

## MYCOLOGY

# Last Stand for the Body Snatcher Of the Himalayas?

The caterpillar-hijacking fungus *Cordyceps sinensis* is touted as a natural Viagra. But overharvesting has put the peculiar parasite's back against the wall

**KUNMING, CHINA**—Some people kill for it. Others risk their lives for it. To many, it's the creepiest thing they've ever seen. It is *Cordyceps sinensis*, a parasitic fungus that consumes its host, ghost moth caterpillars, from inside out as they hibernate in alpine meadows in the Himalayas and on the Tibetan Plateau. But one of nature's more curious creatures is in trouble: Surveys by the Chinese Academy of Sciences' Xishuangbanna Tropical Botanical Garden (XTBG) in Yunnan Province have discovered that the range of *C. sinensis* is shrinking fast. "It's disappearing before our eyes," says XTBG entomologist Yang Da-Rong.

The fungus is in this predicament because it's one of the hottest commodities around. There are nearly 400 known species of *Cordyceps*, mostly in Asia, including 68 in China, but *C. sinensis* is prized above all others as a treatment for everything from impotence to cancer. Also called *aweto* or *yarchagumba*, *C. sinensis* caught the fancy of Western herbalists in 1993, when Chinese track coach Ma Junren claimed that *Cordyceps*-based concoctions boosted the stamina of his record-setting runners. "What makes it fascinating is all the unproven hype," says Nigel Hywel-Jones, a mycologist at the National Center for Genetic Engineering and Biotechnology in Bangkok.

Hype or no, huge demand coupled with dwindling supplies—China's harvest was about 100 tons in each of the past 3 years, less than 10% of the hauls 20 years ago—pushed top-grade *C. sinensis* to \$60,000 per kilogram last year. (Prices have receded to under \$10,000 per

**Prize parasite.** Scientists searching for *C. sinensis* in Tibet.

kilo.) Cultivation is a dream: *C. sinensis* grows poorly in the lab. "A few labs claim to have commercially available isolates for mass production," says Hywel-Jones. But he suspects that they are not *C. sinensis*.

Hywel-Jones got the urge to sample *C. sinensis* on his first survey in Bhutan in 2002. "I had heard it was a natural Viagra," he says. He took a bite—"It tastes fine, a bit nutty"—then joked to a male colleague, Tshitila, that he needed a woman. "There were none around, so I sprinted after a yak saying, 'That will do.'" But at 4300 meters above sea level, Hywel-Jones passed out from lack of oxygen. "When I came round, Tshitila was standing over me laughing and telling me that it doesn't work that quick."

Every year in late spring, villagers in search of "Himalayan Viagra" fan out across Tibet and surrounding swaths of southwestern China, Bhutan, India, and Nepal. Yang estimates that more than 1 million people forage for *C. sinensis* on the Tibetan Plateau alone. "Only the elderly and children stay home," says XTBG's Peng Yan-Qiong. Collectors crouch on hands and knees in search of "summer grass winter worm," brownish fruit bodies a few centimeters long that are hard to discern from alpine vegetation. In a couple of months, says Yang, a skilled collector can earn \$2000—more than most Chinese villagers earn in a year.

Tragedy comes with the turf. In July 2007, a gun battle between rival villages over access to prime *C. sinensis* habitat in Sichuan Province's Garze Tibetan Autonomous Prefecture left eight people dead, according to news reports. That followed an episode several weeks earlier, when collectors in Nepal were stranded in the mountains by a late-season blizzard. By the time the army arrived, dozens had perished.

Against this backdrop, a 23-person-strong

XTBG team set out to assess how the species is holding up. On Yang's first survey 25 years ago, he recalls, *C. sinensis* was so cheap that he could trade a bag of salt for a bag of the fungus. These days, locals see the scientists as competition: "Villagers don't like us to collect *aweto*," says Yang. But his team persisted, and in 47 excursions over the past two summers they documented what Yang calls a "shocking" decline: Prime habitat starts 500 meters higher than it did 20 years ago, translating to a 70% to 97% decline in *C. sinensis* biomass.

Meanwhile, the harvesting hordes are punishing the fragile land. "They destroy the soil and trample vegetation," Yang says. As a result, he says, each year some 3.5 square kilometers of grassland are "turned into desert." That, in turn, is degrading a vital watershed where many of China's major rivers originate, including the Yangtze and Yellow.

If *C. sinensis* dies out, it may take a few biological secrets to the grave. Its life cycle is a fungal version of the movie *Invasion of the Body Snatchers*. In late summer, the fruit bodies disperse spores, just as ghost moth larvae are shedding their skin. "That's when larvae are vulnerable," says Yang, who estimates that up to 12% of ghost moth larvae become infected. "But we don't understand the infection mechanism."

Infected larvae, which live in the soil, fall under the spell of the fungus, which steers the caterpillars to park vertically near the surface, head up. As *C. sinensis* consumes its victim, its fruit body slowly pushes up out of the head and by early spring emerges from the soil. Ghoulish as it sounds, Yang views the *Cordyceps*-moth relationship as "coevolutionary," in that the fungus may keep moth populations at sustainable levels.

To protect *C. sinensis*, Yang suggests a number of measures, including a law that would mandate a kind of crop rotation: harvesting the fungus from some areas while leaving others unmolested for a few years to give habitat time to recover. Yang's team is also taking a Johnny Appleseed approach, dispersing moth eggs in *C. sinensis* habitat.

If these remedies fail, *C. sinensis* may make its last stand high in the Himalayas, in areas even the most industrious or foolhardy of fungus hunters cannot reach.

—RICHARD STONE

