POISON-DART FROGS

Lurid and Lethal

Text and photographs by MARK W. MOFFETT

As a bird flashes by high above him, Paulino Hueso lifts the mouth of a long blowgun to his lips and gives a quick puff. The snapping sound of a dart striking bark signals a miss.

Hueso's darts are tipped with one of the most potent toxins known. It is secreted by two-inch-long *Phyllobates terribilis* (right), a frog found only in a small area of lowland rain forest in western Colombia.

When one boldly hopped to within inches of my camera, I kept in mind the warning of John Daly, one of the scientists who discovered *P. terribilis:* The frog can be lethal even to the touch.

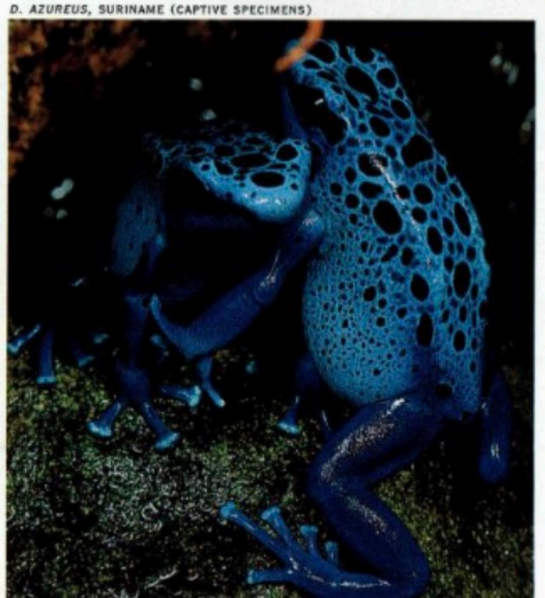
DENDROBATES SPECIOSUS, PANAMA

D. FANTASTICUS, PERU

D. HISTRIONICUS, PANAMA

D. TINCTORIUS, FRENCH GUIANA

D. AZUREUS, SURINAME (CAPTIVE SPECIMENS)



Frogs of a different color

King of the frond in its streamside Ecuadorian habitat, *Epipedobates tricolor* (above) exudes epibatidine, a chemical with analgesic qualities. Two hundred times as powerful as morphine, the substance shows great medicinal promise, especially for patients who do not respond to painkillers derived from opium poppies.

Despite their popular name, only 55 of 135 recognized species of poison-dart frogs are known to be toxic, and of those only three are used by hunters to tip their darts.

Ranging from a half inch to three inches long, toxic species flaunt neon colors that warn predators. The gallery of touch-me-nots at right includes species from habitats as diverse as lowland rain forest and semi-arid mountain terrain.

The sparring pair at far right are females of a threatened species now being successfully bred in captivity.

A matter of taste

Across Central and northern South America, each species of poison-dart frog exudes its own potpourri of chemicals.

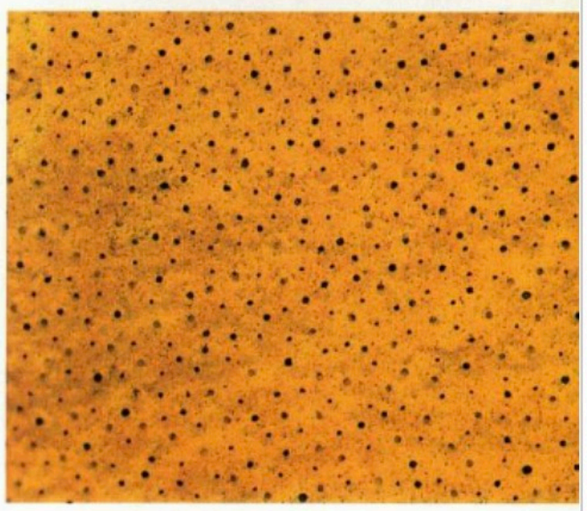
In the forests of Taboga Island, Panama, *Dendrobates auratus* and a species of ground-dwelling tarantula frequently blunder into each other (left). Though it preys on other frogs, the spider will normally retreat from this situation. Every so often, however, I have seen a tarantula foaming at the mouth in its death throes. Did it make the mistake of biting the wrong kind of frog?

D. auratus may be bad news for tarantulas, but the pumiliotoxin it secretes may someday have a useful application as a cardiac stimulant for heart attack patients.

Researcher John Daly of the National Institutes of Health has identified nearly 300 alkaloid compounds secreted by poison-dart frogs. A class of chemicals including cocaine and morphine, alkaloids also include curares—extremely toxic compounds derived from plants and also used to tip darts.

A number of poison-dart frog species are bred at the National Aquarium in Baltimore. There curator Jack Cover (right, at left) holds a mildly poisonous species for Daly—who can gauge toxicity by taste. There's no danger here, for frogs caught in the wild gradually become less poisonous, and captive offspring are nontoxic. The change may be due to diet. The frog's natural menu—mostly insects such as tropical ants and springtails—cannot be duplicated in a terrarium.

Tasting the skin of a wild *P. terribilis* would be foolish in the extreme. Through minute skin pores (right) it secretes batrachotoxins that cause irreversible muscle contractions, leading to heart failure. Indian hunters, though, do taste it indirectly. Upon killing an animal, they lick its flesh to find the part of the carcass affected by the toxin and cut it away.



Last blowgunners

Since firearms arrived in the rain forest, the crafting of dart guns has become a dying art among the Emberá Chocó people of Colombia. Paulino Hueso begins with the trunk of a freshly felled palm. He splits it, then splits each of the halves (top left). His father, Camilo, sands the two best quarters to form the blowgun's shaft. Then he chisels the central bore with a gouge (center left). Finally, the two sections are mated and secured with bark strips.

Darts are made from the stem of a different palm, then fletched with fibers from kapok tree seeds. Though bows are not used for hunting in the region, a miniature one is twanged to fluff the kapok (bottom left).

Camilo rubs a dart tip on a *P. terribilis* (right) and is ready to hunt. The poison will be potent for more than a year.

This was the only time I saw him touch a frog—and then only on the toe. Normally he uses a leaf as a barrier, and he would never let the frog contact cut or broken skin.

Courtship and care

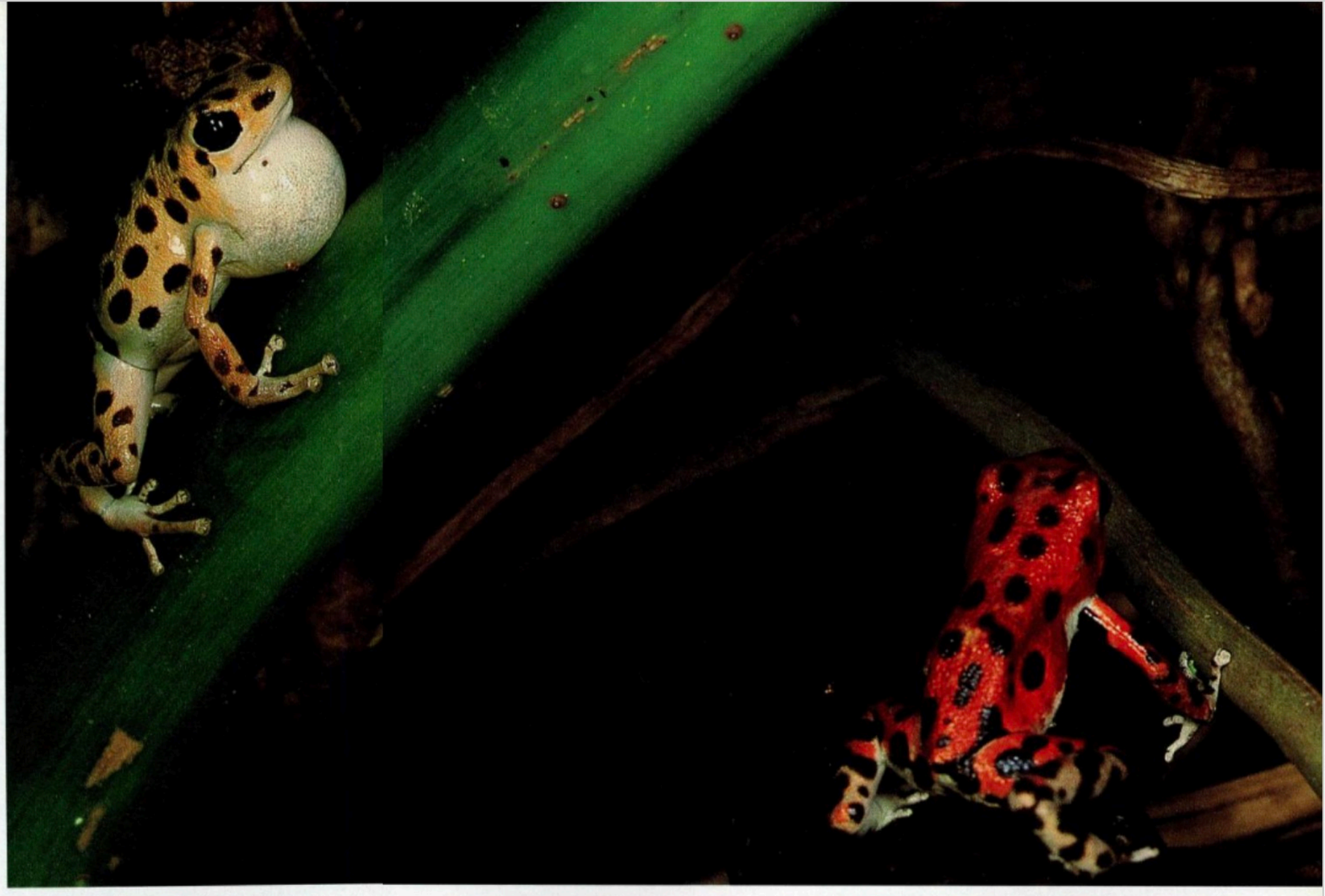
All puffed up, a male *Dendrobates pumilio* (right) courts a female with a song of insect-like chirps. The most aggressive males pounce on any others that dare to move. This forces subordinates to freeze. A dominant male (bottom middle, at right) pushes an immobile rival away from the female at rear.

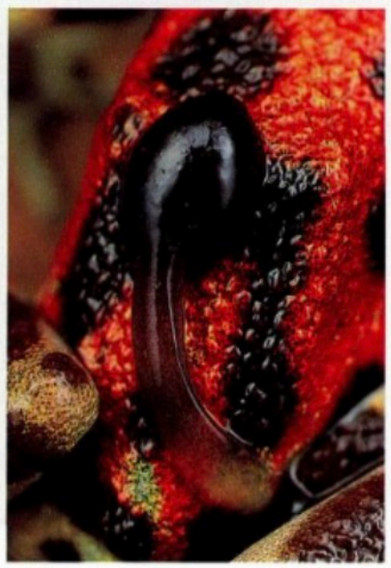
After fertilization, the female is left to guard her batch of 2 to 16 eggs hidden in leaf litter on the forest floor. When the tadpoles hatch, she backs in among them, and one wriggles up onto her back (bottom right).

On a rare trip away from the forest floor she climbs into the canopy. The ascent is arduous, for most poison-dart frogs lack the well-developed toe pads of true tree frogs. She seeks little pools of water cupped in the leaves of certain plants. Into one of these pools she deposits the first tadpole.

Then she goes back for another. And another. One by one she carries her tadpoles to private water holes in the canopy.

In most species the male cares for eggs and tadpoles. When a *D. auratus* father visits his young, researcher Kyle Summers (below) follows to study paternal behavior.





A mother's work is never done

After her tadpoles are stashed in leaf pools, a *D. pumilio* mother returns to the canopy every few days to tend her scattered brood.

On her arrival, a tadpole signals with a quick upward flick of its tail. The mother responds by backing into the pool, at right, and laying unfertilized eggs, rich in nutrients, to nourish the tadpole.

Tadpoles have not yet developed toxins and are easy marks for predators like canopy-roaming crabs, at left.

By spacing tadpoles around the canopy, a parent increases the odds that some of them will survive.

Frog-swapping frenzy

It's International Frog Day in the Netherlands, where collectors trade or sell rare varieties for top dollar. The Amsterdam event requires that all specimens be bred in captivity. Concern for wild populations of poison-dart frogs has also led to international regulations restricting exports.

Many enthusiasts display their frogs in large climate-controlled terrariums. Robbert Kurpershoek (above) needs a flashlight to search for the *D. pumilio* that live in his Netherlands living-room forest.

For a wild *D. pumilio* there's no pampered life. This dominant male paused just briefly to lean on a snail—as if to give a motivational speech to his lethal amphibian colleagues. □

On Assignment

JAMES L. STANFIELD

This could have been JIM STANFIELD's last picture. The veteran GEOGRAPHIC photographer snapped the self-portrait 2,000 feet over Sumatra as he sat in the gunner's seat of a re-creation of a 1919 Vickers Vimy bomber, featured in this issue. Moments later the plane's starboard engine failed.

"I knew we were going down," says Jim, "but I wasn't worried. The pilot, Peter McMillan, really knew what he was doing. There wasn't a chance to panic; I was making pictures the whole time—until Peter landed us safely in a rice field."

Making Geographic pictures for nearly three decades, Jim has covered everything from rats to royalty. His article on the Vatican (December 1985) won kudos from Pope John Paul II and grew into a book, now translated into 11 languages.

But is a plane crash part of a day's work? "Well, I was in a helicopter crash in New Orleans in 1971; that was a mess of spewing oil hoses. The Vimy crash was cleaner."

"The one time I accidentally touched a *Phyllobates terribilis* frog my finger went numb," recalls biologist MARK MOFFETT (below, at right). Both he and assistant Essdras Suarez wear gloves as poison-dart maker Paulino Hueso releases a deadly yellow hopper.

"Lucky for me, skin contact alone doesn't kill; the frog toxin must enter your bloodstream through an abrasion or cut to work." Unlucky for Mark, a sunburn blistered his legs as he dragged his dugout canoe up Colombia's Saija River. "For a week I couldn't stand up unassisted," he says. "That pain was bad enough, but the possibility of a *terribilis* bumping into my open sores made me very nervous."

More of Mark's adventures appear in *The High Frontier: Exploring the Tropical Rainforest Canopy* (Harvard University Press).

MARK W. MOFFETT

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