

‘*CANDIDATUS LIBERIBACTER AFRICANUS*’ RELATIVES AMONGST NATIVE RUTACEOUS HOSTS OF *TRIOZA ERYTREA* IN SOUTH AFRICA

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Citrus production in South Africa has come a long way since the arrival of the first orange trees on South African soil, June 14th 1654, as noted in the journal of Jan van Riebeeck. Presently, South Africa is ranked 13th amongst the world’s fresh citrus production being the third largest exporter of citrus behind Spain and Turkey. Export to the international market reached 1,376 thousand tons of citrus during 2010/11.

Due to the economic importance of this industry, extensive research is being done on citrus in South Africa to ensure that the industry thrives, even under threat from various diseases. One such disease is locally known as citrus Greening. The causal agent of Greening is an unculturable bacterium referred to as ‘*Candidatus Liberibacter africanus*’ (Laf). Similar to Greening, citrus Huanglongbing (HLB), which is considered to be more devastating than Greening, is described from Southern China, India, Brazil and Florida and is caused by a bacterium related to Laf known as ‘*Candidatus Liberibacter asiaticus*’ (Las). A third citrus-infecting Liberibacter is described from Brazil which is known as ‘*Candidatus Liberibacter americanus*’ (Lam).

The origin of these citrus infecting Liberibacters has long been a main discussion amongst researchers, with two theories being debated. The first theory can be described as the ‘multiple continental hypothesis’ in which it is believed that each Liberibacter originated from the continent where it was first described: Las from Asia, Laf from Africa and Lam from South America. Contrary to this theory is the single origin theory that states that all known Liberibacters evolved from a common ancestor that was present on the African continent and host by an indigenous rutaceous tree.

In a recent CTHB-funded study, Liberibacters related to Laf were identified from three indigenous Rutaceous hosts, *Clausena anisata* (Horsewood tree), *Vepris lanceolata* (White Ironwood) and *Zanthoxylum capense* (Small forest knobwood). Due to the close relationship seen for these newly identified Liberibacters and Laf, it was proposed that they be given subspecies status and were subsequently named ‘*Candidatus Liberibacter africanus* subsp. clausenae’ (LafCl), ‘*Candidatus Liberibacter africanus* subsp. vepridis’ (LafV) and ‘*Candidatus Liberibacter africanus* subsp. zanthoxyli’ (LafZ).



Conferences, field trips and trees sampled. **Fig a:** The citrus virology group at the 19th conference of the international organization of citrus virologist where the work discussed in this nugget was presented. **Figs b-g:** Various field trips where samples of *Clausena anisata* (Figs. i and j), *Vepris lanceolata* (Figs. g and h) and *Zanthoxylum capense* (Figs. k and l) were collected.

The sheer diversity seen for closely related *Liberibacter* species from South Africa suggest that Laf has its origins on the African continent. This is further supported when one considers that Laf is only present on the African continent, where commercial citrus is an introduced crop. In an attempt to explain how Laf came to infect citrus, it must first be noted that the insect vector of Laf, *Trioza erytreae*, is capable of colonizing and feeding on all three

indigenous rutaceous hosts from which these novel Liberibacters were identified. *Trioza erytreae*, however, preferentially feeds on commercial citrus varieties compared to its native rutaceous hosts. This preferential feeding would have indirectly placed selective pressures on either one of the Liberibacters present within indigenous rutaceous hosts to adapt to a new citrus host. Further studies are, however, needed to determine whether LafCI, LafV and LafZ are capable of being acquired and transmitted by *T. erytreae*.

The presence of various Liberibacter species from South Africa does conclusively settle the debate regarding the origin of all citrus-infecting Liberibacters. However, it gives some insight into the possible origin of Laf from the African continent and should be further investigated. Additionally, these indigenous Liberibacters may hold the key into finding alternative control strategies in combating Greening disease in South Africa.