Biological indicators to detect biotoxin in rural drinking water

The humble little cricket - and duckweed - might just find itself suddenly in demand when it comes to safe drinking water in the rural areas of the country.

CSIR scientists have developed a method of using a water plant and insects as indicators of the toxicity of blue-green algae in rural drinking water.

According to CSIR limnologist Dr Paul Oberholster, bloom-forming cyanobacteria in eutrophic surface waters of South Africa have caused increasing concern over the past decade as a result of its toxic potential.

Duckweed was exposed to different levels of synthetic cyanobacteria biotoxin

"Safe drinking water is one of our most basic needs in life. Although water is essential for all life forms, it can also be a cause of disease and death if it contains harmful substances or organisms. The ingestion of cyanobacterial microcystins released upon cell lyses, can cause sickness or death of animals and pose serious problems for human drinking water supplies," he writes in an article published in the *African Journal of Biotechnology*.

To date, only life stock deaths and some domestic animal poisonings have occurred due to cyanobacterial poisoning in South Africa. However, international research has shown a positive association between chronic exposure to low levels of cyanotoxins in drinking water and higher incidence of colorectal and liver cancer, especially in China.

The commonest and most reliable screening test for cyanobacterial toxicity, the mouse bioassay, is not always feasible in South Africa, especially for water purification plants in rural areas.

The study therefore looked at alternative but reliable test methods by subjecting a water plant (duckweed) and four different insects (American cockroach, common cricket, yellow mealworm and brine shrimp) to low concentrations of synthetic cyanobacteria biotoxin and crude extract of the cyanobacteria *Microcystis aeruginosa*.

The study found the duckweed (*Spirodela punctata*) most sensitive after exposure to the toxins. Within the first 12 hours after exposure its chlorophyll pigment ratio within fronds started to change. After five days it showed a reduction of root growth and fronds weight.

While the American cockroach (*Periplaneta americana*) and yellow mealworm (*Tenebrio molitar*) survived the tests without too much damage, the common cricket (*Gryllus bimaculatus*) died within 48 hours after exposure to a low concentration (0.1 *µg*/L) of synthetic cyanobacteria biotoxin.

However, further research is needed to standardise the tests before it can be used as an alternative to the mouse bioassays. For now, though, duckweed and the little cricket can act as rapid, reliable and affordable screening tools for the presence of cyanobacterial toxins in rural drinking water.

- Wiida Fourie