

Footprints in the agar: growing bacteria from ants' feet to combat plant diseases

Ant infosheet

Ants: guardians of the forest – and the field

The future of farming

Every year, 20–40% of the global crop production is lost due to pest insects and crop diseases.^[1] This is a big problem that is currently addressed mainly by using large amounts of chemical pesticides, even though these chemicals can be harmful to birds, mammals, insects, and plants,^[2-4] while also polluting the soil, air, and water.^[5] A sustainable alternative to chemical pesticides is biological control, which is the use of living organisms to combat pest species.^[6] Biological control is widely applied in greenhouses, but in open field systems like corn fields, the lack of sedentary species, which stay in the system after release, has delayed a similar breakthrough. However, ants are a promising candidate.



African weaver ants (*Oecophylla longinoda*) in a mango orchard carrying a cricket that they have caught. The ants help the farmer by reducing pest insects and crop diseases.

Image courtesy of the author

Ants in agriculture

Ants invented chemical agriculture 50 million years ago.^[7] Yes, you read that right! Fungus-growing ants grow monocultures of a specific fungus, which they eat. To ensure that other competing fungi and weeds do not ruin their fungus gardens, they house antibiotic bacteria on their bodies, which they smear around the gardens, just like we use chemical pesticides. Apart from doing their own agriculture, ants have also been used by humans to protect their crops from pest insects and diseases.

The use of ants for biological control dates back to 304 AD, where farmers in China sold and used weaver ants (*Oecophylla smaragdina*) to protect their citrus trees.^[8] Back then, it was common knowledge that if you did not have ants in your trees, you would have poor fruits and a bad harvest. Since then, the practice of using ants in agriculture has largely been forgotten. However, in recent years, researchers have rediscovered the beneficial effects of ants against pest insects and plant diseases, and found that they can be effective in fruit orchards.^[9, 10]



An ant in an apple orchard

Image courtesy of the author

Ants and microbes

Ants have a lot of different bacteria and fungi on their bodies.^[11] Some are picked up from the surroundings when the ants walk, while others live on the ants in symbiosis. The symbiotic bacteria can be mutualistic, helping the ants by protecting them against diseases. To do so, the bacteria and fungi produce antibiotic chemicals that can fight off other microorganisms that might be harmful to the ants.

Antibiotics can either inhibit (i.e., reduce/hinder) the growth of microbes or kill the microbes.^[12] Producing antibiotics can be advantageous to the microbes, as it helps them compete for food, water, or places to live. When a bacterium, for example, produces an antibiotic chemical, it can fight off some of the nearest-neighbour microbes, resulting in more space or easier access to food for the bacterium.^[12]



Ants live in dense, social societies, where they are in close contact with each other – they groom each other, and even feed their nestmates mouth to mouth. This increases the risk of catching and transmitting diseases.

Image courtesy of the author

The first ever antibiotic, penicillin, used for human medicine was discovered by Alexander Fleming, and it is produced by the fungus *Penicillium notatum*.^[12] Fleming was growing some bacteria on agar plates, but one of the plates was contaminated with a fungus, which had most likely been dispersed in the air. He found that this fungus had excreted something that inhibited the growth of bacteria on the plate! This led to the discovery of penicillin, which is now the most widely used antibiotic.

As with Alexander Fleming's penicillin, the antibiotic chemicals produced by the microorganisms found on ants could also be used to produce new antibiotics for us humans in the future.^[13] During these experiments, you might find something that can someday save lives!

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