Pecan diseases in South Africa

Gert J Marais

The pecan industry in South Africa is growing at a rapid pace. Trees are planted in virgin soils, or where other crops have been produced in the past. The ecological equilibrium in these areas is disrupted and new interactions between the plants and other living organisms such as microorganisms, insects, and smaller animals are established. This also lead to situations where plant pathogenic organisms such as fungi start attacking pecan trees that has not been seen before, or where unique diseases occur not seen elsewhere in the world.

Farmers from the Hartswater area frequently reported scab on nuts over the last few years, although the origin and causal agent of the disease was unknown. It is, however, known to be a disease occurring in certain parts of the south-eastern USA, which is caused by the fungus, *Fusicladium effusum* (previously known as *Cladosporium caryigenum*). Scab in the USA is observed as light brown circular lesions on stems, leaves, shucks and nuts. The lesions are at first olive-green spots that turn black as they age (Figure 1).

At the end of 2013, a project was launched between SAPPA and the University of the Free State to conduct a survey of pathogens on pecans in the Hartswater area. This was expanded to the Prieska area at the end of 2014. The purpose of the project is to monitor the fungal species and their incidences over a 3-year period during the growing seasons of pecans. In addition, the project aims to identify the most prominent and problematic pathogens, and finding possible solutions to control their effect on pecan trees.

Studies done by the University of the Free State in the Hartswater, Prieska, Hopetown and Upington areas during the 2013/2014 season did not show any presence of *Fusicladium effusum*, or typical scab symptoms. However, symptoms of anthracnose and black spot have been observed on nuts and leaves in most of these areas. Results indicated that the fungus, *Alternaria tenuissima*, is constantly

associated with anthracnose lesions (Figure 2) and *Neofusicoccum parvum* with black lesions (Figure 3).

A survey done in the Hartswater area indicated that at least 120 different fungal species are associated with pecans in this area. These fungi range from known pathogenic fungi, never reported before on pecans, to saprophytic fungi that normally only grow on dead or dying plant material. Although the latter fungi are not regarded as pathogenic to plants, their presence is normally an indication that other stress factors are playing a role in the overall health of the pecan trees, making the trees susceptible to attack by non-pathogenic fungi.

This is most probably what is experienced in the case of *Alternaria tenuissima*, which is a known endophyte of various plants. This fungus occurs systemically inside plants without any obvious disease systems. When the plants are becoming stressed because of other factors, this fungus can cause visual symptoms such as leave spot and anthracnose on nuts. Proof of this is that *Alternaria tenuissima* is constantly isolated from both apparently healthy and diseased plant parts. When this fungus is artificially inoculated on leaves and nuts, however, typical disease systems are observed, showing its ability to cause disease. Almost all pecan samples, whether diseased or healthy, analysed in the previous season, contained *A. tenuissima*. This is an indication of the high incidence and widespread occurrence of this fungus.

Neofusicoccum parvum has shown to be highly aggressive in glasshouse experiments where the fungus was able to penetrate and colonise a pecan nut within 5 days, causing black spot. This fungus is mostly associated with stink bugs and pecan nuts in the Hartswater area, but recent observations also indicated that this fungus is dominant in plant material taken from branches showing die-back. Evidence is normally a darkened lesion in the core of the branch.

A number of other important plant pathogens have also been isolated. However, no information exists whether these fungi have previously been associated with pecans. As part of the ongoing project between SAPPA and the University of the Free State

the pathogenicity of these fungi to pecans will be determined, and fungicides will be screened for their ability to control these fungi.

A fungus that was constantly isolated from the Hopetown and Prieska areas in the 2013/2014 season is *Trichothecium roseum*. In the USA this fungus is mostly found on pecan nuts that are infected with the scab fungus, called pink mold. This fungus apparently enters nuts through scab lesions and produce masses of pink spores until late autumn. It can invade the kernel of thin-shelled pecan varieties that lead to pink rot and causing an oily appearance of the nut shell, and a rancid odour. Pink rot is effectively controlled by controlling the scab fungus. It thus seems that *T. roseum* needs another pathogen to cause damage, after which it can colonise the nut as a secondary invader. The reason for pink mold occurring in the Hopetown and Prieska areas is yet not known, but further work is needed to investigate its association with any other pathogens on pecans in these areas.

Other pathogens also isolated from pecans in the last season include *Colletotrichum gloeosporioides* and *Neocosmospora vasinfecta*, both of which have not yet been reported from pecans before. Their pathogenicity on pecans is not known, but they have shown to be important pathogens on other crops such as mango, cotton, watermelon and cowpeas. This will be part of further studies that are planned for the 2014/2015 season.

It is apparent that we are just starting to scratch the surface of understanding the occurrence of pathogens in pecans in South Africa, and the initial data we have collected differs dramatically what is experienced elsewhere in the world. It is, therefore, important that the pecan industry in South Africa needs to collect its own data and finding solutions that would likely be as unique as the diseases it is experiencing.

Many fungi that were found on pecans in South Africa over the past season are known to be opportunistic fungi and are secondary invaders. This indicates that other underlying problems are experienced that could likely be attributed to environmental conditions, nutritional quality of soils, or the adaptive strength of cultivars. This gives hope that if the industry can find and maintain the ideal

conditions under which pecan trees in South Africa can grow, many of the opportunistic pathogens will also decline in numbers. There is, however, still a long way to go before this point will be reached.

Image: Chuck Reilly
http://phys.org/news/2014-09-compound-bacteria-pecan-scab.html
Figure 1: Typical symptoms of scab in pecan nuts in the USA, caused by *Fusicladium effusum*.

Figure 2: Anthracnose with typical sunken black lesions associated with *Alternaria tenuissima*.

Figure 3: Black spot lesions associated with *Neofusicoccum parvum*.