IN THE LAB

Victory in louse wars?

Head lice — yuck — have developed a creeping resistance to common insecticides. Maybe it's time for a new tack — like blasting them with hot air.

By Regina Nuzzo, Special to The Times
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IN the war against head lice, we face an enemy that is fast and plentiful, with nimble armies that can evolve and outwit standard weaponry. Will we ever take the lead in this scalp-biting, nit-picking arms race?

Last month, experts from around the world gathered in Buenos Aires to swap battle tactics at the Third International Congress on Phthiraptera, the group of 3,000 species of wingless parasitic insects that includes *Pediculus capitis*, bane of parents and school nurses across the land.

Researchers reported needed progress in the fight. Some are turning to new classes of insecticides for which head lice have yet to develop resistance. Others are eschewing the poison and getting creative: tricking lice into thinking they're drowning; moisturizing the blighters until they leak water; or blasting hot air until the insects are desiccated hulls.

They know that their efforts will not save human lives. Head lice — unlike their close relatives, body lice — don't carry diseases, says Dr. Sydney Spiesel, an associate clinical professor of pediatrics at Yale University.

"They're just a nuisance," he says. "Honestly, nobody likes to have bugs in their head."

Every year, 6 million to 12 million Americans are infested with head lice, regardless of socioeconomic status, says Deborah Altschuler, director of the National Pediculosis Assn. Annual sales of anti-louse shampoos exceed $160 million, according to some estimates — and for years, the insecticides they contain have been the gold standard for getting rid of head lice.

But recent reports suggest that many lice alive today have inherited mutations rendering them impervious to common treatments such as lindane, a potent DDT-related insecticide (it is banned in California) and permethrin, the active ingredient in Nix.

Some researchers are instead reaching into the barnyard medicine cabinet for a new anti-louse remedy: ivermectin, an insecticide that has been used to treat parasites in horses and sheep for years. It has also been used over the last decade to treat river blindness and some types of roundworm infection in humans, and, in some countries, human scabies.

Small preliminary studies suggest that two oral doses of ivermectin can also kill head lice that don't respond to other insecticides. Louse researcher Dr. Craig G. Burkhart, clinical professor of dermatology at Medical University of Ohio at Toledo, is working with pharmaceutical companies to develop an ivermectin product that could be applied directly to the scalp.

Neurotoxins aren't the only way to slay a louse. One new treatment already on the market in Europe uses slippery silicone instead. The over-the-counter product, a lotion consisting of a substance called dimeticone, has a polymer base that slides easily across a louse's hide and into its breathing tubes.

After the lotion dries, large molecules left behind form a snug coating, blocking those tubes.

"You effectively shrink-wrap the louse," says Ian Burgess, director of the Medical Entomology Centre, a private research organization in Royston, England, that helped develop the new product.

Strangely enough, asphyxiation isn't what kills the louse, Burgess says. Instead, the coating tricks the insect into thinking that it's being engulfed by water. "In response, the
louse immediately closes down all the hatches, as if it were a submarine.* It switches
to a state of suspended animation — but unfortunately for the louse, the shrink-
wrapping is there to stay. After a while, the creature exhausts its energy reserves and
dies.

In a study published last year, 70% of 127 people who used dimeticone lotion — a
night application and morning rinse — were free from infestation after two treatments.
Negotiations are now underway with companies in the U.S. to license the product,
which is known as Hedrin in Britain. Dieno George, chief executive of the British
pharmaceutical company Thornton & Ross, estimates that pharmacies in the U.S.
could carry the lotion as early as summer 2007.

Another potential lice-killer might be waiting in the shower. Many hair conditioners and
cream rinses contain compounds — modified vegetable oils, mostly — that attach to
both hair oil and water. A louse's casing is slightly oily and also semi-porous, and this
composition is crucial to the beast for sweating out its extra moisture. Cream rinse,
when it mixes with body louse wax, throws off this delicate balance. "What was once a
somewhat waterproof louse is perhaps not so waterproof anymore," Burgess says. The
moisturized louse starts to lose water — and in time, it will dehydrate and die.

In a study of 126 subjects published last year, a combination of conditioner and
meticulous removal with a comb — the so-called wet combing method — worked
effectively for 57% of lice-infested volunteers in England and Scotland. In another
study, researchers found that volunteers who soaked their hair in conditioner rid
themselves of lice 50% of the time, even if they didn't do any combing.

Using conditioner with combing is highly touted by public health groups in Britain,
Burgess says — but the technique has yet to receive widespread endorsement in the
U.S.

Quick drying, rather than slow leaking, is the idea behind a new desiccation device that
promises to treat an infestation in as little as 30 minutes.

The LouseBuster, a portable hot-air machine with a flexible hose, can expel twice as
much air as a hair dryer. Its blast of 140-degree air can suck the moisture out of
whatever happens to be in its path — be they adult lice clinging to hair strands or eggs
cemented to the strands' base.

"It would be like sticking your head out of a car window at 150 mph," says Dale
Clayton, a professor of biology at the University of Utah and co-inventor of the
LouseBuster. "That would dry out your eyeballs right away."

In a study published in Pediatrics this month, Clayton and his colleagues tested the
new device and other hot-air methods on 169 lice-infested children in Utah.

By slowly raking a nozzle expelling hot air along the scalp, the LouseBuster killed 80%
of adult lice and 98% of eggs, even when operating at a slightly cooler temperature
than a normal hair dryer.

A week after being treated with the new device, all of the infestations had disappeared.
There were no reported aftereffects, not even dry scalps, Clayton says.

The LouseBuster is being developed by a University of Utah spinoff company called
Larada Sciences, for which Clayton is chief scientific officer. The patent-pending
technology is going through the Food and Drug Administration review process, Clayton
says, and he hopes it will be available within a couple of years.

Home hair dryers are no substitute for the new device, he says. For one thing, they
don't perform as well as the LouseBuster, which has a wide-tooth comb at the end of
the hose that helps direct the air to the scalp. More important, it's easy for overzealous
parents to burn delicate scalps.

The price is still uncertain, but Clayton expects the LouseBuster to be available for
schools and clinics for a few hundred dollars.

Not all nifty ideas end up making a difference in the head lice war, however. A few
years ago, Spiesel invented a shampoo that causes louse eggs to glow brightly under
the right conditions, making them easier for parents to pick out. Sadly, the formulation
is still sitting in the lab without a developer. Spiesel is philosophical about the demise
of the product, which he once thought of calling HeadLights.

"It's a shame, but it's not like it was an antibiotic that would save lives," he says. "It's
just head lice."

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(INFOBOX BELOW)

Settling into a new home

Head louse research is a lot more fun these days than it was 10 years ago. Until very
recently, scientists studying head lice were forced to walk around with tubes of head
lice strapped to their legs. The researchers' own blood fed the hungry critters every few
Scientists can now rear thriving colonies of hundreds of human head lice on simulated scalps in the lab. Instead of fresh scientist's blood, the lice enjoy a meal of reconstituted blood donated from the Red Cross. The lice live on artificial membranes of paraffin and scurry around artificial forests of hair laying clutches of eggs every few days.

Unfortunately, some newly hatched young never figure out the system, says John Clark, professor of environmental toxicology at the University of Massachusetts at Amherst.

And for adults brought in from the wild, a simulated scalp doesn't seem to satisfy — probably because such lice have had a taste of real blood the way nature intended. "Once that happens, everything else is not fine," Clark says.

Scientists use the artificial scalps to conduct experiments on lice that can't safely be done on lice residing on people. Clark, for example, is looking for compounds that entice lice to crawl to a designated spot on the scalp for easy pickup and disposal.