

MALFORMATIONS, MALFORMATIONS EVERYWHERE ...

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Malformations are characterized as excessive enlargements and deformation of plant organs. They are caused by most plant disease causing organisms such as insects, fungi, phytoplasmas and viruses. They appear either as the direct symptom of disease, or may be the consequence of other physiological changes caused by the initial infection. These malformations lead to sterility of the flowers that, in the case of commercial plants, leads to losses in yield and profit.

The best known case of malformations on a tree in South Africa, but also around the world, is that of mangos (family Anacardiaceae). As mangos are an important agricultural crop, with a total gross value of R0.18 billion in South Africa for the 2010/11 marketing season, their malformations have warranted significant investigation. The causal agents (*Fusarium* spp.) and physiology, with regard to hormone and nutrient levels, have been well studied. Two other members of the Anacardiaceae afflicted by malformation symptoms are commercial pistachio in Iran and the South African native tree karee. Malformations of pistachio are found to be caused by a phytoplasma, but the causal agent for karee is still unknown. Other affected native trees in South Africa include proteas and waterberry. The causal agents of malformations of waterberry are also *Fusarium* spp. (Kvas, 2010), whilst the witch's broom malformations of protea are caused by mites and a phytoplasma (Wright *et al.*, 2002).

General literature on karee is sparse, which is a surprising revelation for the South African Botany community as we consider it being a widespread, hardy, abundant evergreen tree species. Virtually nothing is known about the malformation symptoms on karee, and nothing about the impact of these symptoms on this prominent native tree. It is thus with concern that we note that our beloved evergreen karee that we so often take for granted, has fallen victim to the same foe as its relatives mango and pistachio – malformations (Fig. 1a, b).



Fig. 1 Malformations of karee. a) Floral malformations of karee. b) Vegetative malformations of karee.

We have taken up the task of documenting as much as we can on the effect of these malformations on karee and to initiate investigations to what is causing them, the extent to which they occur and the impact they have. Since we know the causal agents for mango malformations are *Fusarium* spp., assumed that species from this genus would be the causal agents. However, very few *Fusarium* spp. were to be found. We did, however, numerous other endophytic fungi concentrated in the malformed tissues (with 573 morphological species found!). The majority of these were *Alternaria* spp. that are known plant pathogens although not prominent as tree pathogens and not known to cause malformations.

While we were collecting samples and growing uncountable cultures, we discovered other organisms in addition to fungi. After careful microscopic dissection we found some amazing insect assemblages within the malformed tissues of karee, which were not as prominent on the unaffected tissue. With the help of entomologist Jaco Saaiman, we have characterized a total of 19 morphological insect species from 14 families. Over 90% of the insects belonged to the Psyllidae. Psyllids are known to act as carriers for malformation causing agents such as phytoplasmas and viruses. Since malformations of pistachio are caused by phytoplasmas, these organisms may be candidates of causing the malformations in karee. In future we shall thus focus on searching for these unculturable plant pathogens.

Currently, we do not know how far reaching the effects of karee malformations have spread. Our surveys could only reach trees in Kimberley (NC), Pretoria (GP), and Bloemfontein (FS) areas, but we found a metropolis of malformations in Christiana (NW). We therefore kindly request that other researchers and members of the public notify us when they see malformations on karee. This will enable us to continue our investigation and help save and protect our evergreen karee (Fig. 2).



Fig. 2 Karee (*Searsia lancea*) in Bloemfontein

Relevant literature:

- Kvas, M. 2010. Characterisation of *Fusarium* species associated with floral malformation of *Syzygium cordatum*. M.Sc. Microbiology & Plant Pathology, University of Pretoria, South Africa.
- Marasas, W.F.O., Ploetz, R.C., Wingfield, M.J., Wingfield, B.D., & Steenkamp, E.T. 2006. Mango Malformation Disease and the Associated *Fusarium* Species. *Phytopathology*, 96(6): 667 – 672.
- Wright, M., & Wieczorek, A. 2002. PCR detection of phytoplasma from witches' broom disease on *Protea* spp. (Proteaceae) and associated arthropods. In VI International Protea Research Symposium, 602: 161 – 166.
- Zamharir, M.G., & Mirabolfathi, M. Association of a Phytoplasma with Pistachio witches' Broom Disease in Iran. *Phytopathology*, 159(1): 60 – 62.