

# Looking for Mr Goodbug

Will work for food.

**Elisabeth Malartre**

It all began with bedbugs. One night at 'Paradise Cabins' in Eureka left Jim Chiampi with red splotches sprinkled all over his body. For the next few itchy days in his lab at UCI, he toyed with how to fix bedbugs so that they wouldn't find humans attractive.

Seymour Benzer's work on the heritability of behaviour in fruitflies started people looking for behaviour genes. Is there a 'gay' gene? A gene for aggressiveness? What about the 'depression' gene?

The cloak of culture wraps human behaviour; it's difficult to sort out learned from instinctive behaviour. Not so with insects. Parasitic male wasps hatch from a moth egg ready to mate within minutes. Virgin females are already interested in smooth egg-shaped objects. No learning there.

Chiampi idly watched ants on the lab windowsill. They were coming and going from the potted orchid: living in it, but not harming it. Images of army ants flashed in his mind, a parade of millions devouring the countryside, waving bits of leaves. Could he make these ants attack and destroy their orchid?

He vaguely remembered an article in *Nature*. Leafcutter ants (*Atta* spp.) were mainly tropical, one species just recently sequenced. But importing leafcutters was impossible. He'd need to modify a native ant species. Nothing too small; a head size of two millimetres is ideal for leafcutters. He settled on local harvester ants. Primarily seed-eaters, they dismantle vegetation when it suits them, surrounding their mounds with shredded plant bits.

By 2015, cutting and pasting genes into animals was routine. Chiampi consulted the Genes2Go digital catalogue: he downloaded the genome for the one *Atta* species and several non-leafcutters for comparison. After weeks of looking, he identified the leafcutting genes and fed the sequences into his synthesizer.

Two hurdles to overcome: programming the local ants to shred plants for food instead of collecting seeds, then getting them to find specific plants among non-target species.

After several hilarious failures, and some painful bites from frustrated genetically modified ants, he was ready to field-test strain HA-12.

He and a few friends built a large, hermetically sealed, domed sandbox and

embedded a small pampas-grass plant in it. Then he mated the neck of the ant colony box to the enclosure and lifted a tiny portcullis gate to let the ants out.

Slowly, a few scouts appeared and spread out over the sand. One found the pampas grass and began waving its antennae. It headed to the nest, leaving a scent trail back to the plant. Forager ants emerged from the colony, like tiny cows heading to pasture.

Chiampi squatted next to the nest box and popped open a beer. Within minutes, the ant trail broadened from single file to several abreast, pouring out of the colony until a solid line of ants marched towards the doomed plant. Soon they were carrying pieces of plant back towards the nest. Watching them was hypnotic.

"How long to take down that plant?" asked his sister Marion.

"An average colony of leaf cutters can eat as much plant material in a day as a cow. I've got only a few hundred ants in there. I figure maybe an hour."

The ants beat that easily.

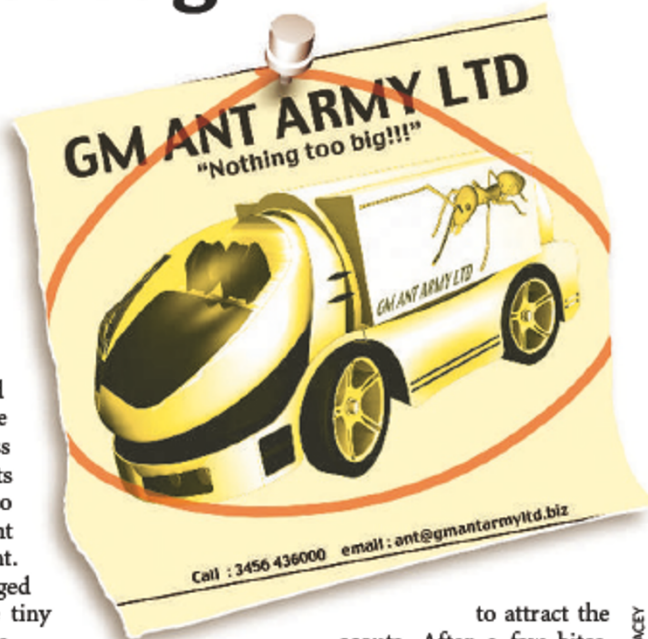
A sceptical friend recorded the test on a cell phone and posted it on the Internet. Millions watched as the ants swarmed, the plant shivered, then collapsed.

Herbicide manufacturers protested, sending squads of 'concerned citizens' to Congress to protest about the dangers of genetically modified ants. Pickets wearing huge mutated fly suits and carrying "Frankenbugs no!" signs milled outside Chiampi's lab. The news vultures were enthralled — waiting, expecting the weight of outraged public opinion to crush GM ants, as it had crippled GM foods 20 years before.

But the public, sick of battling ants in the kitchen and dandelions in the lawn, loved the idea. Turnabout is fair play. If we can't stop 'em, make 'em useful.

Chiampi hurriedly switched his ants to eating dandelions. He called his start-up 'Dandi-Ants' and moved out of his university lab and into a tilt-up.

Targeting was easy. Chiampi sprayed some target plants with a pheromone (the "scent of death", Marion called it)



to attract the scouts. After a few bites, the taste of the plant itself kept the ants focused. Then they cut up all the others like it.

Chiampi's research jump-started the entire formi-farming industry. Beekeepers once trucked their hives to orchards for pollination services. Now formi-farmers offer mobile weed eradication from ant colony trucks.

Ants go everywhere; no cliff is too steep, no perch too isolated. They're highly motivated workers, harvesting their food. And by keeping the queens securely in the colony, the industry ensures that the sterile workers return to the nest at night.

On California's steep hillsides ants now dutifully clear fuel-modification zones around houses, replacing expensive prison labour or damaging herds of goats, while leaving sensitive plant species untouched. For especially common weeds, there are specialized strains of ants.

Today, the homeowner can hire legions of ants. Crabgrass in the lawn? Mint overrunning the petunias? No problem! We'll be over in an hour. No more weekends spent digging in the dirt! And no more poisons!

The kudzu weed has stopped eating Georgia. The gorgeous Big Sur coastline has emerged from a curtain of pampas grass. In the western deserts, ants eliminated water-sucking tamarisk. Springs reappeared. Wildlife flourished.

Humans are learning to harness the little things that run the world, to help save it.

Elisabeth Malartre is the pen name of a biologist and writer living in Laguna Beach, California, who teaches at the University of California, Irvine.

JACEY