Soledade Pedras

Chemistry Defending Plants

According to Soledade C. Pedras, her greatest success and pride is in being able to apply her passion for and knowledge of chemistry in the field of plant biology (known as bio-organic chemistry). It is, in fact, an unusual combination, but the spin-offs can be extremely beneficial for the field of agriculture and in helping to solve the problem of famine in some parts of the world.

After obtaining a doctorate from the University of Alberta, Pedras pursued a career at the NRC's Plant Biotechnology Institute of Saskatoon. In 1994, she was offered a position as Assistant Professor of Chemistry at the University of Saskatchewan where she directs a research team of approximately 10 graduate students, research associates, and technician assistants. Pedras and her team are studying the molecular and enzymatic defence reactions of plants to attacks by pathogens. Her goal is to discover the chemical and biological strategies that plants use to resist various toxins (often transmitted by microbes, insects or other creatures) found in their natural environment. Once they are well known and analysed, these particular defence strategies can be transmitted to other plant species through traditional plant breeding or modern genetic engineering.

The following is a very concrete example of what is keeping Pedras busy at present. Western Canada is known for the numerous agricultural species under cultivation, including canola and mustard plants. Unfortunately, these plants are subject to attacks from disease-causing micro-organisms that release phytotoxins. Destruxin B is a phytotoxin produced in plants attacked by the Alternaria blackspot microbe. However, a certain type of white mustard, also attacked by micro-organisms, will not develop Alternaria blackspot because it has developed a very effective defence mechanism. And what Pedras has succeeded in discovering is this very special defence mechanism.

To discover the mechanism, she had to use modern chemical techniques. First, HPLC (high-performance liquid chromatography) was used to analyse the disappearance of destruxin B concentrations in white mustard plants. Pedras then isolated the transformed destruxin B product, by separation methods such as FCC (flash column chromatography). The crucial phase was to determine the chemical structure and composition of the extracted product, which was done through the application of NMR and HRMS techniques (nuclear magnetic resonance and high-resolution mass spectroscopy). This was how Pedras discovered that enzymatic protein was transforming the destruxin B into an inoffensive HO-destruxin-B molecule. Using the same chemical techniques, Pedras' team succeeded in isolating and characterising this enzyme.

In the not too distant future, it will be possible to sequence this protein and determine the gene that contains the code responsible for synthesizing the enzyme. Through Pedras' work and the collaboration with molecular biologists, this coding gene can be used and introduced into the gene pool of other species of plants (such as canola) to make them resistant to Alternaria blackspot. Thus, through her research and relentless work, Pedras will soon find the key to defending plants through, environmentally friendly solution (eliminating insecticides and fungicides) while increasing farmers' harvest yields.