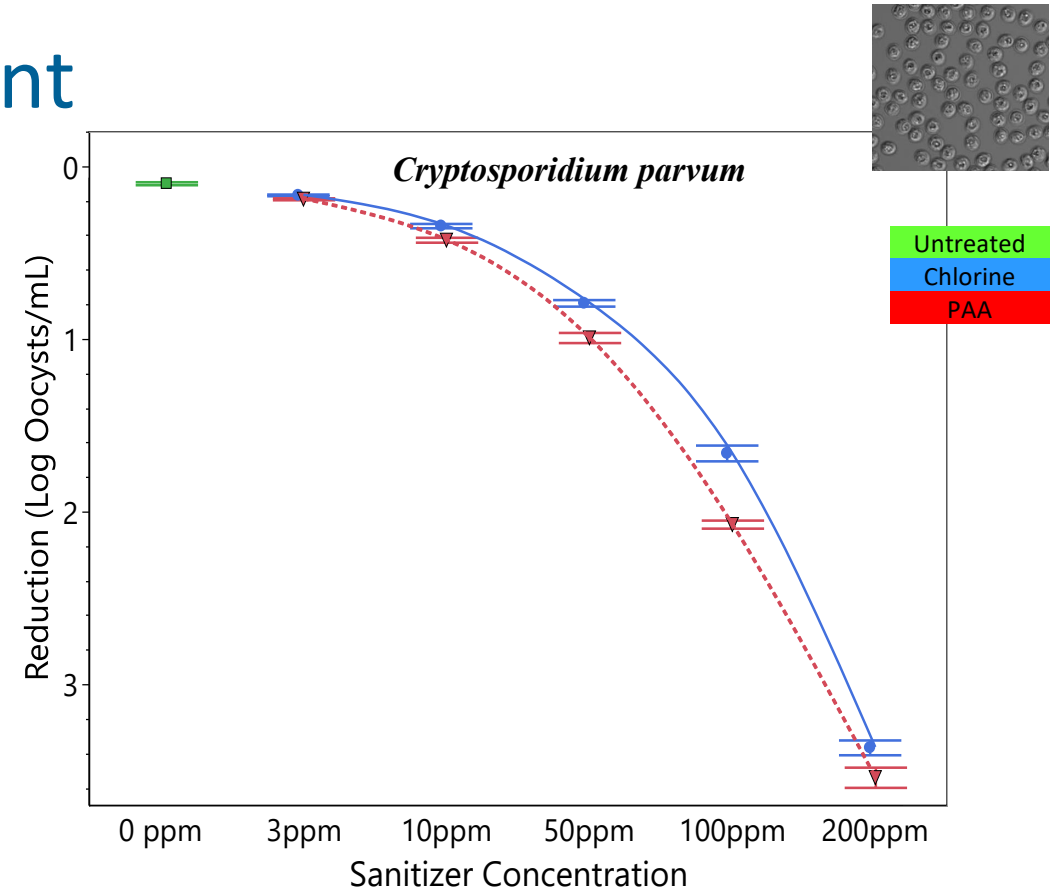


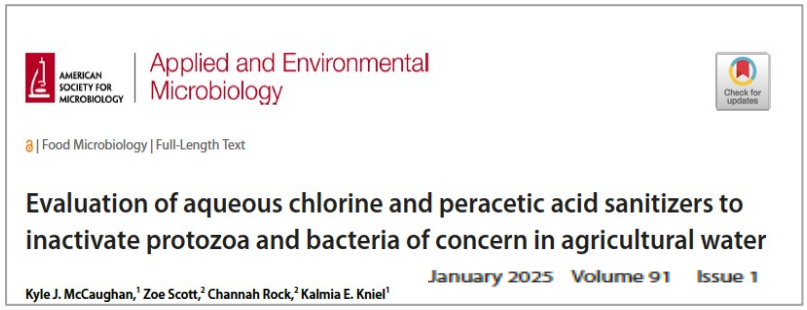


2-3 log removal of *Eimeria* and *Cyclospora* oocysts, variability with filter size and water flow rate (Rosenthal, Sharma, Jenkins, Kniel, et al)

Irrigation water treatment

- Regardless of concentration, PAA was significantly ($p<0.05$) more effective than Chlorine
- Neither sanitizer was able to effectively inactivate all *C. parvum* oocysts




Applied and Environmental Microbiology

| Food Microbiology | Full-Length Text

Evaluation of aqueous chlorine and peracetic acid sanitizers to inactivate protozoa and bacteria of concern in agricultural water

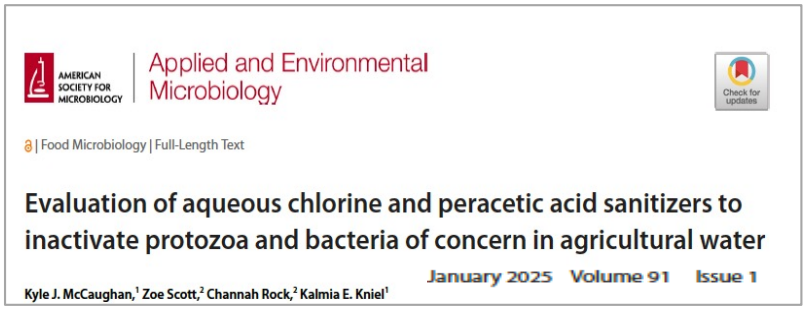
January 2025 Volume 91 Issue 1

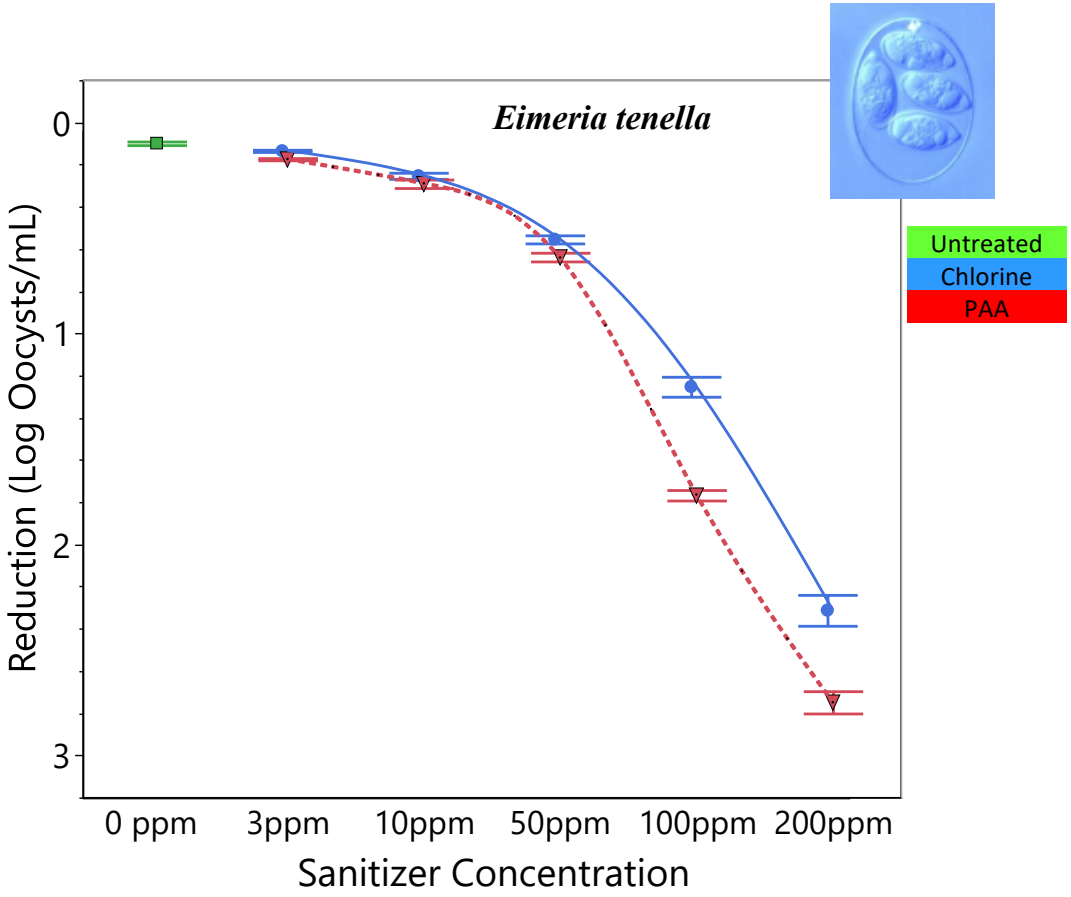
Kyle J. McCaughan,[1] Zoe Scott,[2] Channah Rock,[2] Kalmia E. Kniel[1]

Data are the combined averages from experiments conducted in W1 and W2, and at 12 and 32°C after 10 minutes of treatment (n=24 per treatment). Error bars are constructed using one standard deviation from the mean

Irrigation water treatment

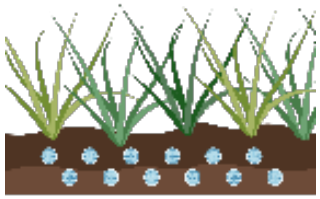
- Regardless of concentration, PAA was significantly ($p<0.05$) more effective than Chlorine
- Neither sanitizer was able to effectively inactivate all *E. tenella* oocysts
- Oocysts of *E. tenella* were more resistant to sanitizer treatment than those of *C. parvum*





Data are the combined averages from experiments conducted in W1 and W2, and at 12 and 32°C after 10 minutes of treatment (n=24 per treatment). Error bars are constructed using one standard deviation from the mean

Soil persistence?

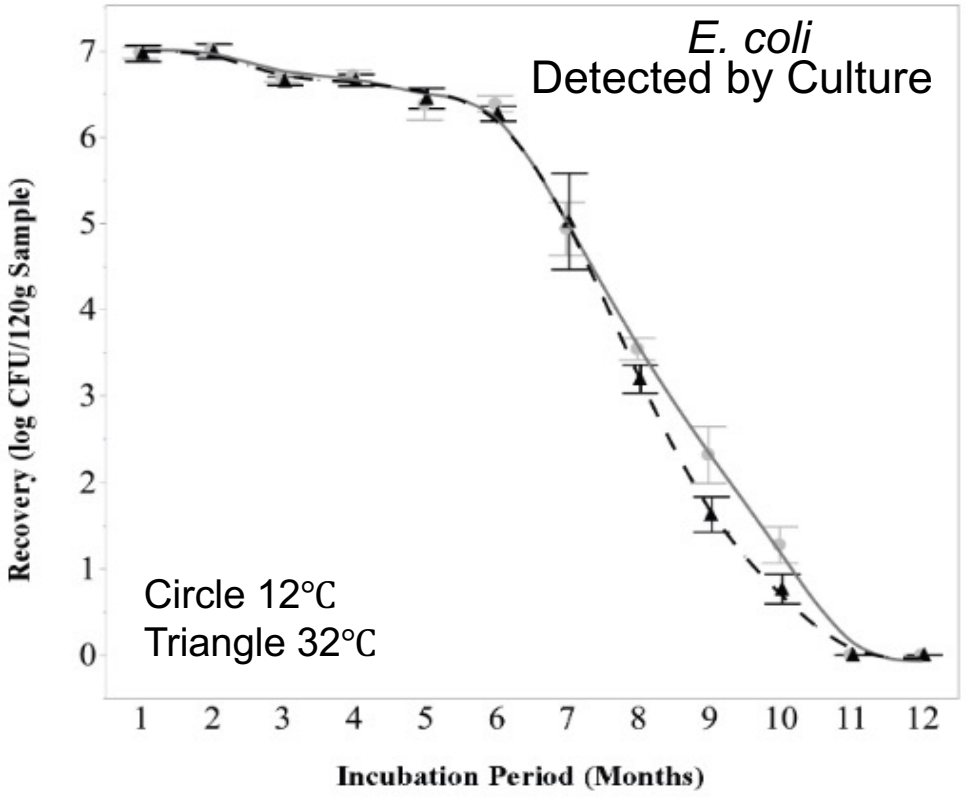


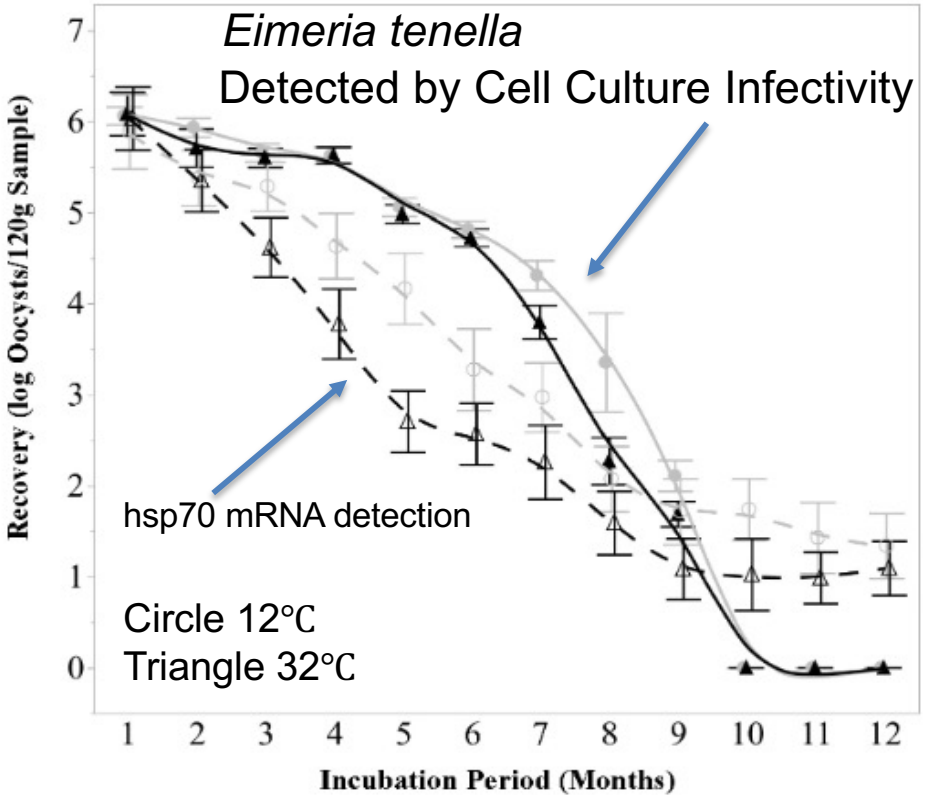
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FOOD MICROBIOLOGY
May 2026 Volume 92 Issue 5 e02467-25
https://doi.org/10.1128/aem.02467-25

Persistence of protozoan parasites and *Escherichia coli* on plant tissue in soil

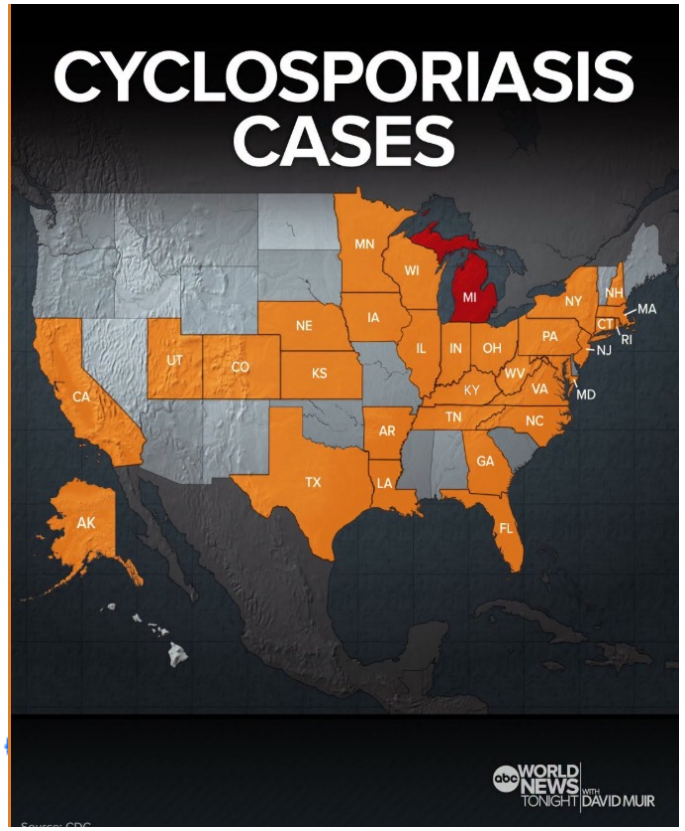
Kyle J. McCaughan [1], Michelle D. Danyluk [2], Kalmia E. Kniel [1]





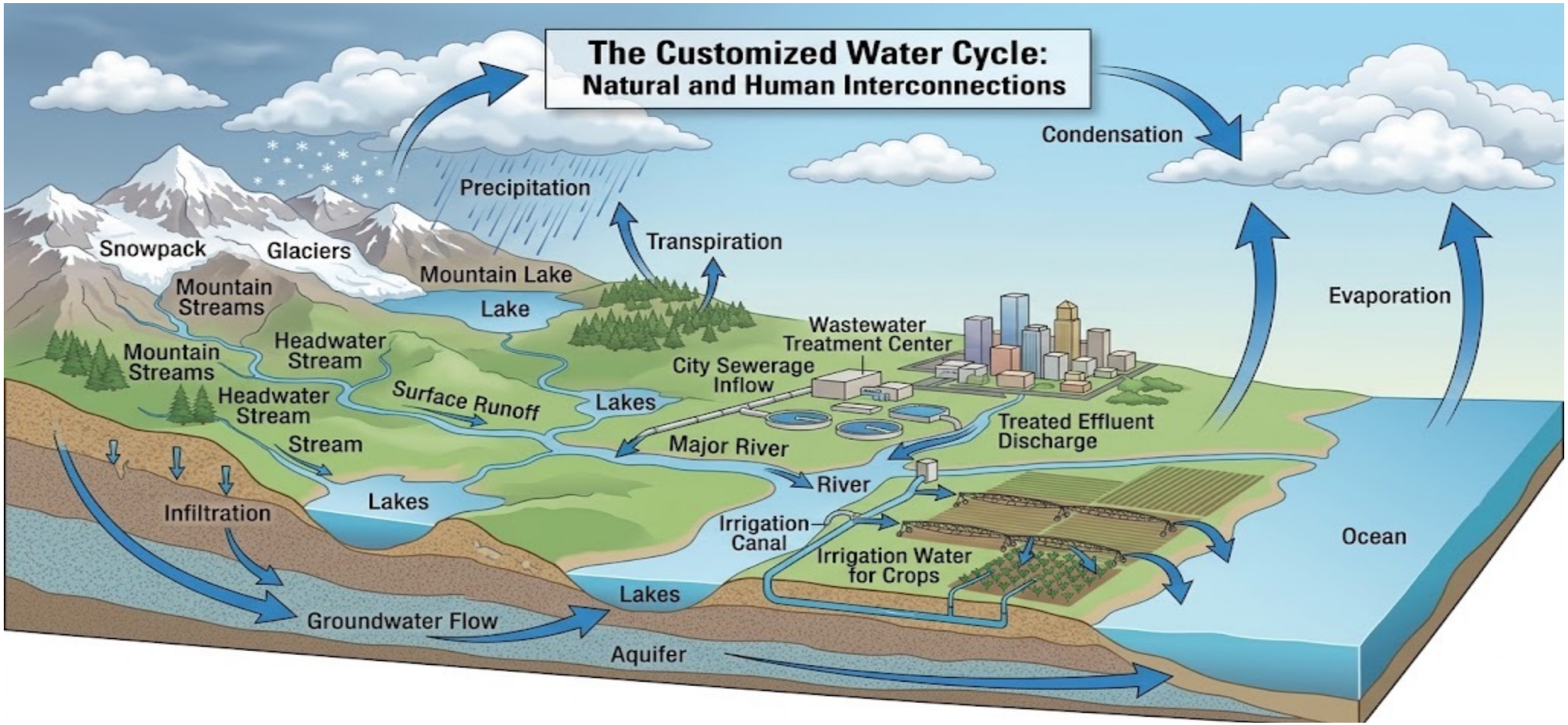
Where will we go next?

- What can we learn from this unique opportunity? Studying clusters of cases?
  - lettuce distribution of specific lots?
  - conditions of those?
  - other products?
- Opportunities for amplification and movement?
  - *Think Water*
- Wastewater treatment systems





Is there Potential (or unique opportunities) for Water Transmission



Sporulation

TABLE 1. Effect of time, temperature, and suspending fluid on sporulation of human- and baboon-derived *Cyclospora* sp. oocysts

Suspending fluid, time (days)	% Sporulation of oocysts at indicated temp (°C)				
	Human				Baboon
	4	22	30	37	30
Deionized water					
1	ND[a]	ND	ND	ND	
2	ND	ND	ND	ND	
4	ND	ND	ND	ND	
5	ND	ND	ND	ND	14
6					20
8	ND	15	18	ND	
9					23
14	ND	22	24	5	
2.5% $K_2G_2O_7$					
1	ND	ND	ND	ND	
2	ND	ND	ND	ND	
4	ND	ND	ND	ND	
5	ND	12	13	ND	19
6					24
8	ND	21	23	ND	
9					22
14	ND	23	24	3	

[a] ND, no sporulated oocysts detected.

APPLIED AND ENVIRONMENTAL MICROBIOLOGY, Apr. 1997, p. 1631–1632 Vol. 63, No. 4
0099-2240/97/$04.00+0
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Sporulation of *Cyclospora* sp. Oocysts

H. V. SMITH,[1]* C. A. PATON,[1] M. M. A. MTAMBO,[2] AND R. W. A. GIRDWOOD[1]

Scottish Parasite Diagnostic Laboratory, Stobhill NHS Trust, Glasgow G21 3UW, United Kingdom,[1] and Department of Veterinary Medicine & Public Health, Sokoine University of Agriculture, Morogoro, Tanzania[2]

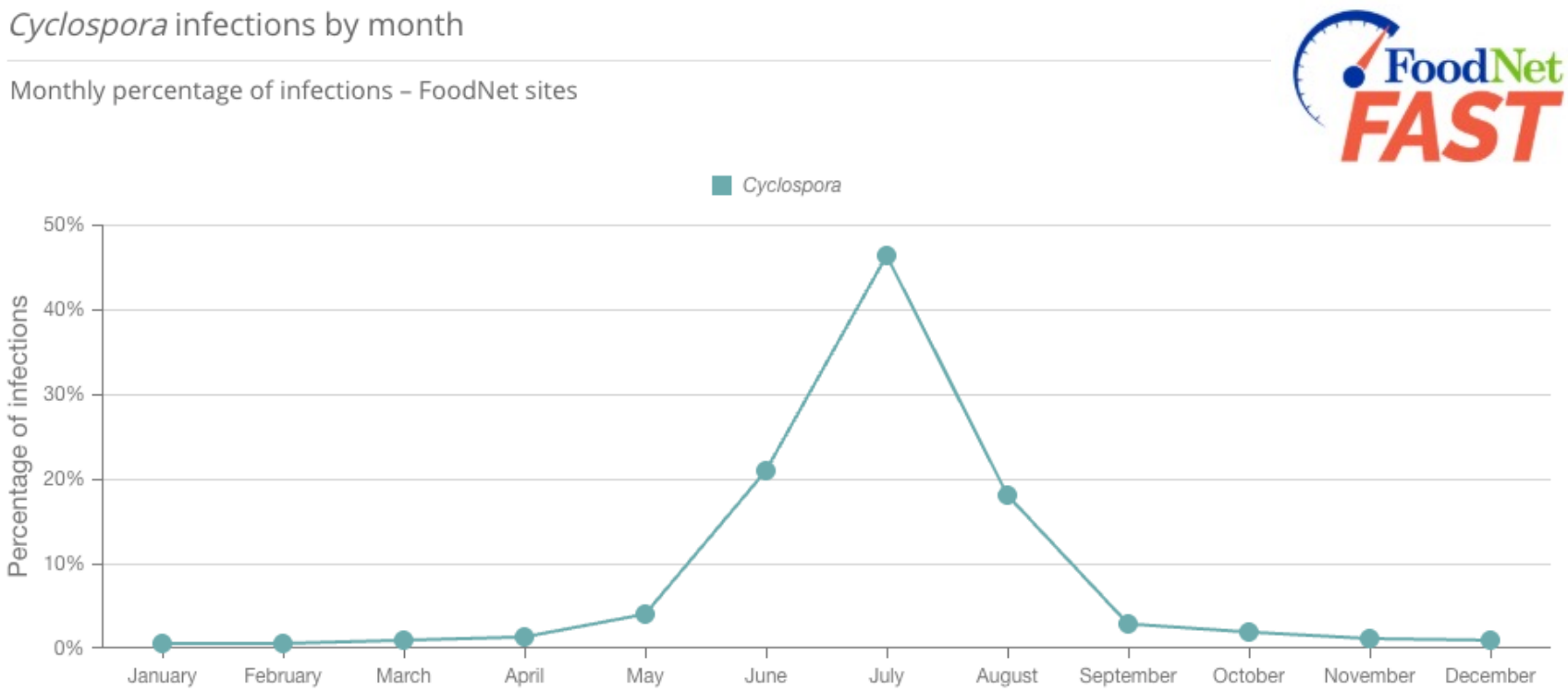
Received 25 November 1996/Accepted 16 January 1997

***Cyclospora* sp. oocysts sporulated maximally at 22 and 30°C, irrespective of whether they were stored in deionized water or potassium dichromate. Storage at either 4 or 37°C for 14 days retarded sporulation. Up to 12% of human- and baboon-derived oocysts previously stored at 4°C for 1 to 2 months sporulated when stored for 6 to 7 days at 30°C.**

- Must consider sporulation in the timeline of infectivity
- Should reevaluate the potential for water contamination given when there is time for sporulation

Seasonality (warmer temps, moisture, humidity)

Cyclospora Season (May –September/ April-October)



Seasonality (warmer temps, moisture, humidity)

- In Guatemala, infection more frequently observed during the early rainy season (21–22°C)
- In Peru during the summer (16–19°C) in the coastal desert areas where precipitation is low.
- In Haiti, prevalence is highest during January–April, which are the coolest (27–29°C) and driest months of the year.
- In Katmandu, Nepal, the high infection season occurs during the summer and the beginning of the rainy season during months of June and July (19–29°C)
- Rainy season in Honduras

Are these connections to poor sanitation or sporulation

Am. J. Trop. Med. Hyg., 91(3), 2014, pp. 537–540
doi:10.4269/ajtmh.13-0535
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Cyclospora cayetanensis in a Pediatric Hospital in Morelia, México

Guadalupe E. Orozco-Mosqueda*, Orlando A. Martínez-Loya, and Ynes R. Ortega
Hospital Infantil de Morelia Eva Sámano de López Mateos, Servicios de Salud de Michoacán, Michoacán, Mexico; Center for Food Safety, University of Georgia, Griffin, Georgia

Kaminsky *et al. BMC Infectious Diseases* (2016) 16:66
DOI 10.1186/s12879-016-1393-6

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

Marked seasonality of *Cyclospora cayetanensis* infections: ten-year observation of hospital cases, Honduras

Rina Girard Kaminsky[1*], Javier Lagos[2], Gabriela Raudales Santos[3] and Samuel Urrutia[4]

Am. J. Trop. Med. Hyg., 91(3), 2014, pp. 537–540
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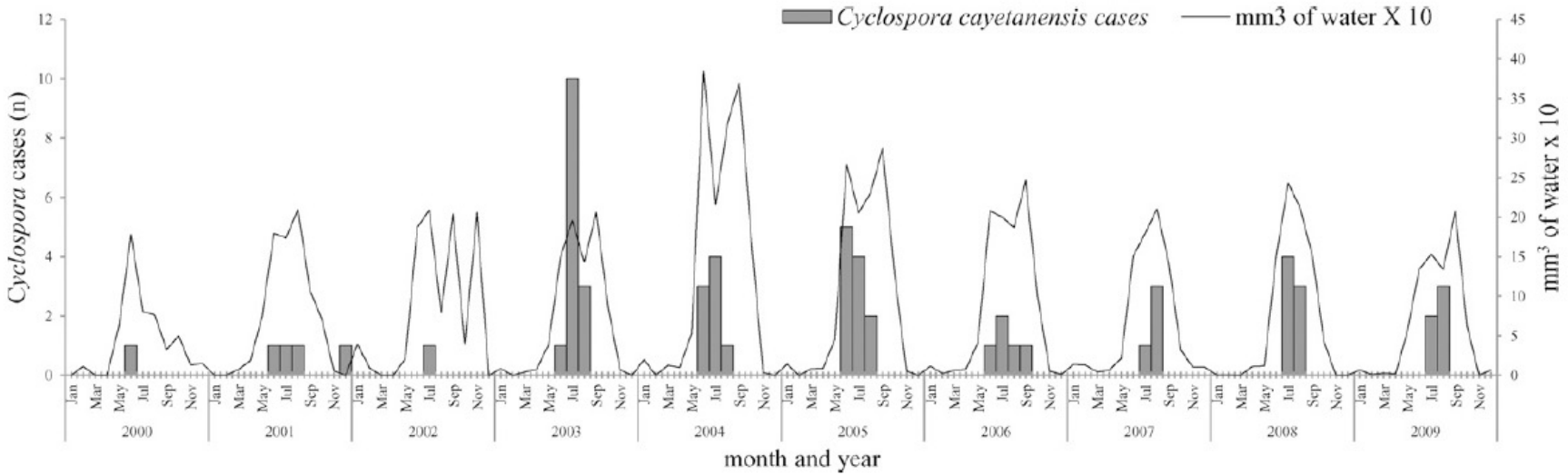
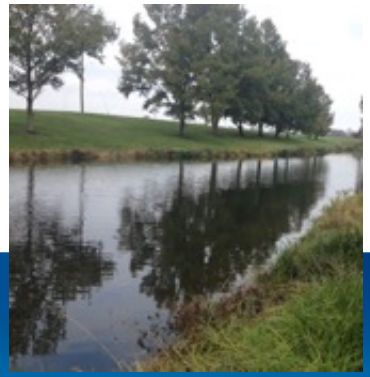


FIGURE 1. Seasonality of *Cyclospora* in children seeking medical attention at the Pediatric Hospital of Morelia, Michoacán, Mexico, 2000–2009.

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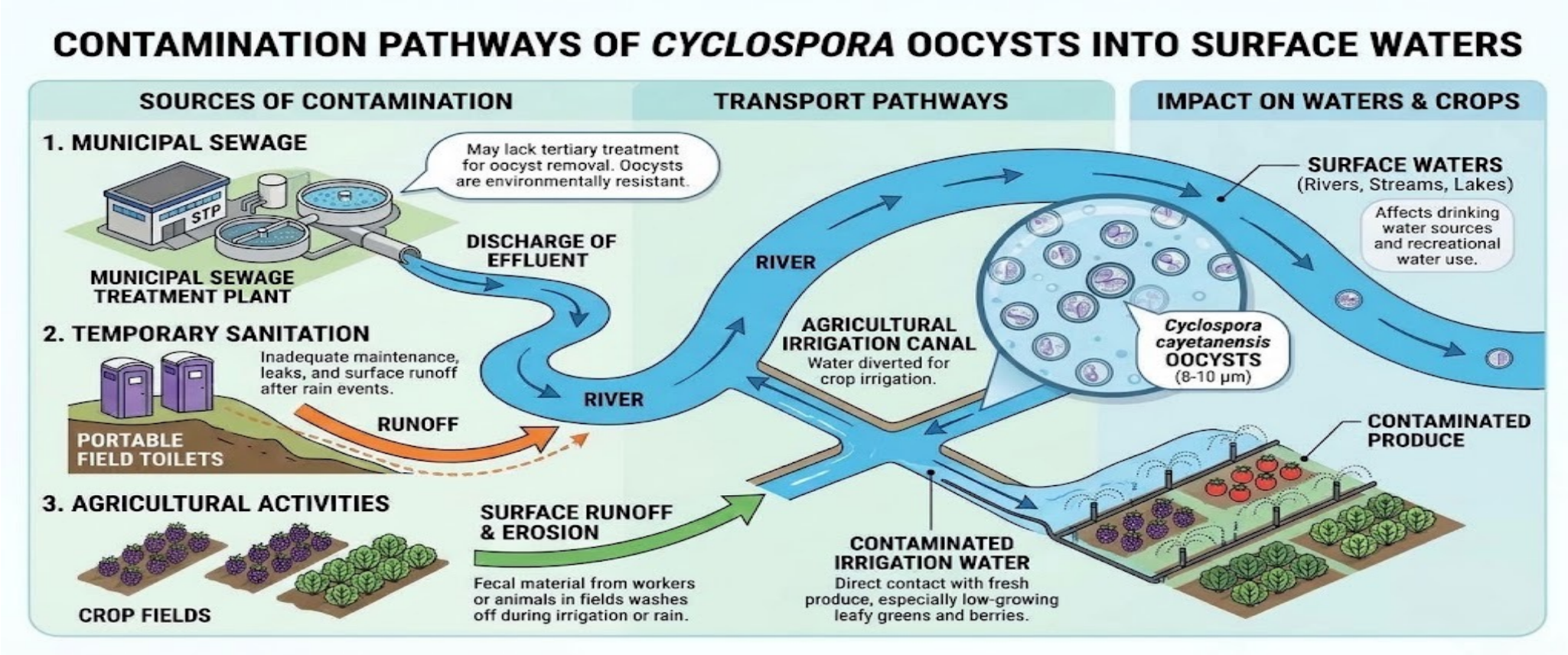
Key Industry Controls

- Attention to handwashing, sanitation of restrooms and portable toilets, avoiding use of sewage sludge, managing sewage spills etc.
- **Knowledge of water, watershed, the sewer shed, and sewage leaks**
- It is important that controls against human fecal contamination are implemented across the supply chain, since oocysts can be introduced by people at any stage.
- The persistence of *Cyclospora* in the environment is uncertain
- The triggers for sporulation are not well understood (temperature, acidity, oxygen, etc.)
- Focus on preventive measures



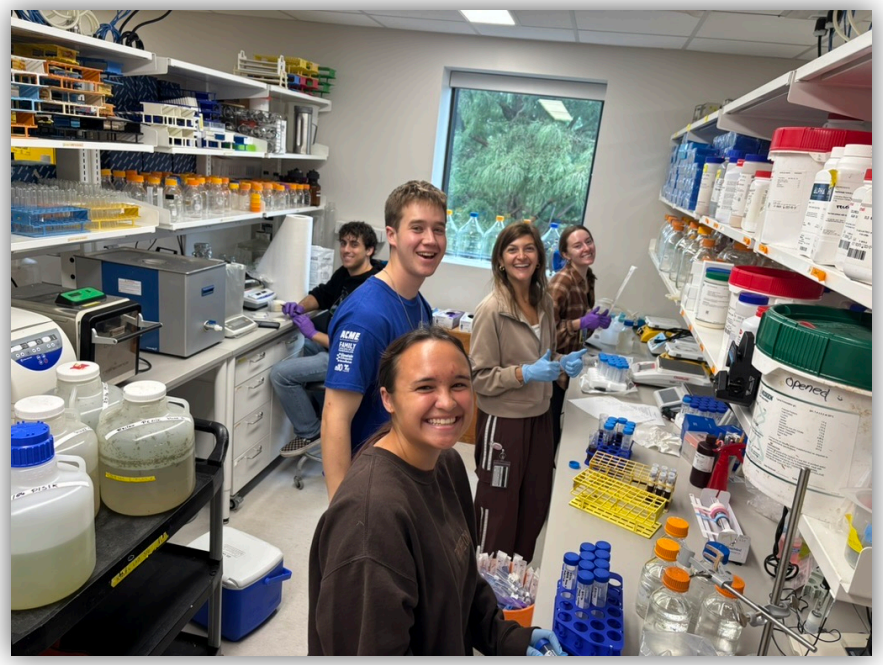


Surveillance studies suggest that *Cyclospora* oocysts may be present in surface waters at varying degrees and oocyst presence could be associated with ineffective sewage treatment or contamination, and the role and placement of portable toilets can be explored



Thank you!

kniel@udel.edu



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Questions?

PSA Updates

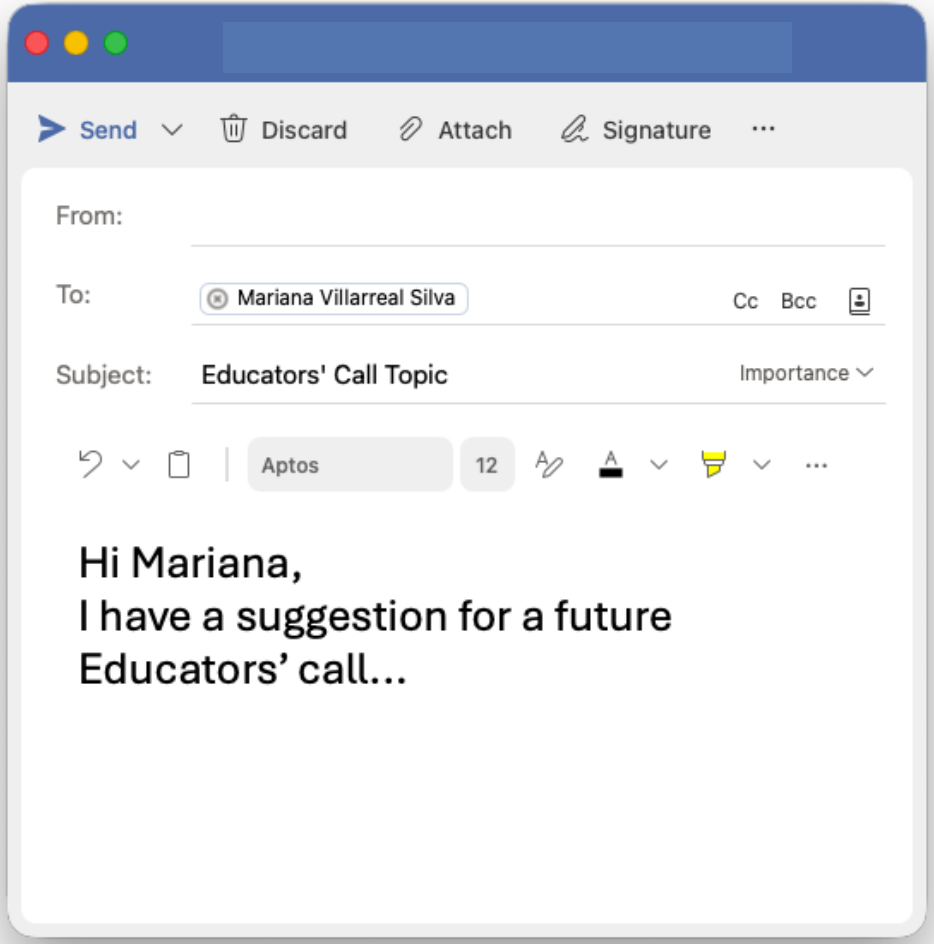
- Secured next year's funding and on track with all key deliverables
- We are planning more sessions in English and Spanish, likely after the holidays
- Please share your ideas and suggestions!

Join our Produce Safety Educators' group!

English

Spanish

Input welcome on future Educators' Call topics

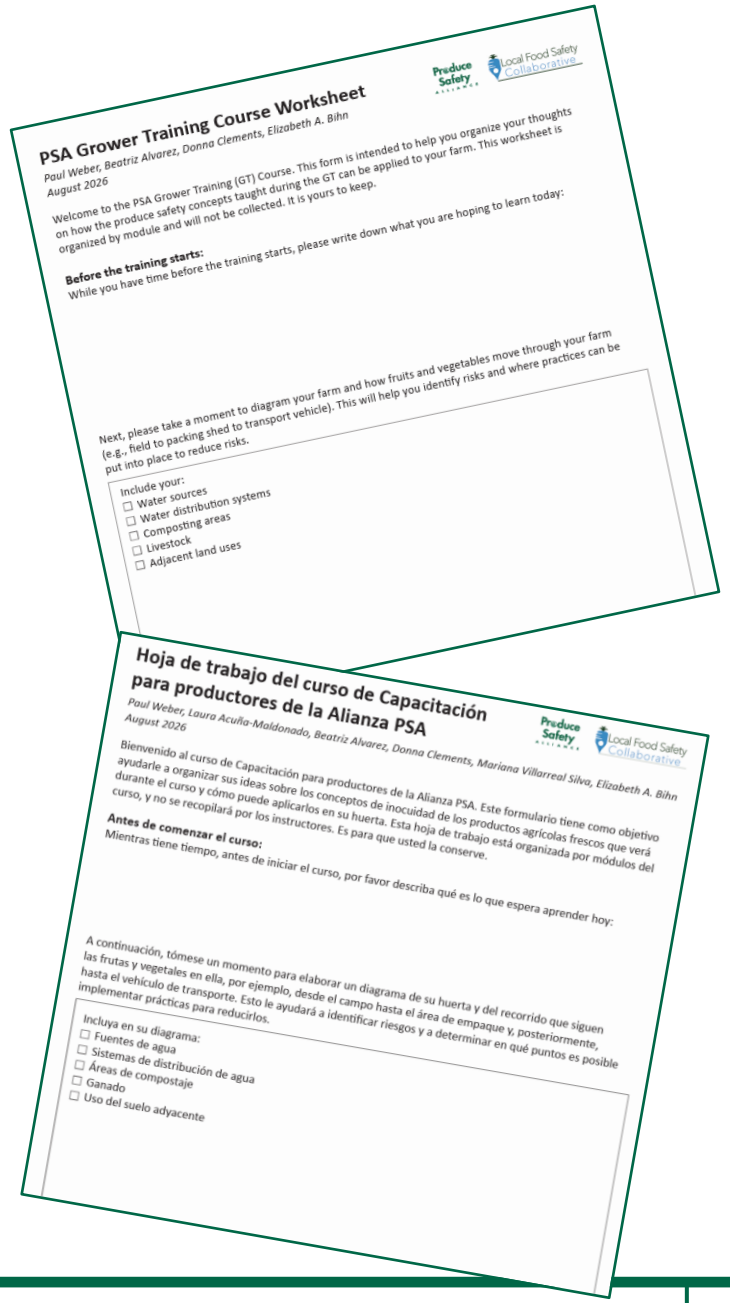


Is there a topic that you would like to see presented? Please email:

- Mariana Villarreal Silva
- mv378@cornell.edu

New PSA Trainer Resource

- PSA Grower Training Course Worksheet
  - English:
    - https://resources.producesafetyalliance.cornell.edu/documents/PSA-Grower-Training-Worksheet.pdf
  - Spanish:
    - https://resources.producesafetyalliance.cornell.edu/documents/PSA-Grower-Training-Worksheet-Spanish.pdf



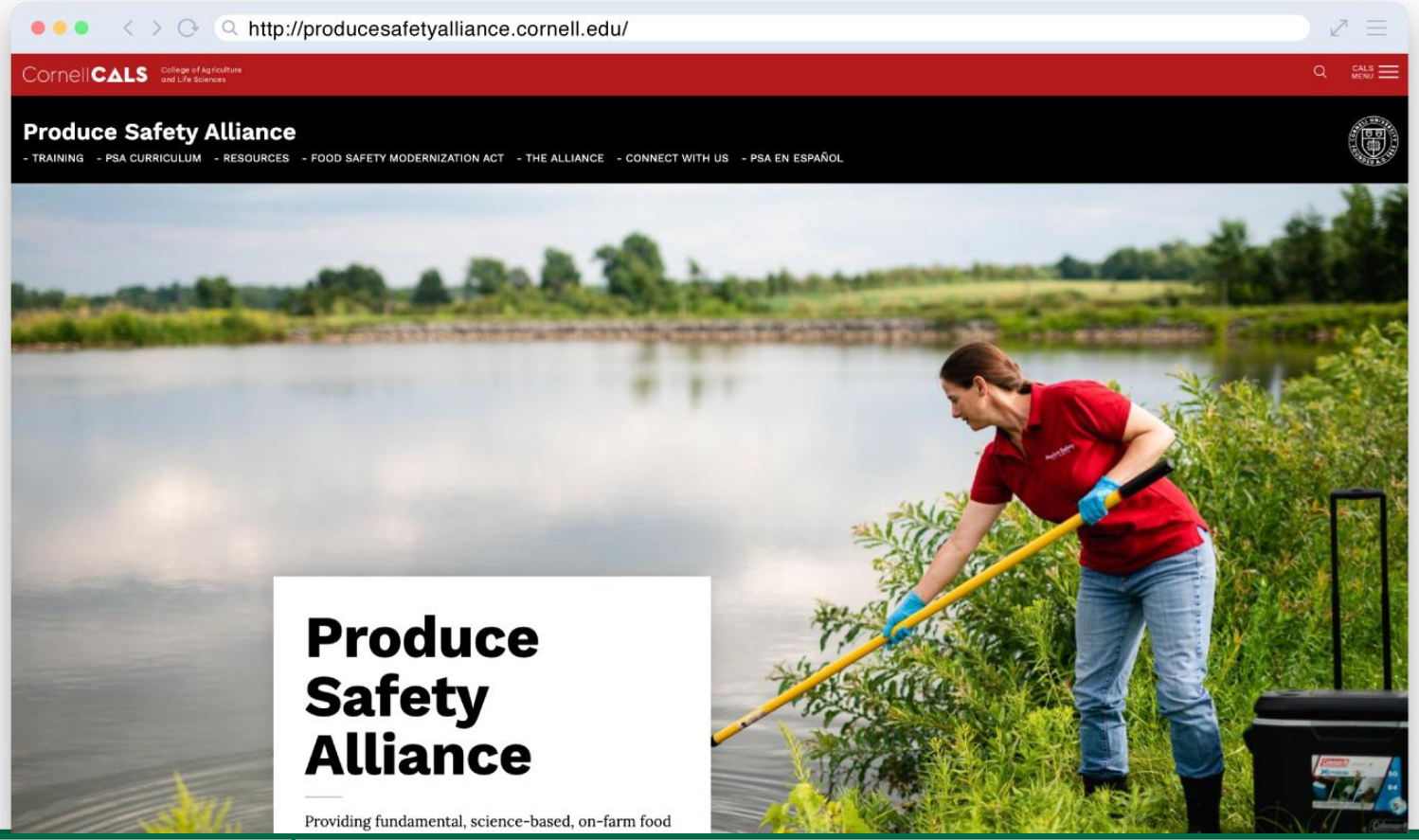
Thank you!

- To Dr. Kali Kniel, for sharing her valuable time and expertise to enrich today's session
- To you, for your engagement and ongoing commitment to produce safety education



PSA on the Web

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