Root Wars

Canadian Geographic's September/October 2017 issue explores how scientists from Brock University, Ont., have learned that an insecticidal fungus actually benefits and provides nutrition to plants. With your students, use this infographic and the following questions to learn more about this insecticide and how it benefits its surrounding plants.

Check for understanding

1. What is *Metarhizium* and how does it work?

2. What did researchers at Brock University discover about *Metarhizium*?

3. Create your own infographic to show your understanding and describe how Metarhizium helps to fertilize surrounding plants.

THE ROYAL CANADIAN GEOGRAPHICAL SOCIETY
LA SOCIÉTÉ GÉOGRAPHIQUE ROYALE DU CANADA
CANADIAN Geographic EDUCATION
3M Science. Applied to Life.™

Root Wars

Extend your geographical thinking

1. **Part A: Agriculture and the Canadian landscape**
   Explore what agriculture is and how it plays a role in Canada's economy and landscape. Use Canadian Geographic Education's blank map of Canada to map out the types of crops grown across the country for commercial use. Examine and discuss the patterns and trends of crop distribution. Why is this important to know and why should we care? How would our lives be different if we didn't have agriculture?

   Part B: Pesticides – Pros and cons
   Research the role pesticides play in Canada's agricultural industry. One half of the class will consider the benefits of using pesticides and the other half will look into why farmers should refrain from using them. Choose a side to the debate and find arguments to defend your point of view. Participate in a class debate.

2. **Pesticide Indicators**
   Go to the Agriculture and Agro-Food Canada website to learn about the pesticide indicators. Have them explore the trends and patterns, focusing on how pesticide use has changed over time and how pesticide use correlates with water contamination. Have students explore the maps and graphs to learn more about how trends differ across the country and the importance of proper pesticide management practices.

Resources

- Agriculture and Agri-Food Canada
- Canadian Agriculture and Food Museum education programs
- Agriculture in the Classroom Canada
- Food Secure Canada
- Sustainable Table

Root wars

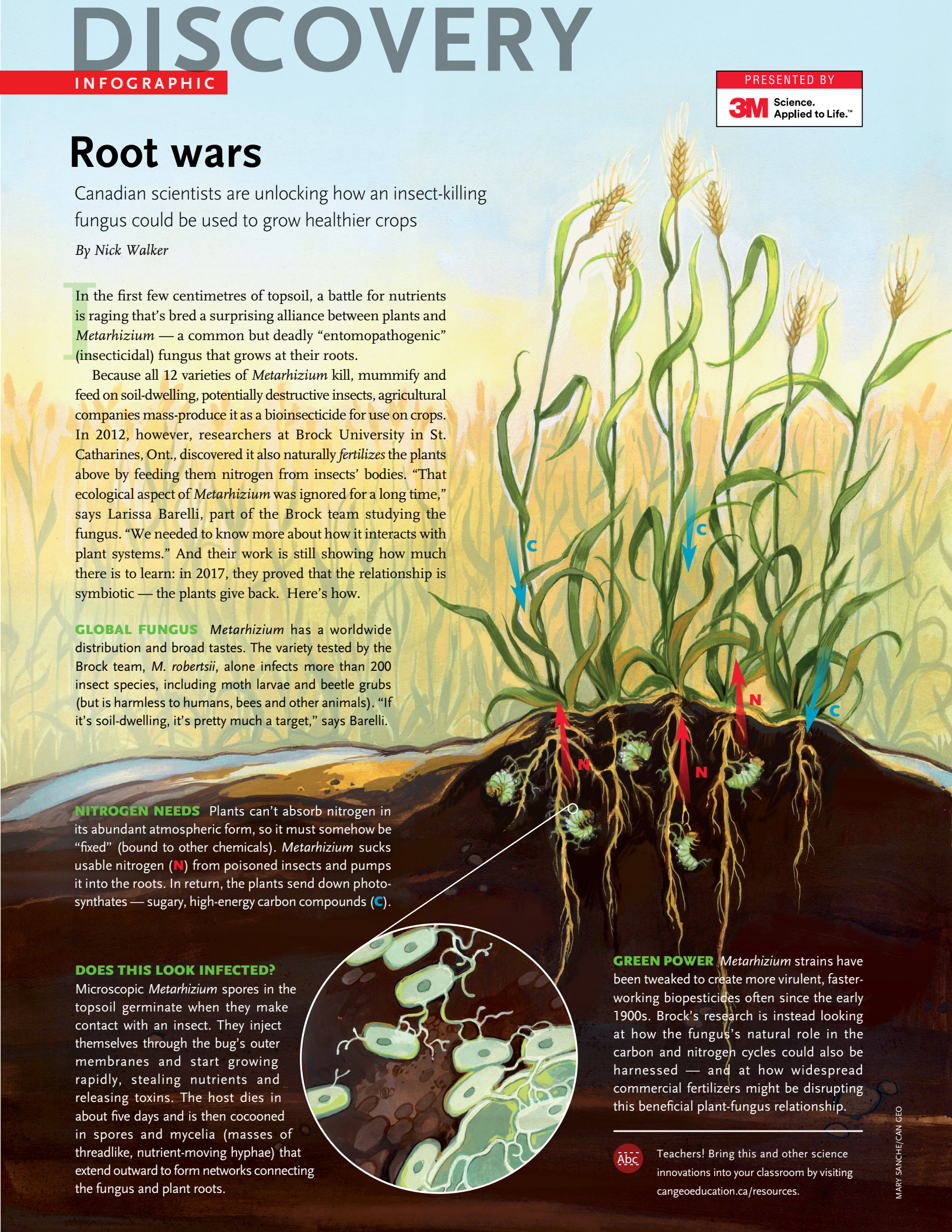
Canadian scientists are unlocking how an insect-killing fungus could be used to grow healthier crops

By Nick Walker

In the first few centimetres of topsoil, a battle for nutrients is raging that's bred a surprising alliance between plants and *Metarhizium* — a common but deadly "entomopathogenic" (insecticidal) fungus that grows at their roots.

Because all 12 varieties of *Metarhizium* kill, mummify and feed on soil-dwelling, potentially destructive insects, agricultural companies mass-produce it as a bioinsecticide for use on crops. In 2012, however, researchers at Brock University in St. Catharines, Ont., discovered it also naturally *fertilizes* the plants above by feeding them nitrogen from insects' bodies. "That ecological aspect of *Metarhizium* was ignored for a long time," says Larissa Barelli, part of the Brock team studying the fungus. "We needed to know more about how it interacts with plant systems." And their work is still showing how much there is to learn: in 2017, they proved that the relationship is symbiotic — the plants give back. Here's how.

GLOBAL FUNGUS *Metarhizium* has a worldwide distribution and broad tastes. The variety tested by the Brock team, *M. robertsii*, alone infects more than 200 insect species, including moth larvae and beetle grubs (but is harmless to humans, bees and other animals). "If it's soil-dwelling, it's pretty much a target," says Barelli.



NITROGEN NEEDS Plants can't absorb nitrogen in its abundant atmospheric form, so it must somehow be "fixed" (bound to other chemicals). *Metarhizium* sucks usable nitrogen (**N**) from poisoned insects and pumps it into the roots. In return, the plants send down photosynthates — sugary, high-energy carbon compounds (**C**).

DOES THIS LOOK INFECTED? Microscopic *Metarhizium* spores in the topsoil germinate when they make contact with an insect. They inject themselves through the bug's outer membranes and start growing rapidly, stealing nutrients and releasing toxins. The host dies in about five days and is then cocooned in spores and mycelia (masses of threadlike, nutrient-moving hyphae) that extend outward to form networks connecting the fungus and plant roots.

GREEN POWER *Metarhizium* strains have been tweaked to create more virulent, faster-working biopesticides often since the early 1900s. Brock's research is instead looking at how the fungus's natural role in the carbon and nitrogen cycles could also be harnessed — and at how widespread commercial fertilizers might be disrupting this beneficial plant-fungus relationship.

Teachers! Bring this and other science innovations into your classroom by visiting cangeoeducation.ca/resources.

MARY SANCHE/CAN GEO