Hi my name is Emma Sage, from the Coffee Quality Institute, and today we are going to continue with the second part of our coffee bugs seminar series which is on coffee pathogens. What do I mean by bugs? Pathogens, bacteria, fungi, viruses or other microbes that can cause disease. Pests are usually destructive insects that you can see relatively easily and microbes bacteria fungi and others. Today we are going to talk about coffee pathogens which are generally considered to be agents that cause disease or illness to a host.

First I'm going to cover coffee rust which is a big important one. It is an obligate parasitic fungi which basically means that it is stuck to one host, obligate, and its parasitic which means it takes but does not give and it's a fungi. It is likely native to East Africa and its life cycle is dependent on Coffee, so it's obligate to coffee specifically. It is suspected still that it has an alternative host but is yet to be determined. It is very environment responsive so it needs free water to reproduce, it has a very specific range of temperatures it prefers, it is impacted by altitude, and it's also impacted by the sort of microclimate that's created by cultivation style, meaning how dense the rows are planted or what type of and what percentage of shade is involved. The real challenge of coffee rust is that it's so productive it's so numerous and it's very tough. A very small single spot of spores like the ones you see on this leaf can grow 4-6 new generations in just a few months which means hundreds of thousands of spores, and these spores that you can see in the microscope image here on this side are very very tough. It's even believed that they can exist on the outside of airplanes traveling across continentally. Plant symptoms include the characteristic yellow and orange spots, defoliation, tree loss and production loss and ultimately another bad outbreak the rust can kill whole plantations of coffee. For control options there are some strategies to create a more open environment that are helpful to encourage: airing out the moisture, getting more wind influence to help and make sure the moist environment isn't a perfect breeding ground for the rust. Generally there are some fungicides, including copper fungicides, and there are some organic options that require very heavy management, I'd say, and then a longer term option is to breed some new lines of coffee that have a better resistance.

Next there are root rots. There are all kinds of different species of root rot but they're all fungi and it's spread underground through mycelium, so it's pretty tough one. The symptoms on the plants present as leaves wilting and branches just kind of die and the trees slowly die. Control is challenging but you have to remove the trees with the roots, and burn the whole thing. There is also some fungicide that can be applied.

Coffee wilt disease is another fungal disease and it's a major pathogen in Africa that was first described in the 1920s in West. It's a fungi that colonizes the plants xylem, which is the water connecting tissue the plant that runs all the way through all of the woody parts, so it essentially cuts the plant off from water, hence the wilting, and it presents on the plant as a wilting appearance. Leaves fall off, and you will see a blue or black stain on the outer stem of the wood, in some cases, which is actually the the fungus. Certain things that you can do to control the coffee wilt disease is to prevent it by making sure to not damage your coffee's trunks at any time, such as during weeding or pruning. If there are sort of wounds in the coffee trunk it makes

it easier for the fungus to enter the plant and infect. And then again you have to remove the whole trees and burn them to get rid of this.

Next we have the coffee eye spots and leaf spots, and this is a large group of fungi and generally these don't cause major issues like plant death, but they're very very prevalent all around the world, these different spots. One of the things I'll talk about is the brown eye spot specifically, it's distributed worldwide and it presents with these brown spots on leaves or berries. So the consequence of this is that it can reduce plant productivity because this leaf for example isn't as healthy so it's not going to photosynthesize and get energy for that plant very effectively. The eye spots or this fungus generally spread via spores like any fungi, they can also be transported by rain, water or wind. They're controlled generally by fungicides, in many cases again this is not a huge problem so it's probably left untreated.

Dieback. Dieback is a little bit of a complex phenomenon because it can be fungal but also can be physiological. The fungal infection interferes with the water movement within the plant so this is a type of wilt disease like we just mentioned, and then the physiological version of dieback can happen for many reasons, which makes it a bit challenging to diagnose. Maybe there is overproduction the previous year, maybe there's excess sun or poor nutrition, or just some kind of general weakness of the plants such as by pest or drought or soil problems etcetera.

Coffee berry disease is a specific fungus, it first was reported in Kenya in the 1920s, and has hence spread around Africa. Right now it's still isolated to the African continent but it is spread by spores as any fungi is so by wind, rain or anything that can transport the spores even animals and people, and the infection really becomes present or diagnosable when the fruit occurs, and you can see an example of the fungus just starting on a fruits vs. when it's completely taken over the fruit. Coffee berry disease is a really devastating problem and it results in a large amount of crop loss, even as much as 75%. There are certain varieties that have been reported as resistant to coffee berry disease, so genetic control, if you will, is a good way to avoid this. Otherwise there's a really intensive fungicide schedule that is necessary, therefore it doesn't often happen effectively.

That concludes the set of coffee pathogens that will be talking about today. A note about control of diseases, there are a few different methods generally that can be used to control coffee pathogens. One is chemical control, so we talked about a bunch of fungicides today, cultural control, meaning things we do as humans - physically removing and burning the affected stems or even changing the density of the coffee plantations to bring in more air flow, for example. There are genetic controls which is breeding for resistant lines, and there's biological controls which are fighting like with like. We didn't talk about that today, but an example would be to find a different coffee fungi that is present in coffee environments that would out-compete a pathogenic fungi. To wrap up our mini seminar, on coffee pathogens we have seen that, pathogens are pretty exclusively fungi, and they are widespread and can be very damaging, can be closely linked to the environment with example of rust, but also some of them may be more damaging like the leaf spot.Short-term control measures often utilize fungicides and longer-term

solutions include things like breeding for disease resistance and other research investments like looking for biological controls. That concludes our mini seminar on coffee pathogens. If you'd like to learn more about cqi please visit our website