Scientists find plant gene that affects stress resistance

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A University of Saskatchewan team of scientists has isolated a gene that has never before been identified in helping plants to resist stress.

The study—published this month in the top-ranked plant journal *The Plant Cell*—could pave the way for development of agricultural and forestry crops that are more tolerant to environmental stresses such as ultra-violet light and other types of radiation.

“Our next step is to see if plant genes we’ve isolated also play a similar role in fighting infections,” said U of S microbiologist Wei Xiao. “In previous research, our team and others have shown that similar genes in human and animal cells play an important role in protection against both viral and bacterial infections.”

In an unusual collaboration, Xiao teamed up with U of S biochemist Hong Wang, two post-doctoral fellows and three graduate students on the study. Doctoral student Rui Wen is the lead author on the paper.

Using Arabidopsis, a widely accepted research model plant closely related to canola, the team cloned and characterized four genes suspected of playing a role in the plant’s stress responses. The team found that when plants were subjected to a DNA-damaging stressor, the plants in which one of the four genes had been turned off produced seedlings that grew slower and often died, compared with a control group.

“This tells us that these genes likely play an important role in maintaining the genetic stability of the plant and protecting the plant from stress,” said Xiao.

The next step is to look at whether turning on or off any of the other three genes will affect the plant’s resistance to environmental stresses, including viral and bacterial infections.

Xiao’s previous research used cultured mammalian cells to study cancer and immunity. But since deletion of genes in living mammals would cause the embryos to die, the team turned to the plant model.

“This study demonstrates for the first time that we can study this group of genes at the whole organism level, rather than just at the cellular level, which could have applications down the road for human and animal medicine in fighting cancer and infections,” said Xiao, noting that plant, animal and human studies are increasingly converging around gene-based research.

In previous research using human cells, Xiao found that human genes similar to the four plant genes not only fight carcinogens but play a role in fighting viral and bacterial infections.

Xiao’s discovery of the “Beauty and Beast” genes that may govern the development of cancer is cited in Milestones in Canadian Health Research: www.cihr-irsc.gc.ca/e/35216.html

Ten years ago, Xiao discovered a gene in baker’s yeast that when inactivated causes cells to be more susceptible to DNA-damaging agents. His team then identified two similar human genes and found that when either of these was put into the yeast cells containing the inactivated gene, the problem was soon fixed and the cells grew normally.

The plant gene products under study by Xiao and Wang bind with a protein (Ubc13) which has recently been found to control activation of the immune response. This protein has also been linked to an increasing number of human diseases, including Parkinson's and breast cancer.

Long term, the team's goal is to develop screening tests for humans and animals that could detect a cancer-causing imbalance, allowing earlier treatment and prevention. Diagnostic antibodies suitable for such tests have been developed by Xiao and his U of S colleagues and have been licensed to California-based Zymed Laboratories, Inc., and Santa Cruz Biotechnology, Inc.

Source: Canadian Institutes of Health Research