

From carnivorous plants to the medicine cabinet?

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In the tropics, carnivorous plants trap unsuspecting prey in a cavity filled with liquid known as a "pitcher."

The moment insects like flies, ants and beetles fall into a pitcher, the plant's enzymes are activated and begin dissolving their new meal, obtaining nutrients such as carbon and nitrogen which are difficult to extract from certain soils. Carnivorous plants also possess a highly developed set of compounds and secondary metabolites to aid in their survival.

These compounds could serve as a new class of anti-fungal drugs for use in human medicine, says Prof. Aviah Zilberstein of Tel Aviv University's Department of Plant Sciences. In a study conducted together with Dr. Haviva Eilenberg from her lab, Prof. Esther Segal from Sackler Faculty of Medicine and Prof. Shmuel Carmeli from the School of Chemistry, the unusual components from the plants' pitchers were found effective as anti-fungal drugs against human fungal infections widespread in hospitals. The primary results are encouraging.

"To avoid sharing precious food resources with other micro-organisms such as fungi, the carnivorous plant has developed a host of agents that act as natural anti-fungal agents," says Prof. Zilberstein. "In the natural habitat of the tropics, competition for food is fierce, and the hot, moist environment is perfect for fungi, which would also love to eat the plant's insect meal."

Highly resistant and 100% organic

After initial tests of the plant proteins and enzymes that dissolve the chitin of fungi, Prof. Zilberstein assumes that, in the right clinical conditions, the pitcher secondary metabolites can be developed to effective anti-fungal drugs, that may avoid the evolution of new resistant infective strains.

The collaborating team has just published a paper exploring that potential in the [Journal of Experimental Biology](#), based on the biology of the carnivorous plant *Nepenthes khasiana*. This plant species is originally found in India but is also being reared in Tel Aviv University greenhouses.

Currently there is a need for additional broadly effective anti-fungal drugs. Even mildly severe forms of athlete's foot or other skin fungal infections lack effective treatments. The problem becomes more dire at hospitals, where thousands of Americans die each year from secondary fungal infections they acquire during their stay as patients.

Forging a "wild" pathway in drug discovery

The collaborating team has determined plant secondary metabolites that function as anti-fungal agents. "The pitcher of the carnivorous plant produces these compounds in a gland," says Prof. Zilberstein. Until now, no one has published or discussed the anti-fungal metabolites found in the trap liquid of this plant, she says.

"We're hoping that these metabolites are working together to keep fungus at bay. Our aim now is to get funding for pre-clinical tests of these compounds in an animal model, so we can investigate their effectiveness against the two very acute fungal pathogens found in

hospitals worldwide," she says.

The idea that liquid from a plant pitcher could stave off infection has been documented in the folk literature of India, where people drink carnivorous plant pitcher juice as a general elixir. "There is a lot of room for developing compounds from nature into new drugs," says Prof. Zilberstein. "The one we are working on is not toxic to humans. Now we hope to show how this very natural product can be further developed as a means to overcome some basic problems in hospitals all over the world."

Provided by Tel Aviv University

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