



Fungal diseases on coffee – implications for management

Coffee is of major importance for the livelihood of smallholder farmers in southwestern Ethiopia. However, the production of coffee is challenged by four major fungal diseases: coffee berry disease, coffee leaf rust, coffee wilt disease and *Armillaria* root rot. The different diseases cause serious damage at different elevations and shade levels. Thus, it is difficult to find the right management system that can reduce the occurrence of all four diseases at the same place. This is a real challenge for the farmer, who needs to balance between all these diseases. The use of resistant varieties for coffee berry disease is probably important, but could threaten the wild coffee genetic diversity. We found that a white fungus that attacks the coffee leaf rust seems to be able to reduce rust levels. It would be very interesting to promote the use of this white fungus for coffee leaf rust management. Also, it is important to raise awareness of how coffee wilt disease and *Armillaria* root rot are dispersed and how to avoid transmitting these diseases.

Coffee management in SW Ethiopia

In southwestern Ethiopia, coffee is grown in the natural forest under dense shade and also in intensively managed plantations with sparse shade (Fig. 1). However, the most common management type is that of smallholders, where farmers have gradually simplified the forest coffee systems and cultivated their own landraces of coffee for many years. Another unique feature of southwestern Ethiopia is that it is the main reservoir of the genetic diversity of Arabica coffee, which is of global importance. Several fungal diseases, which attack different parts of the coffee shrub, are major obstacles for coffee farmers in this region (Fig. 2). From the farmers' perspective there is a wish to understand how to reduce the impact of the diseases to get higher yields and better revenues. However, intensification of coffee management has the risk of negatively affecting the genetic diversity of coffee, as well as biodiversity values of the shade coffee system in the landscape.

Four fungal diseases

We studied how damage by the four major fungal diseases on coffee varied across the landscape by studying them for several years at 60 coffee farms. These places were selected in sites with high densities of coffee but still differing in how intensively they are managed. All sites were located in Gomma and Gera districts of Jimma zone, Oromia Regional State. We also specifically studied a fungus that is attacking the coffee rust, and potentially could reduce the problems with rust. In each site, we recorded the number of shade trees and altitude, and took samples of coffee leaves to examine how the genetics of the coffee varied between farms.

What did we find?

We found more coffee leaf rust in the most intensively managed parts of the landscape and at altitudes of around 1500 m, whereas coffee berry disease was more problematic on coffee growing in the natural forests and in areas situated at higher altitudes towards 2000 m (Fig 3a).

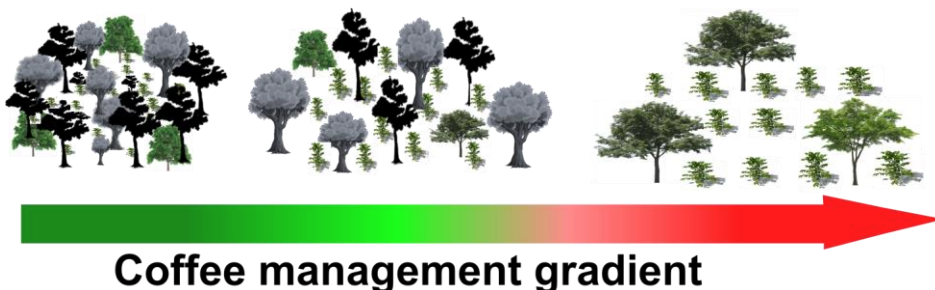


Fig 1. Coffee management gradient from forest coffee to plantation coffee

Coffee wilt disease and *Armillaria* root rot were more severe at high altitude. While coffee wilt disease was more common in the less intensively managed sites, *Armillaria* root rot was more severe in the intensively managed sites. Thus, the different species become a big problem in somewhat different types of environments. The differences in disease level was also partly explained by differences in coffee genetics between sites. In other words some coffee plants are more resistant to a specific disease than others. We also found that the coffee leaf rust and its natural enemy (the so called hyperparasite, Fig 2) like somewhat different environments; the hyperparasite likes more shade and higher altitudes. Interestingly, it seems like the rust is not growing to very high levels in places with more hyperparasites (Fig. 3b).



Fig 2. The four major fungal diseases on Arabica coffee., a) coffee leaf rust (orange) with a hyperparasitic fungus feeding on it (white), b) coffee berry disease, c) coffee wilt disease, d) *Armillaria* root rot

Conclusion, recommendations and further unanswered questions

Since the different fungal diseases have different environmental requirements, farmers need to focus on the most problematic disease. But at the same time, they should be aware that some management actions could increase one of the other diseases. We also need to learn more about the potential of the hyperparasite to suppress rust, which we found encouraging results about. This landscape also has other values such as the wild coffee gene pool and a rich diversity of plants and animals. Thus, there might be other species than the hyperparasite, that have functions as natural pest control agents in this system. This is something worth exploring. Although the use of coffee berry disease resistant varieties is important, there is also risks associated with it since it can result in loss of genetic diversity of wild coffee if it spreads into the forests.

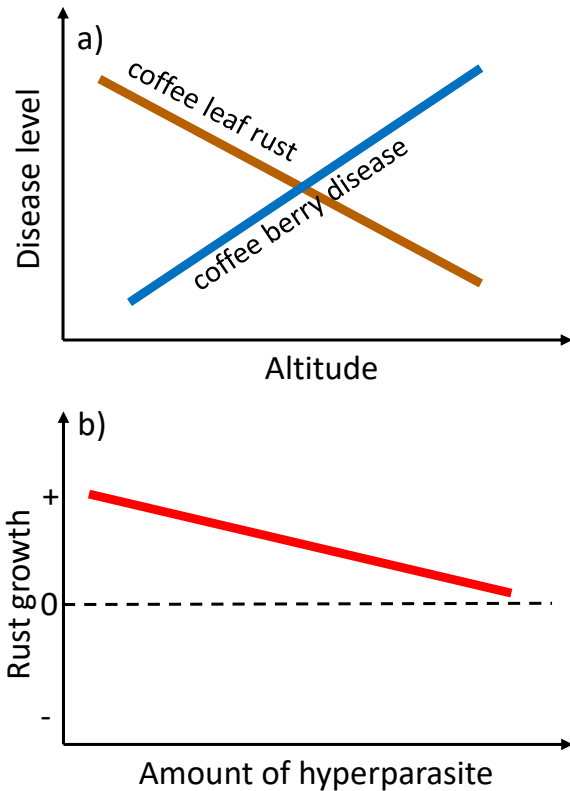


Fig 3. a) coffee leaf rust decreases, while coffee berry disease increases, with altitude. b) growth of rust from the dry to rainy season is reduced in places with a lot of the hyperparasite.

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