Coffee Leaf Rust (CLR) Update

Ka'u Coffee College

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Andrea Kawabata[1] & Lisa Keith[2]

[1]University of Hawai‘i College of Tropical Agriculture and Human Resources

[2]United States Department of Agriculture (USDA), Agricultural Research Service (ARS), Pacific Basin Agricultural Research Center (PBARC)

CLR Teamwork!

Coffee Growers & Producers

Lionel Sugiyama

Eva Brill

Karma Kissinger

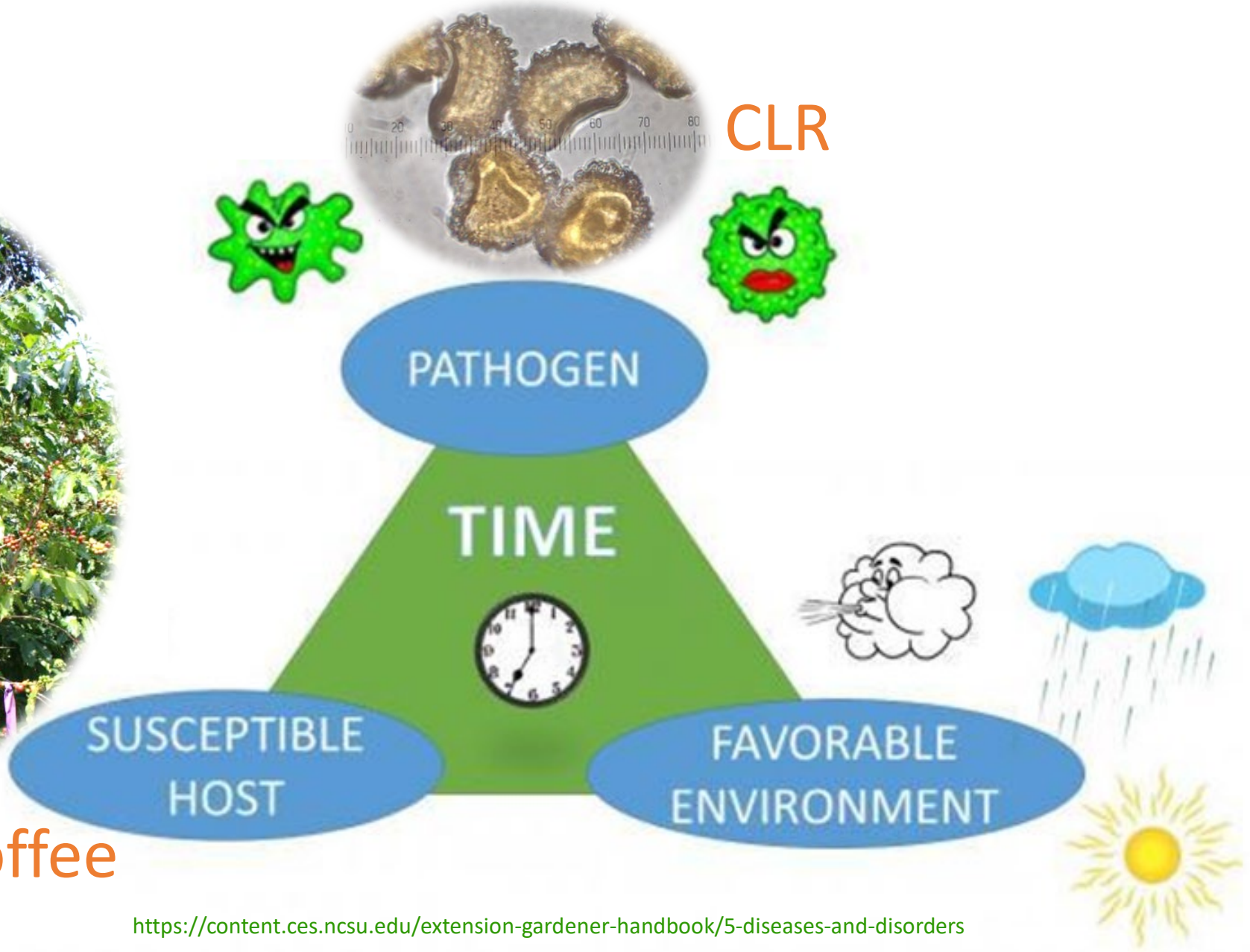
And Many Others

Coffee Leaf Rust

- Biology
- Disease Cycle
- Symptoms & Signs
- Management
- Hawai'i/Scouting & Sampling
- Monitoring, Spraying & Pruning

How is Disease Caused in Plants?

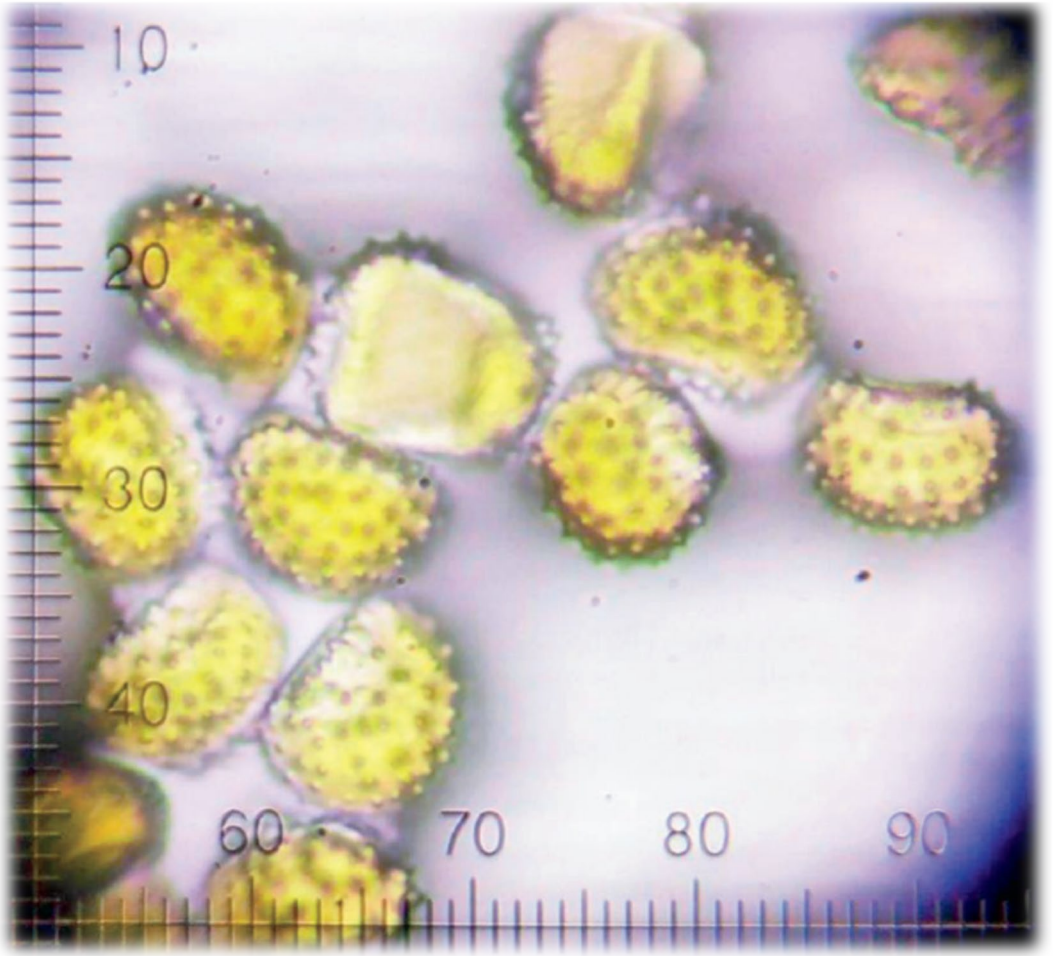
Coffee



https://content.ces.ncsu.edu/extension-gardener-handbook/5-diseases-and-disorders

Coffee Leaf Rust: Biology

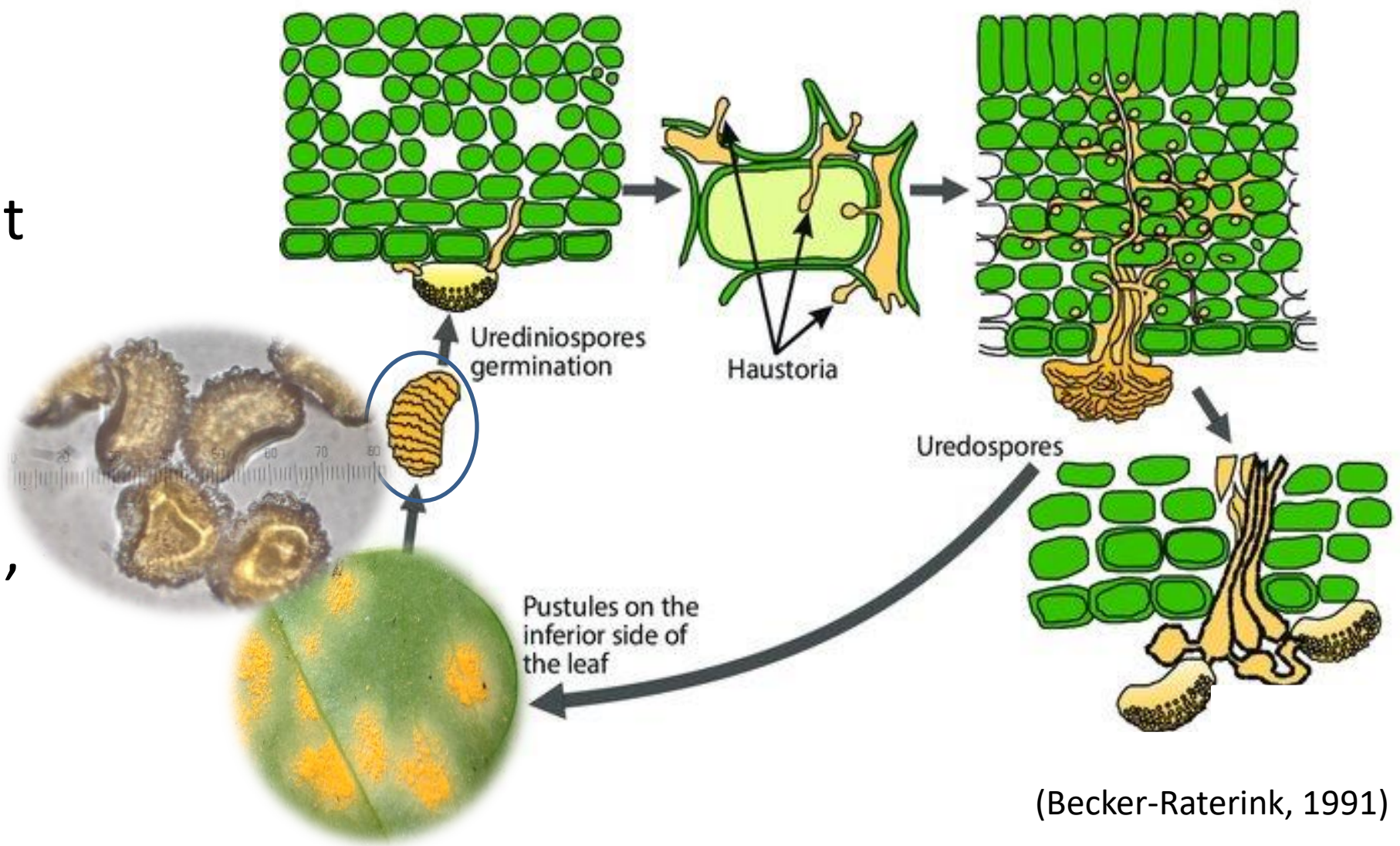
- *Hemileia vastatrix* (half-smooth, devastating)
- Unique spore shape (urediniospores)
- Obligate parasitic fungus
- Coffee is the only host; no alternate host is necessary
- Once a spore lands on a leaf, it waits until conditions are right to germinate



Magnification of the uredospores of coffee leaf rust (x400).
Photo: Isabelle Merle

Coffee Leaf Rust: Disease Cycle

- Spores start infections that develop into spots/lesions that produce more spores
- Varies from season to season, depending on rainfall



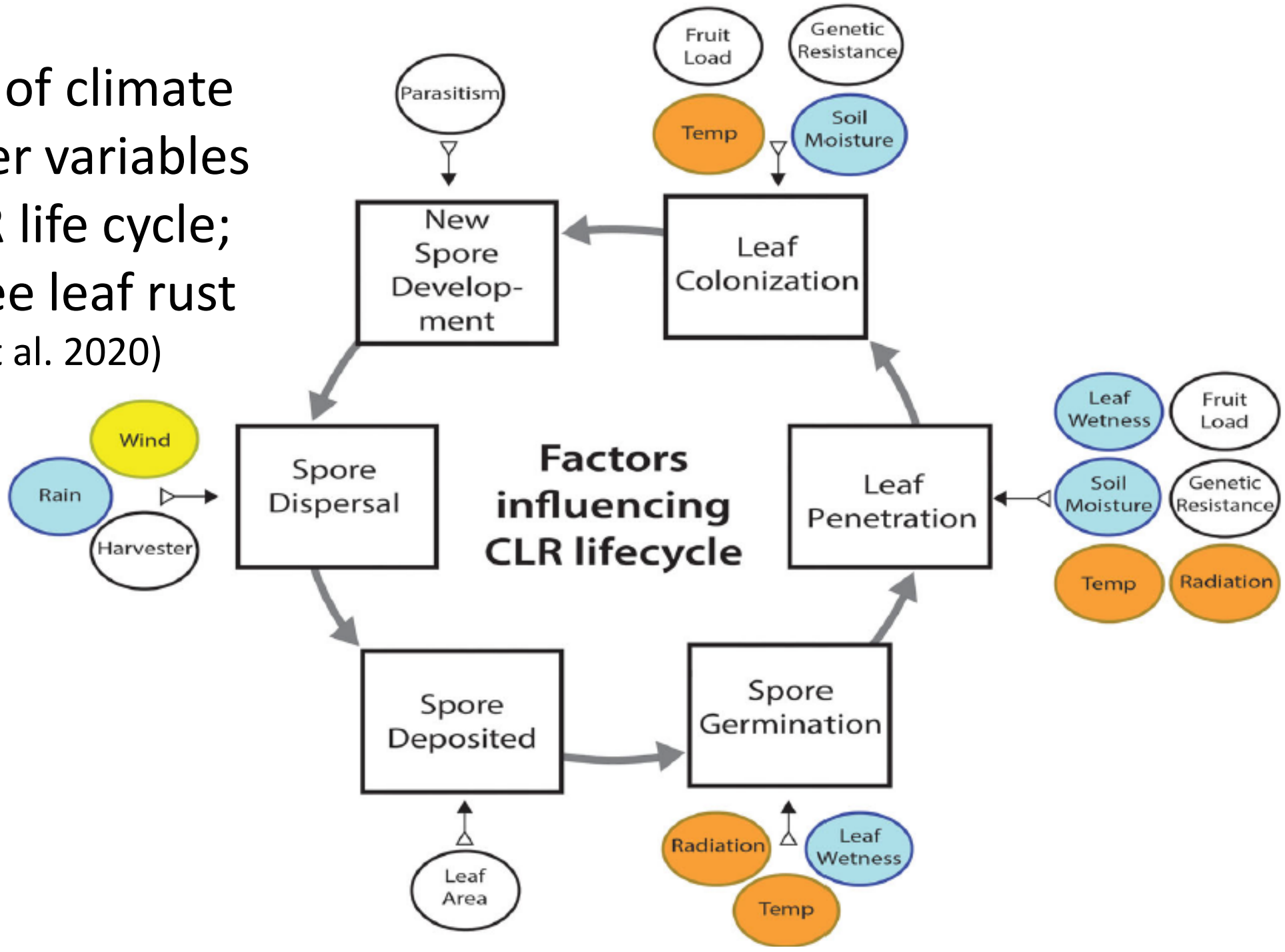
(Becker-Raterink, 1991)

Coffee Leaf Rust: Disease Cycle

- Spore dispersal: Wind, rain and worker activity
- Infection through stomata; 24 to 48 hours water; 15-30°C / 59-86°F, optimum ~21-25°C / 70-77°F
- Sporulation: 10-14 days from infection; Spots enlarge over 2 to 3 weeks; A single spot will produce ~300,000 spores over 3 to 5 months
- Survival: primarily as mycelium in the living tissue; spores can survive ~ 6 weeks; partial shade

Influences of climate and weather variables on the CLR life cycle; CLR = coffee leaf rust

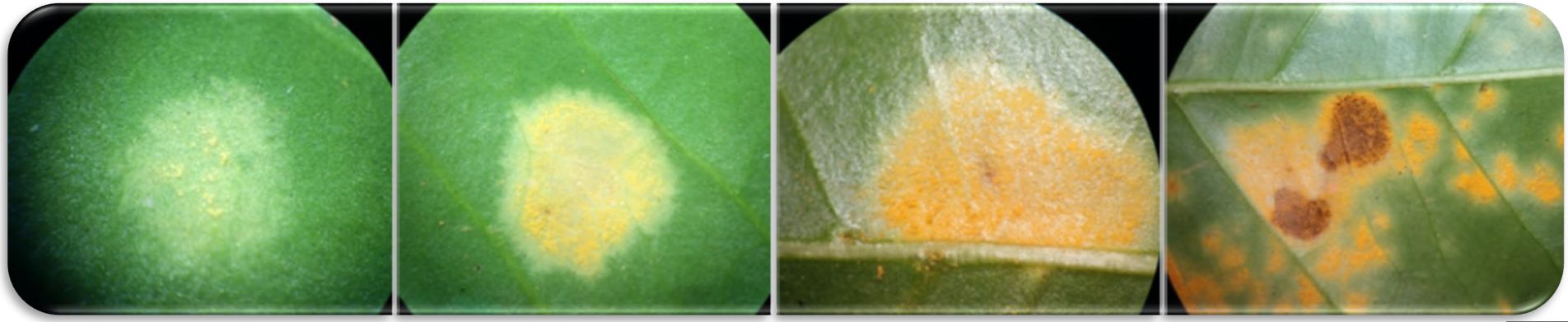
(Rhiney et al. 2020)



Coffee Leaf Rust: Symptoms & Signs

- CLR sporulates through the stomata rather than breaking through the epidermis
- First observable symptoms: small, pale yellow spots on the upper surfaces of the leaves (A)
- Spots gradually increase in size; spores appear on the lower leaf surface (B)
- Powdery spots can be yellow to orange in color; color can vary from one region to another (C)

(A)



(B)

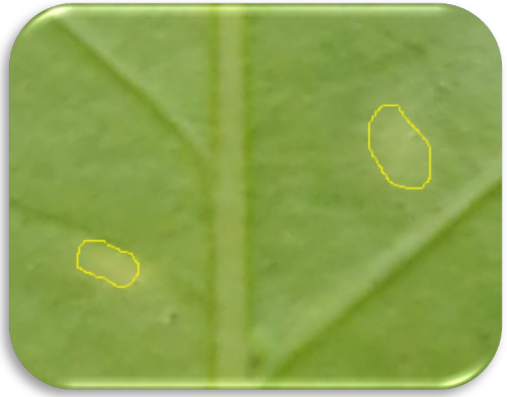
(C)

Coffee Leaf Rust: Symptoms & Signs

- Lesions can develop anywhere on the leaf; tend to concentrate around the margins
- Centers of the spots dry and turn brown, while the margins of the lesions continue to expand and produce spores
- Early in the season, the first spots usually appear on the lowermost leaves
- Infection slowly progresses up the tree
- Leaves drop prematurely, leaving twigs with no leaves

CLR impact on wild coffee on Maui and Hawai'i Island.

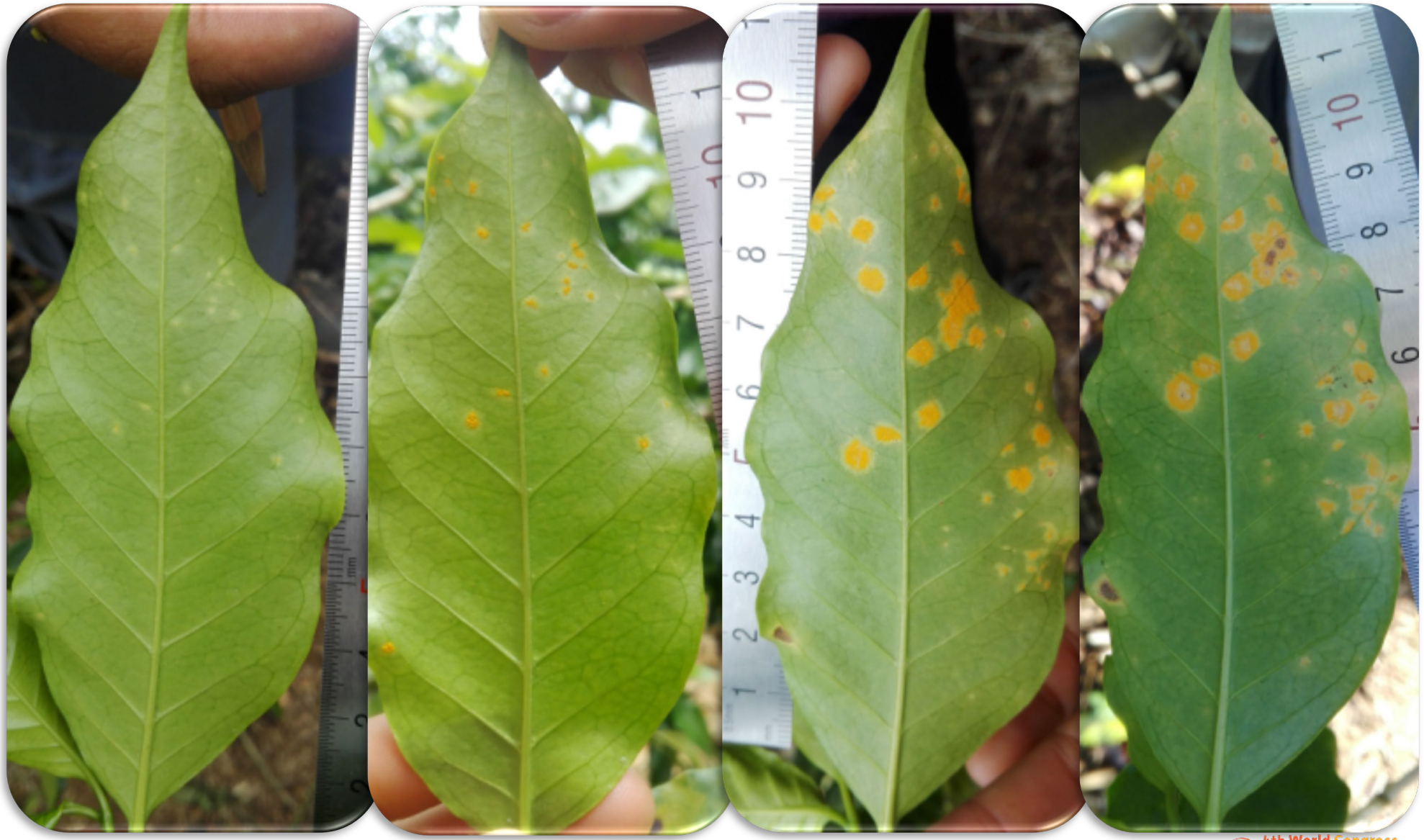
Coffee Leaf Rust: Symptoms & Signs



Lesions without spores

First spores emerge

Increase of rust area with spores

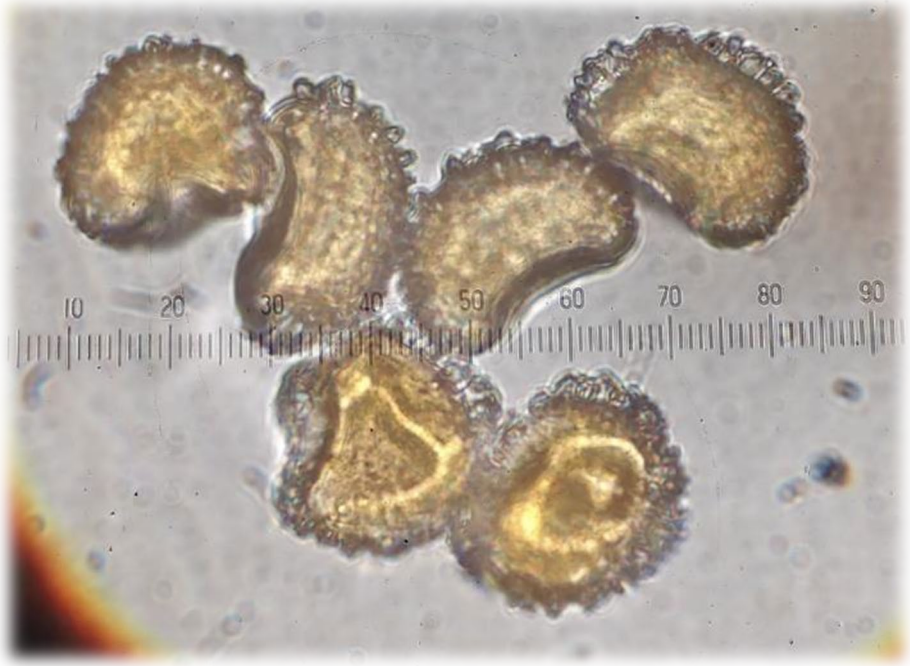


Isabelle Merle, Jacques Avelino, et al. CIRAD

4th World Congress on Agroforestry

Coffee Leaf Rust: Management

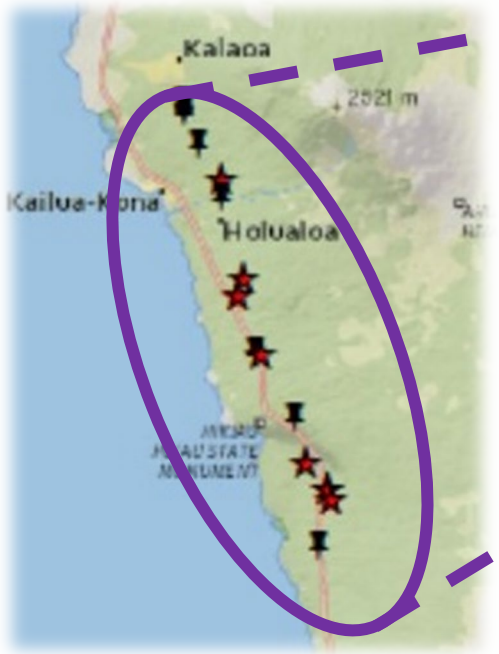
- Coffee leaf rust must be managed as a continuous epidemic on a perennial crop
- Any factor that can reduce sporulation, spore dispersal, or infection can mitigate the epidemic
- Good cultural management is vital
- Protectant and systemic fungicides (important tools; determine when and what to spray)
  - UH Guide (Product rotation is highly recommended to reduce the risk of pesticide resistance by coffee leaf rust and other diseases)
  - Mention of trademark, proprietary product, or vendor does not constitute a guarantee or warranty of the product by the U.S. Dept. of Agriculture and does not imply its approval to the exclusion of other products or vendors that also may be suitable

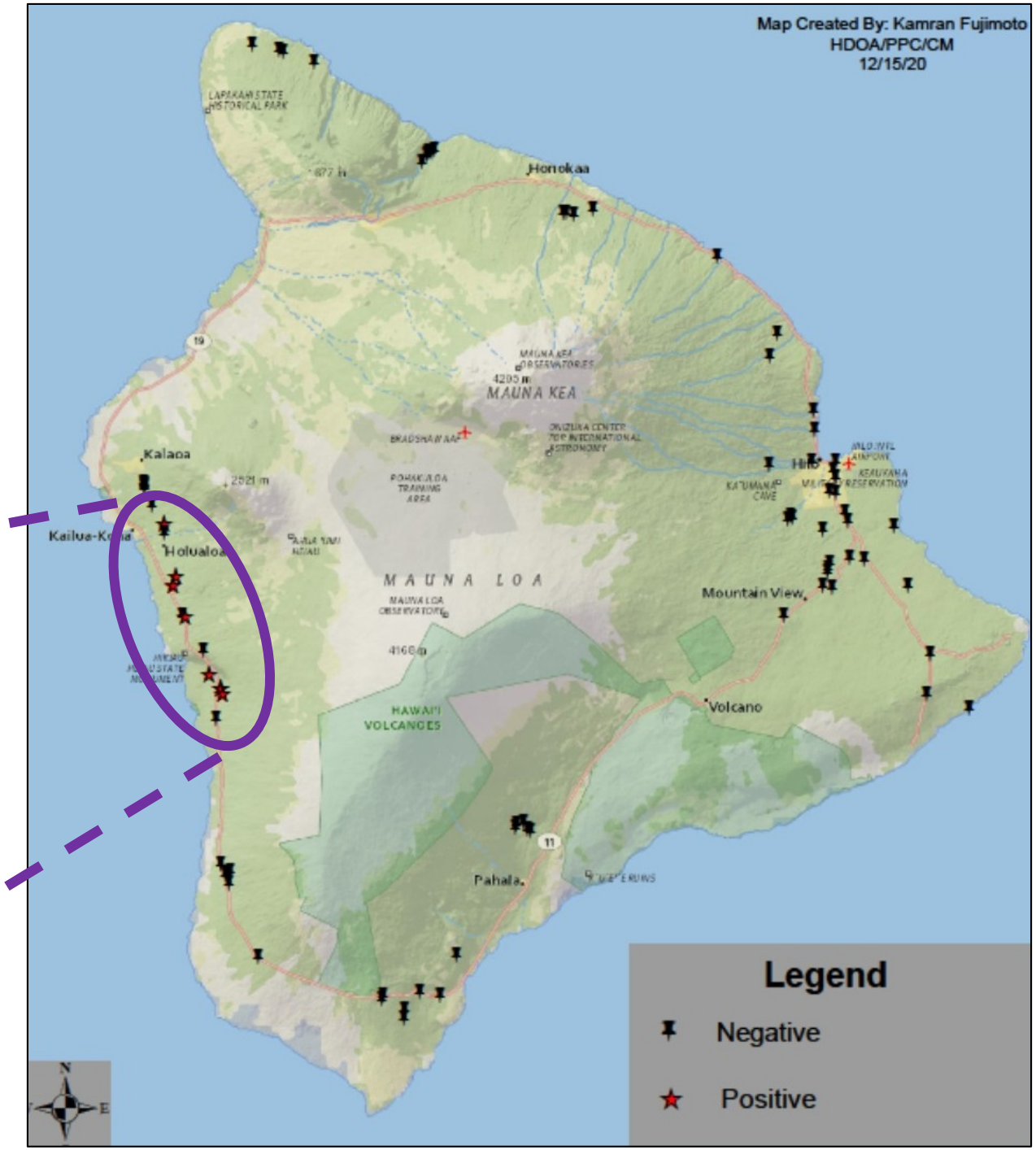


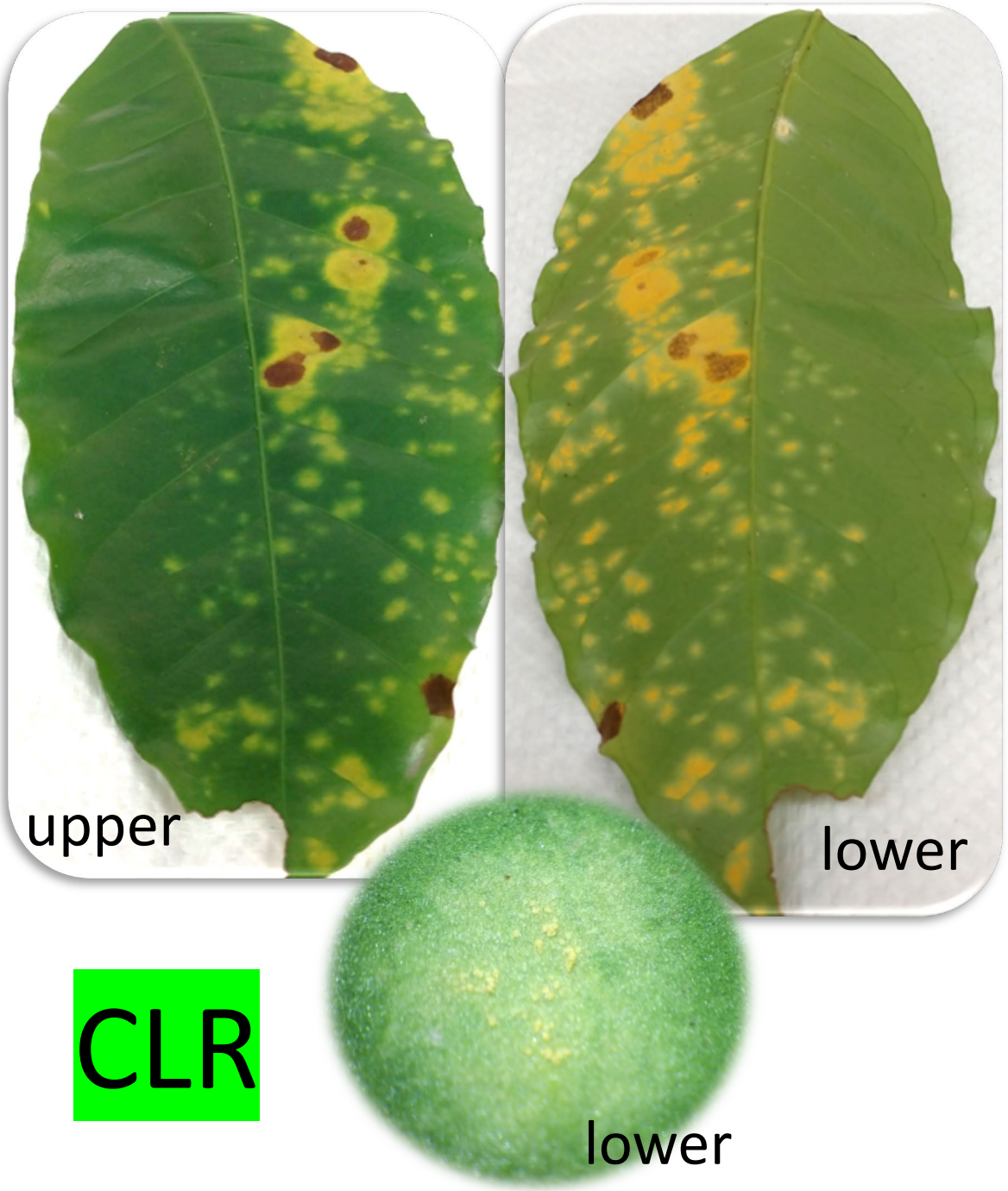
CLR Kona

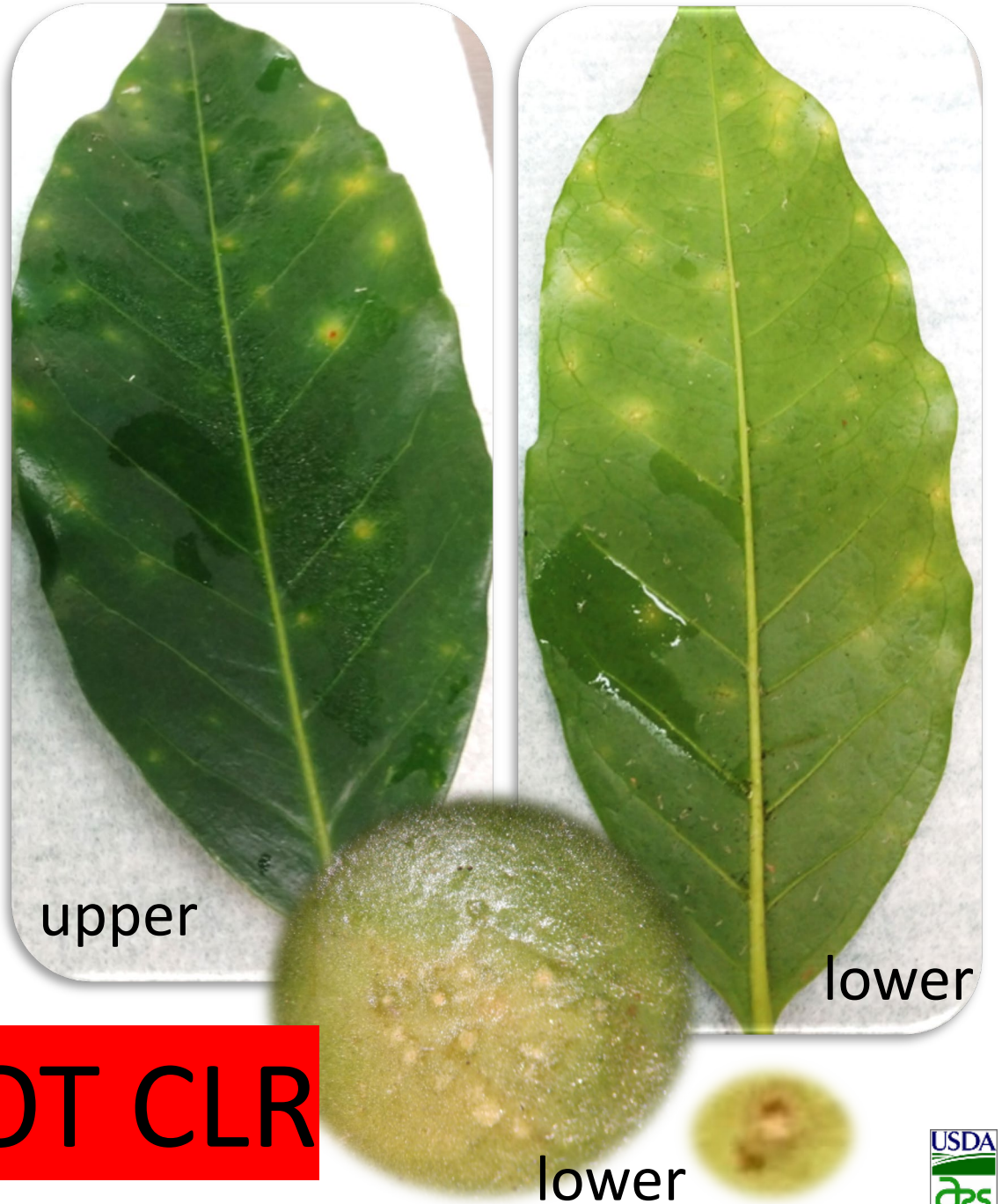
(Holualoa, Honaunau)

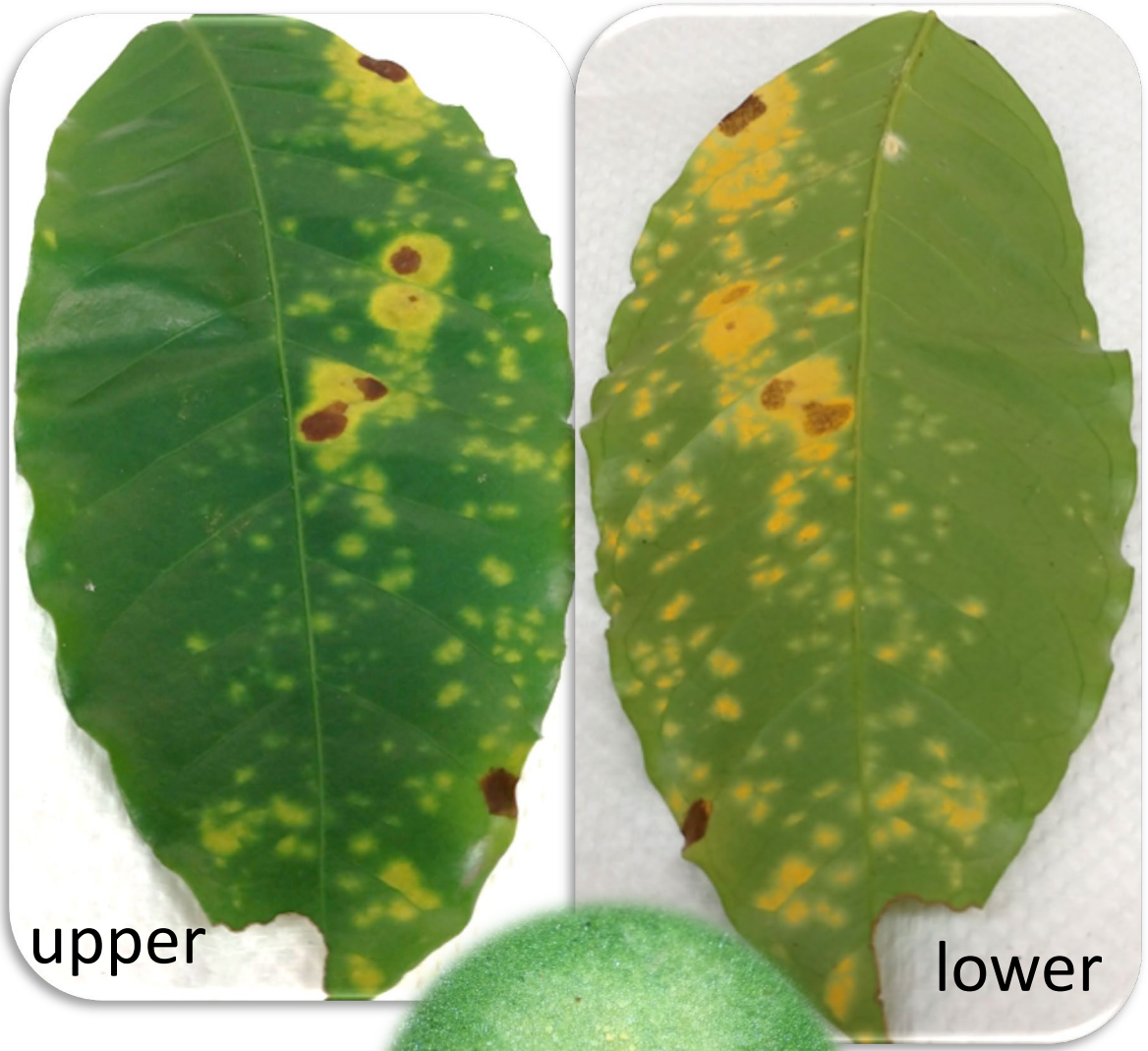
Hawai'i Island CLR Survey (HDOA)






upper
lower
lower
CLR


upper
lower
lower
NOT CLR



CLR

Coffee Leaf Rust Symptoms

- Small, irregular, pale yellow spots on the upper surface of the leaf
- Can be anywhere on the leaf where stomates are
- Tend to be concentrated around the margins
- All stages of leaf development are susceptible
- No pustule formation

Signs

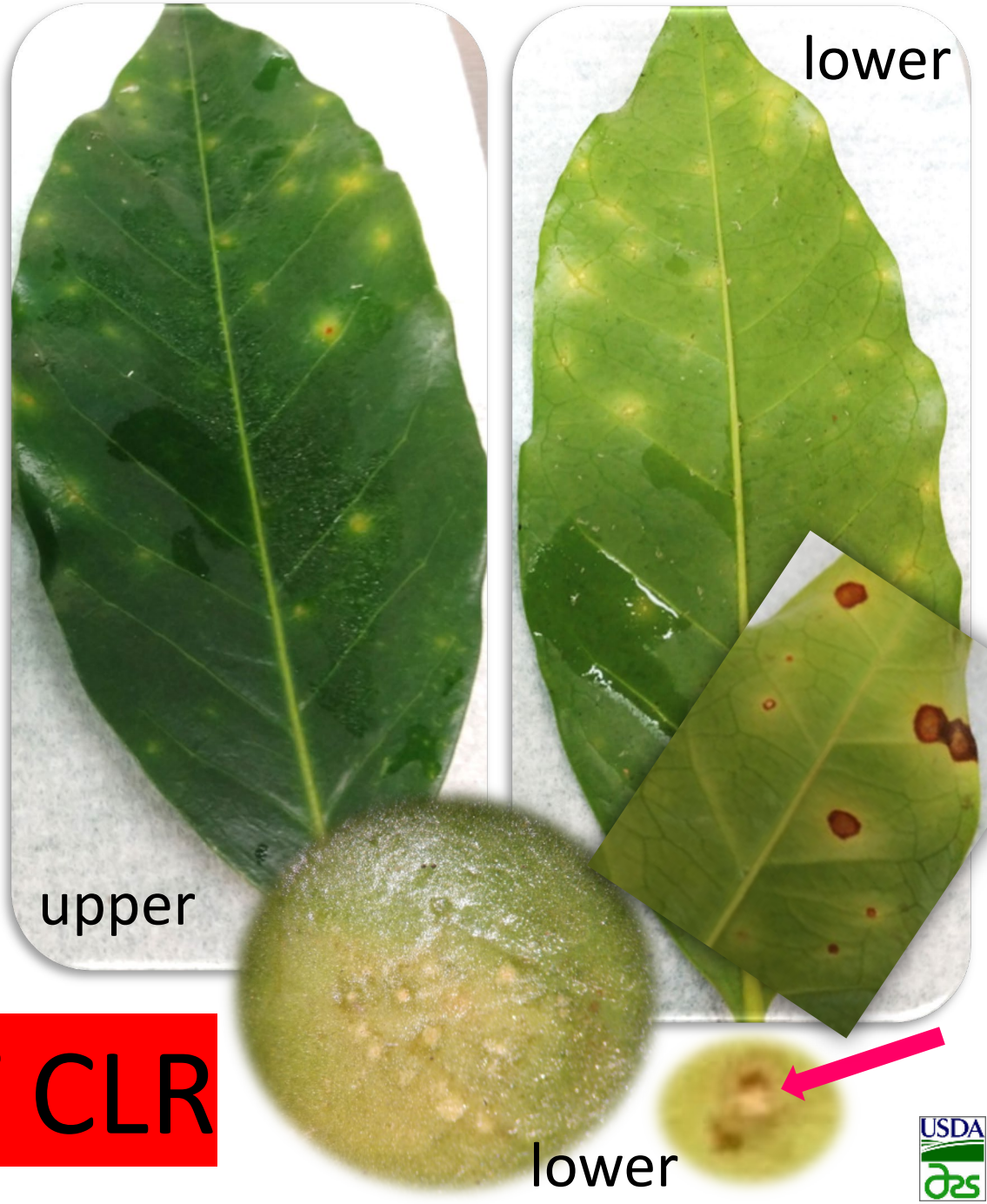
- Powdery spores
- Mycelium is completely within the leaf tissue

Cercospora Spot Symptoms

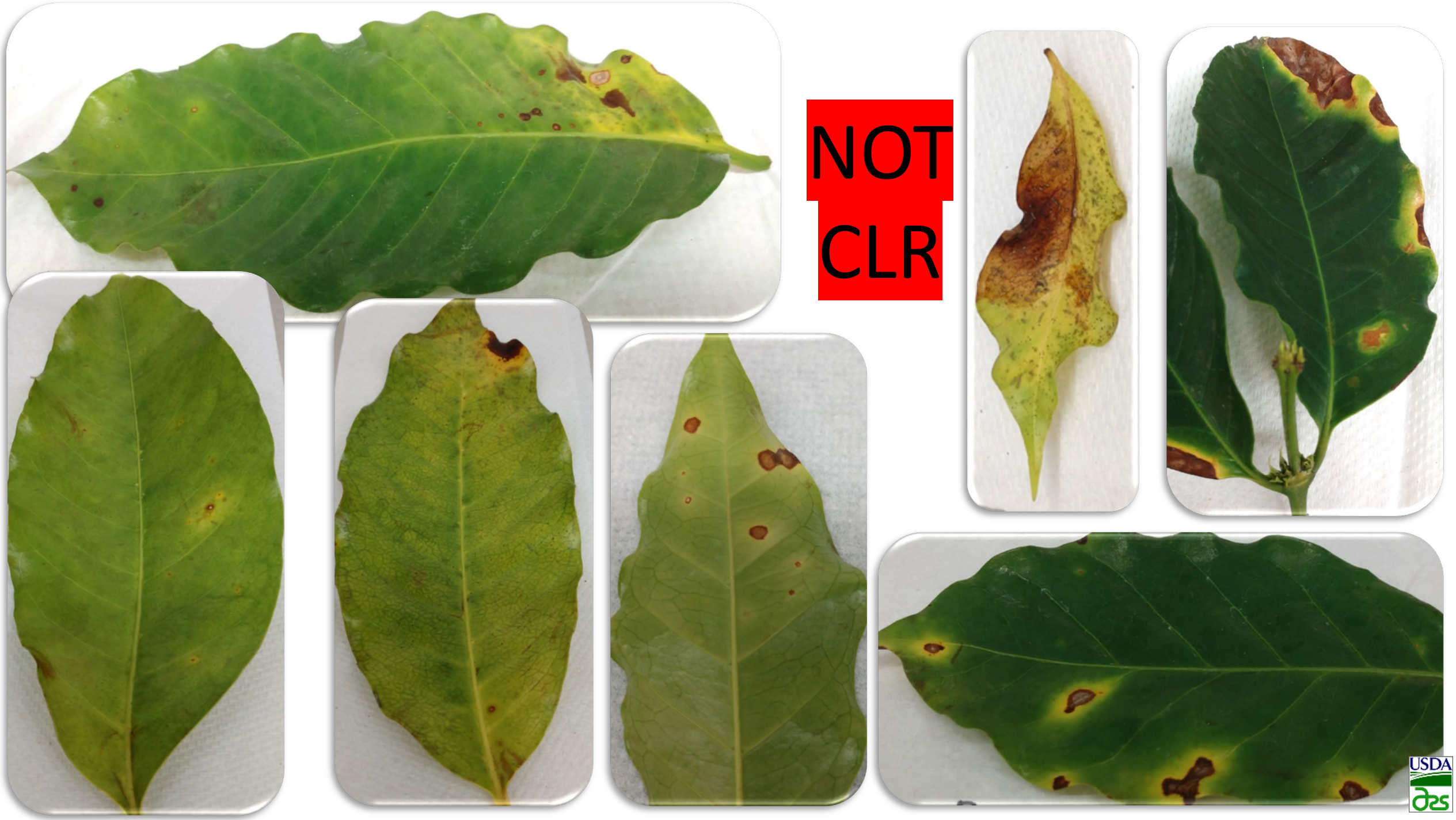
- Small, circular, brown/necrotic spots on either surface of the leaf
- Spots are surrounded by a light-yellow halo
- Can be anywhere on the leaf (including veins)
- All stages of leaf development are susceptible
- After tissue invasion, the plant tissue collapses (see pink arrow)
- Sometimes has concentric rings

Signs

- Spores are not powdery

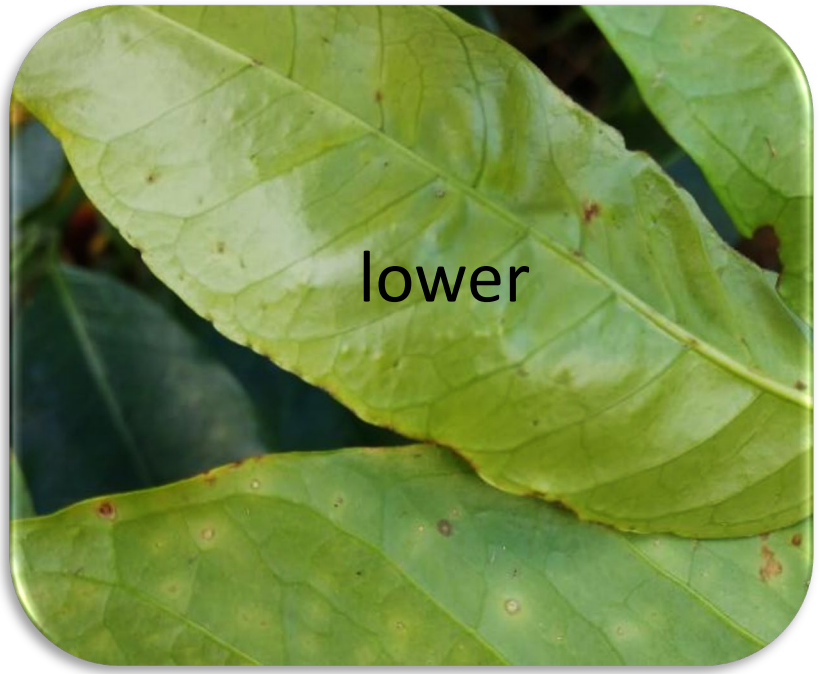


NOT CLR

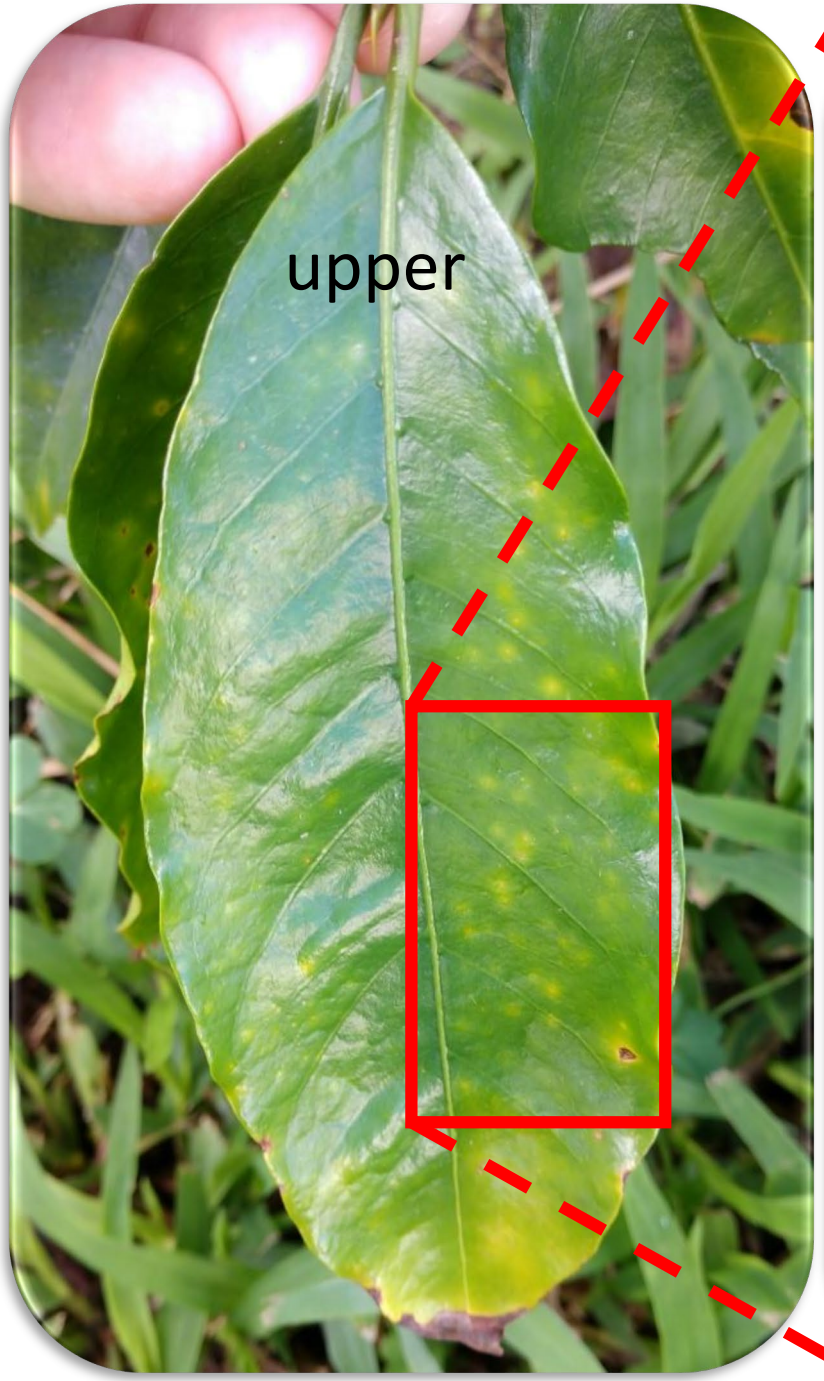

NOT
CLR


upper


NOT CLR
lower


lower


upper



NOT CLR


NOT CLR
(everything else is CLR)

Coffee Leaf Rust: Scouting & Sampling

- Follow sanitation recommendations*
- Scout all areas of the farm for <u>early detection</u>
- Lower third of the tree canopy
- Shaded areas
- Roadways and driveways
- Submit photographs of suspect CLR leaves first
  - Upper and lower leaf surface

  lisa.keith@usda.gov; andreak@hawaii.edu; HDOA.PPC@hawaii.gov
- Sample submission guidelines
  - Surveying, Sampling, and Monitoring of Coffee Leaf Rust (*Hemileia vastatrix*) for Early Disease Control in Hawai'i

    (Kawabata, Nakamoto, Keith and Oishi, 2020)

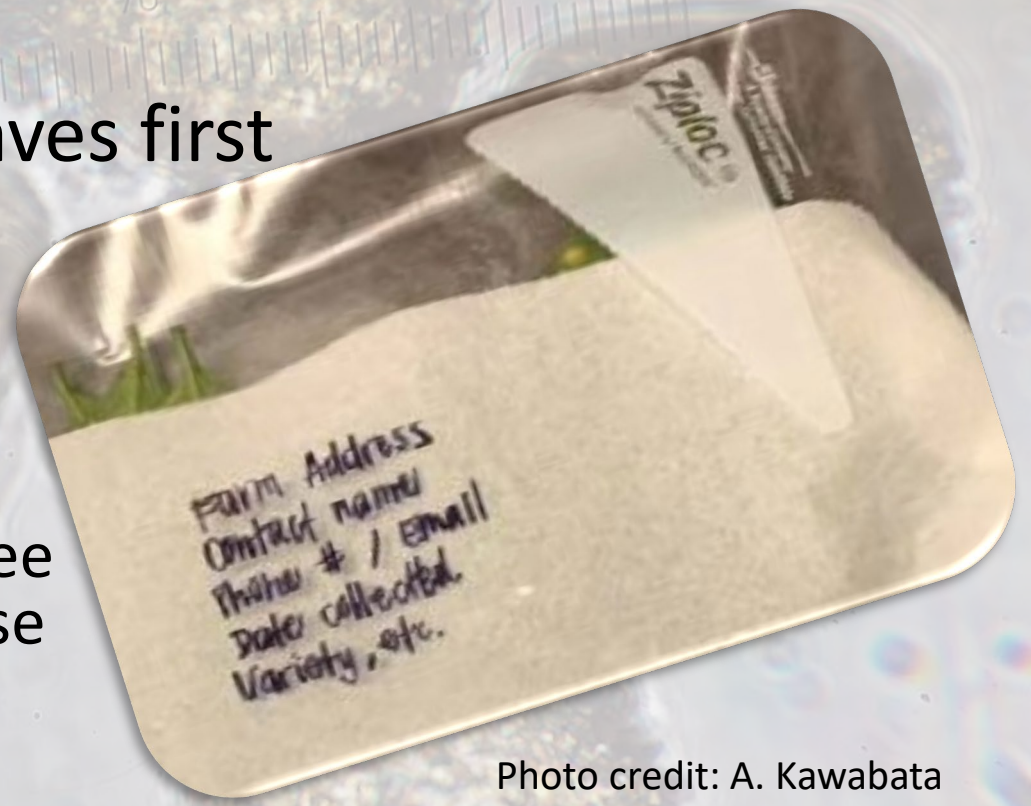


Photo credit: A. Kawabata

Summary

- CLR has been around for ~140 years
- Studied and managed
- For Hawai'i: Where is it? What race is it? What works best?
- Healthy plants
- Eliminate inoculum
- Minimize spread of CLR
- Early and accurate detection
- Short- & Long-term strategies