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New weapon against land mines: rats

By Sandi Doughton
Seattle Times science reporter

MOROGORO, Tanzania — The workday is in full swing for a giant African rat named Henrietta.

Her pink nose twitches as she snuffles through damp grass at the end of a leash. Metal tea infusers filled with explosive chemicals are buried in the ground. It's Henrietta's job to sniff them out.

A novice, she misses the first mock land mine. But the 4-pound female catches a whiff of the next one and begins to scratch madly at the red soil.

Her trainer signals approval by snapping a metal clicker. Henrietta trots over to collect her reward: a bite of banana.

"They're very keen to work, as long as they get food," said Bart Weetjens, a former industrial designer from Belgium. It was his idea to enlist one of mankind's most ancient pests in solving some of the modern world's more vexing problems.

Henrietta and the dozens of other whiskered students scouring this field in eastern Africa are being trained to detect land mines.

Information

Learn more: www.apopo.org

Adopt a rat:

www.herorat.org

In a nearby lab built with World Bank money, other rats are learning to diagnose tuberculosis by sniffing sputum samples.

Both tasks capitalize on the animals' keen sense of smell and zest for food.

"The training is very simple," said the 41-year-old Weetjens. "We associate a food reward with a target scent."



STEVE RINGMAN / THE SEATTLE TIMES

A Tanzanian trainer monitors an African giant pouched rat's search of a simulated minefield. The rat paws the dirt when it catches a whiff of explosives, and is rewarded with food.



STEVE RINGMAN / THE SEATTLE TIMES

Henrietta gets a bite of banana for successfully detecting a buried tea infuser filled with explosive chemicals.



STEVE RINGMAN / THE SEATTLE TIMES

A trainer and rat work a simulated minefield. Twenty-three recent rat graduates helped clear about 100

More difficult is getting people to take his rat pack seriously.

"When I first suggested it," he said, "everyone laughed at me."

That was shortly after Weetjens came to Africa, disillusioned with designing ski boots and seeking more meaningful work. He decided to delve into the land-mine problem.

He visited minefields and saw German shepherds sniffing for buried explosives. The dogs are effective but expensive and vulnerable to tropical disease. Occasionally, one will trigger a mine.

A light bulb went on in Weetjens' head. When he was a kid, his room was crammed with cages of mice, rats and guinea pigs. "I thought: Why not rats?" he said, snapping his fingers.

But not just any rat.

Working with a rodent biologist, Weetjens settled on *Cricetomys gambianus*. Also known as the Gambian or African giant pouched rat, it can reach the size of a cat.

The species is native to much of Africa and resistant to local diseases. Its life span of six to eight years provides a good return on training time. And with a top weight of 6 pounds, the animals are too light to set off land mines.

Standard system slow

Minefields are customarily cleared by a person with a metal detector.

"You've got to go really slow, and every time you hit a bottle cap or nail, you have to stop and probe," said Dennis Barlow, director of The Mine Action Information Center at James Madison University in Virginia.

Once a mine is located, it's detonated with a small explosive charge. At current rates, it would take a century or more to clear the tens of millions of land mines that litter former conflict zones.

By one estimate, 50 people a day are killed or maimed by land mines. Valuable land goes unused.

Bees, wasps and even roaches have been trained to detect explosives, Barlow pointed out. "These types of technology are proving helpful, and the rats show the same kind of promise."

But rats have their shortcomings, Weetjens acknowledged.

They obsessively groom themselves when wet or muddy. On Mondays, after being allowed to feast all weekend on "free" food, their motivation to work for a bite of banana plummets.

graduates helped clear about 100 acres in Mozambique.



STEVE RINGMAN / THE SEATTLE TIMES

Former industrial designer Bart Weetjens started Apopo to train rats to find land mines. The nonprofit organization also trains rats to detect tuberculosis by sniffing human sputum samples.

A nose for land mines

Giant rats trained in Morogoro are sniffing out land mines in Mozambique and will soon be working in Angola and Sudan.



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It takes about 10 months to school a rat. After first learning to associate the "click" with food, the animals are put through simple smell tests in indoor cages.

Like several of her cohorts, Henrietta recently graduated outdoors to the project's 75-acre field. While she works on the basics, more advanced students zip along guide wires in areas sown with deactivated mines. The animals keep their noses to the ground while their luxuriant whiskers probe like tentacles. Pink-tipped tails, which enable the rats to swing through trees like monkeys, wave back and forth.

Sniffing for hidden caches comes naturally to *Cricetomys*. In the wild, the rats stuff food into their cheek pouches, then bury it.

Weetjens estimates the rats are 70 to 80 percent effective at sniffing out mines. When multiple rats work the same area, they're nearly perfect.

Twenty-three rat graduates recently aced international certification tests and are working in Mozambique, where explosive legacies of a 17-year civil war mar the countryside. So far, they've cleared about 100 acres, and the program is preparing to expand into Sudan and Angola.

With about 100 employees, Weetjens' nonprofit organization, Apopo, is a major employer in this agrarian district of Tanzania.

But funding for land-mine detection has dropped since the death of Princess Diana, the cause's celebrity advocate. Success in clearing some areas, particularly in Asia, has defused the sense of urgency, Barlow said.

As land-mine work falls off, Weetjens hopes his rats will find employment in medical screening.

While fewer than 20,000 people a year are killed by land mines, 2 million die from tuberculosis and another 8 million are infected. The disease spreads rapidly, because many people are never diagnosed or treated.

Quick, cheap screening would be invaluable, particularly where clinics lack even microscopes, Weetjens said.

Labs beat by a nose

Animals' noses already have been shown to have potential diagnostic powers. Some dogs seem able to identify cancerous moles and sniff out cancer from breath samples.

No one knows exactly what molecules the animals are picking up on, but some diseases can cause scent changes detectable even to the human nose. The Dutch word for tuberculosis refers to the tarlike odor of patients with advanced cases.

In verification tests, rats are about as accurate as human lab technicians who are working with microscopes. But the rodents are nearly 100 times faster. Every week, the rats spot five to 10 infections that hospital labs missed, Weetjens said.

But he's not planning to loose rats on unsuspecting patients. He envisions mobile rat clinics that could roll into refugee camps, prisons and other TB hot spots and screen samples. Positive results would be confirmed by medical workers.

As with land mines, Weetjens is facing skepticism.

It's a clever idea, with a lot of potential pitfalls, said Dr. Richard Chaisson of the Center for Tuberculosis Research at Johns Hopkins University.

"There are enormous issues of practicality and feasibility," he wrote in an e-mail.

Weetjens is aware of the challenges, and is working with hospitals in Tanzania to document the rats' performance. "This is out-of-the-box thinking," he said. "But out-of-the-box thinking can really revolutionize things."

With optimism that matches his broad smile, Weetjens is scrambling to find money for the TB work. The World Bank grant covered only the lab building. An application to Seattle's Bill & Melinda Gates Foundation was summarily rejected. He recently started a Web site called HeroRat.org to bring in donations from folks who "adopt" individual animals.

"People have a real fascination with this," he said.

As for Henrietta, her half-hour shift at the training field is ending. After one last tea-ball discovery and bite of banana, she leans into her trainer while he rubs her back. He unsnaps the leash from her harness and walks away. Like a dog, she follows at his heels, sniffing the air.

Sandi Doughton: 206-464-2491

or sdoughton@seattletimes.com

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