Houseplant pest gives clue to potential new anthrax treatment

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This is Dr. Nadia Kadi of the University of Warwick with African violets. Credit: University of Warwick

Researchers at the University of Warwick have found how a citric acid-based Achilles heel used by a pathogen that attacks the popular African Violet house plant could be exploited not just to save African Violets but also to provide a potentially effective treatment for Anthrax.

The researchers examined how a chemical structure is assembled in a bacterial pathogen called *Pectobacterium chrysanthemi* (*Dickya dadantii*) that afflicts plants - particularly the African Violet which often appears in many homes as a decorative houseplant.

Like many bacteria *Pectobacterium chrysanthemi* competes with its host for iron. Without a supply of this essential nutrient the bacterium cannot grow. The University of Warwick researchers Dr Nadia Kadi, Dr Daniel Oves-Costales, Dr Lijiang Song and Professor Gregory Challis worked with colleagues at St Andrews University to examine how a "siderophore", one of the key tools the bacterium uses to harvest iron is assembled. They discovered how an enzyme catalyst in the assembly of this particular siderophore - called achromobactin - binds citric acid, a vital iron-binding component of the structure. Their findings show that this chemical pathway could be blocked or inhibited to prevent the bacterium from harvesting iron, essentially starving it.

While an interesting piece of science in itself and of even more interest to owners of African Violet houseplants the Warwick research team found that this work also has major implications for the treatment of several virulent and even deadly mammalian infections including Anthrax.

A second piece of research conducted by three of the University of Warwick researchers (Dr Daniel Oves-Costales, Dr Lijiang Song and Professor Gregory L. Challis) found that the deadly pathogen which causes Anthrax in humans uses an enzyme to incorporate citric acid into another siderophore that is very similar to the one used by the African Violet pathogen. The researchers showed that both enzymes recognise citric acid in the same way. This means a common strategy could be used to block both the Anthrax and African Violet pathogen siderophore synthesis pathways.

Professor Greg Challis University of Warwick said:

"Inhibiting this citric acid-based process could be even more effective in combating an anthrax infection than it would be in combating the African violet pathogen, because the African Violet pathogen has a

second siderophore that can harvest iron from the host and could attempt to struggle on with just this, whereas the anthrax pathogen appears not to have such a back up mechanism."

This new discovery could lead to the design of drugs that might eliminate the anthrax pathogen's ability to harvest iron and stop an infection dead in its tracks. A respiratory anthrax infection is nearly always fatal but this discovery opens new possibilities for combating such infections.

The benefits of the discovery may even go beyond treatments for Anthrax. The researchers are now looking at similar enzymes involved in the assembly of citric acid-derived siderophores in E. coli and MRSA, which may offer further targets for drug development.

More information: The African violet pathogen research "AcsD catalyzes enantioselective citrate desymmetrization in siderophore biosynthesis" is published in Nature Chemical Biology, 2009, 5, 174-182. The paper on Anthrax entitled "Enantioselective desymmetrisation of citric acid catalysed by the substrate-tolerant petrobactin biosynthetic enzyme AsbA" is published in Chemical Communications, 2009, doi: 10.1039/b823147h

Source: University of Warwick