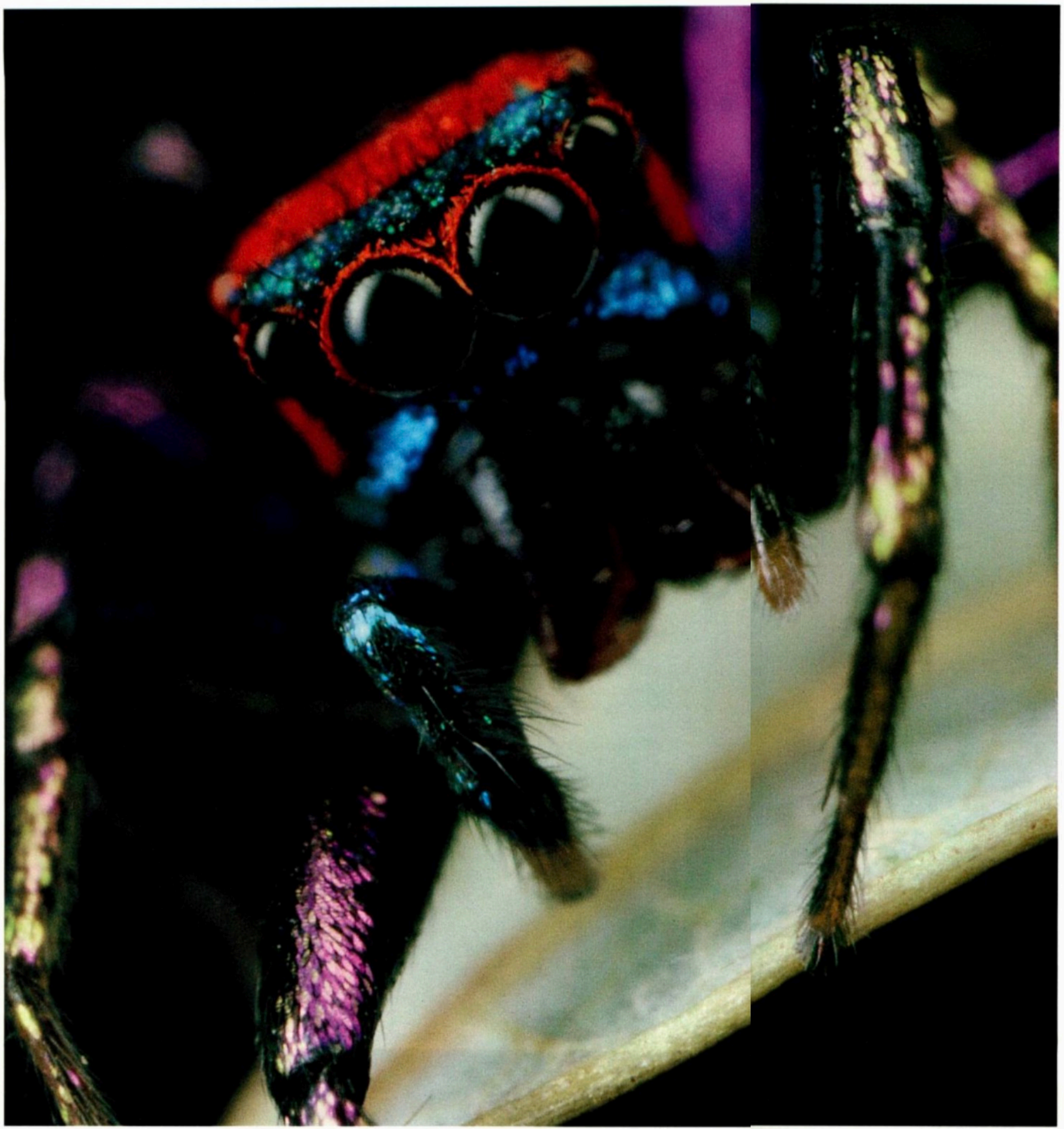


ALL EYES ON JUMPING SPIDERS

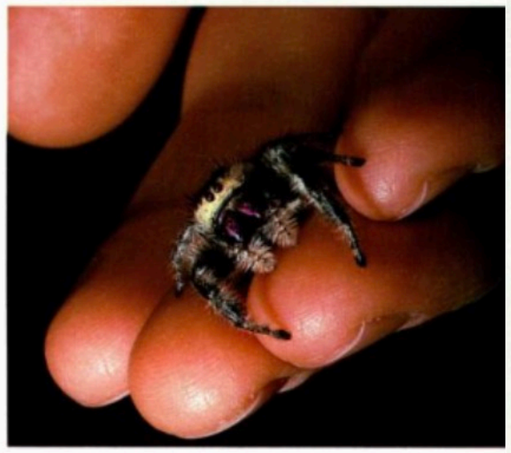
A parrot's colors, an eagle's eyes, a falcon's strike, a roadrunner's leap: The 4,000 or so species of jumping spiders are as diverse as birds and, like them, communicate by gesture, form, and sometimes sound. Many, such as this male *Chrysilla* from Sri Lanka, attract mates with vivid colors. With their acute vision, jumpers look raptly into my camera, even as I focus on them.

TEXT AND PHOTOGRAPHS BY
MARK W. MOFFETT

Powered aloft by an explosive release of internal hydraulic pressure, *Phidippus apacheanus* from Arizona pushes off with four back legs. As it blasts across an inch-wide gap between twigs, its motion is stopped by my high-speed strobe. By trailing silk safety lines, the spider can recover from a fall if it misses.

Phidippus regius walks along fingertips with a certain teddy bearish charm, for it, like virtually all jumper species, will not bite humans. Most jumpers come smaller, from three to eight millimeters. A young *Phyaces* from Sri Lanka (far right) struggles through rough terrain—the ridges of a single fingertip.

In North America you can often find jumpers with striped or mottled



pelts blending into sunlit walls. They stalk flies and mosquitoes, pouncing on them even when several centimeters away. Their chelicerae, or jaws (iridescent in *Phidippus* at left), open in mid-bound, fangs unfolding from their tips. Gripping tenaciously, the spiders kill prey by injecting venom. This also begins to liquefy the victims' tissues, which the jumping spiders later suck out.

Most of what jumpers do may be innate. Yet when I watch them sneak about—leaving sight of their quarry to follow complex routes through the vegetation in search of a better angle for attack—I am struck by flexible behavior that seems to reflect intelligence.

Many of the most impressive jumpers live in the tropics. I have investigated them with Robert Jackson, the world's leading authority

on jumper behavior, and his students at New Zealand's University of Canterbury.

COURT, KILL, AND HIDE

Dressed up to mate, attack, and defend, jumping spiders—found throughout the world—display an astonishing range of forms. Yet all can be readily identified as jumpers, or as scientists call them, Salticidae. They have big front eyes, they wander about without a web—and they jump.

Gaudy colors (A, from Kenya), tufts of hair (F, Kenya), and specialized mating rituals (E, Singapore) sort the sexes and species.

Predatory equipment comes in snout-like jaws hiding fangs (B, Sri Lanka) and in—for jumpers—huge size (C, Australia). This gorilla-like stare is more than a bluff: *Mopsus* is a ferocious hunter.

A *Portia* (H, Kenya) spins two variations: One is a web, rare in jumpers. The second is a body so mottled and irregular that it looks like debris—even to the other jumping spiders it preys upon.

An elongate New Zealander (G) keeps a low profile in grass blades or curled leaves. A little Kenyan (D) mimics a beetle—good defense since to predators spiders taste fine, but most beetles are odious or toxic.


A


E


B

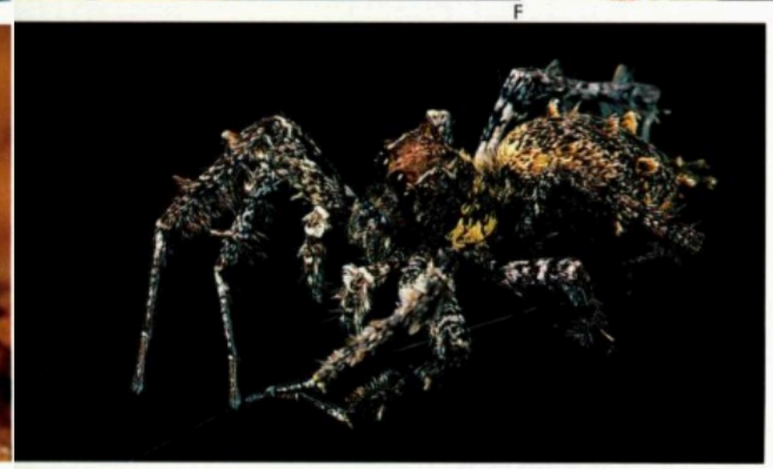

C


F


G

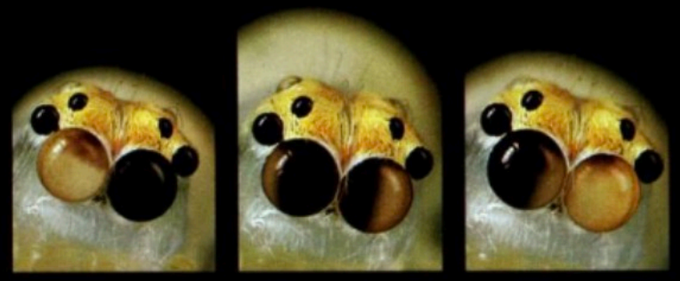
A PHINTELLA AEQUIPES
B MYRMARACHNE PLATALEOIDES
C MOPSUS MORMON
D PACHYBALLUS CORDIFORME
E VICIRIA PRAEMANDIBULARIS
F POSSIBLY OF THE GENUS HYLLUS
G TRITE PLANICEPS
H PORTIA SCHULTZII


D

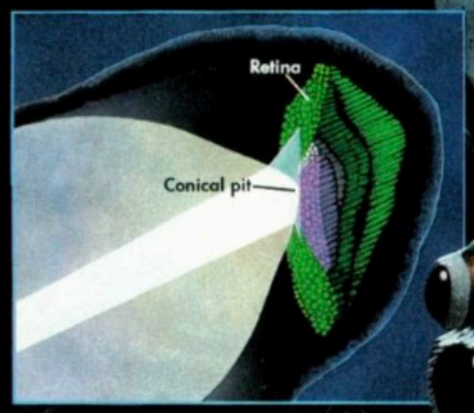

H

A Research Project Supported In Part By Your Society

MISSION: Locate and lock on target

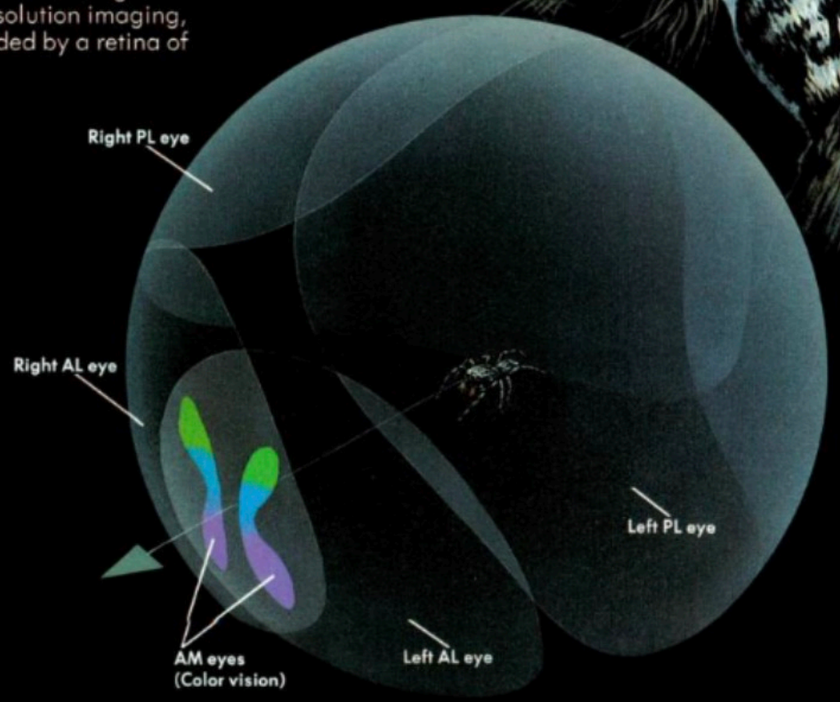


The two large AM eyes can move independently: When showing dark, the eye is looking straight into the camera; when light, it's looking elsewhere.



Swivel and magnify

Shaped like test tubes, the large anterior-median eyes are fixed in the front but swivel in the back to permit limited scanning. Their main function is high-resolution imaging, aided by a retina of four tiers sensitive to green and ultraviolet wavelengths. The conical pit bends light to magnify the image.



Panoramic vision

With four pairs of specialized eyes, a jumping spider is able to sense mate, food, or foe in any quadrant. The four lateral eyes have low resolution but detect motion.

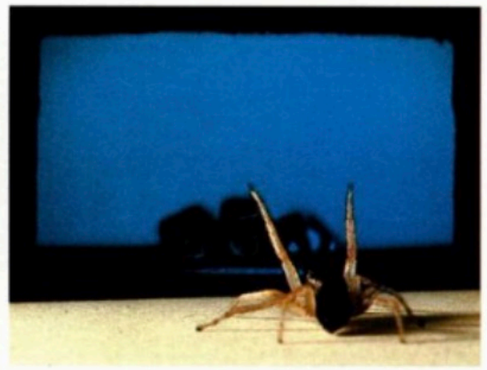
ILLUSTRATION BY
GREG HARLIN, SRW INC.

For the kill or for courtship, the most singular asset in a jumper's repertoire is its remarkable vision. Armed with eight eyes, a jumper can detect motion virtually all around and distinguish detail as far away as 20 times its own body length (artwork, left).

The lateral eyes respond to motion, providing peripheral vision as in humans, though the coverage is far greater.

Once a moving object is detected, the spider swivels its body toward it and zeroes in on it with its anterior-median (AM) eyes.

The internal tubes of these large eyes can be moved independently or together, allowing the spider to scan the object rapidly. With the long focal lengths needed for high resolution, these AM eyes take up more space in the spider's body than does its brain.



Vision is so acute in jumpers that a male *Maevia* shown a female's image on TV will court it (top). But how does a female choose a mate—when males appear in two radically different forms and use different courting rituals, bobbing (left top) and shifting side to side (left bottom)?

At the University of Cincinnati, David Clark (above, at right) and George Uetz alter a computer image to make the tufted *Maevia* behave as if it were the other, shifting, male. They hope to learn whether females are swayed more by appearance or by behavior.

Normally the long "nose" on a Sri Lankan *Myrmarachne plataleoides* male (top, at right) makes him seem a benign character—like Cyrano de Bergerac the poet. When he confronts another male, however, he splits the "nose" and unfolds the halves into jaws with unsheathed fangs at each tip. If the challenge is accepted, the spiders duel Cyrano fashion, their fangs clashing like swords (above).

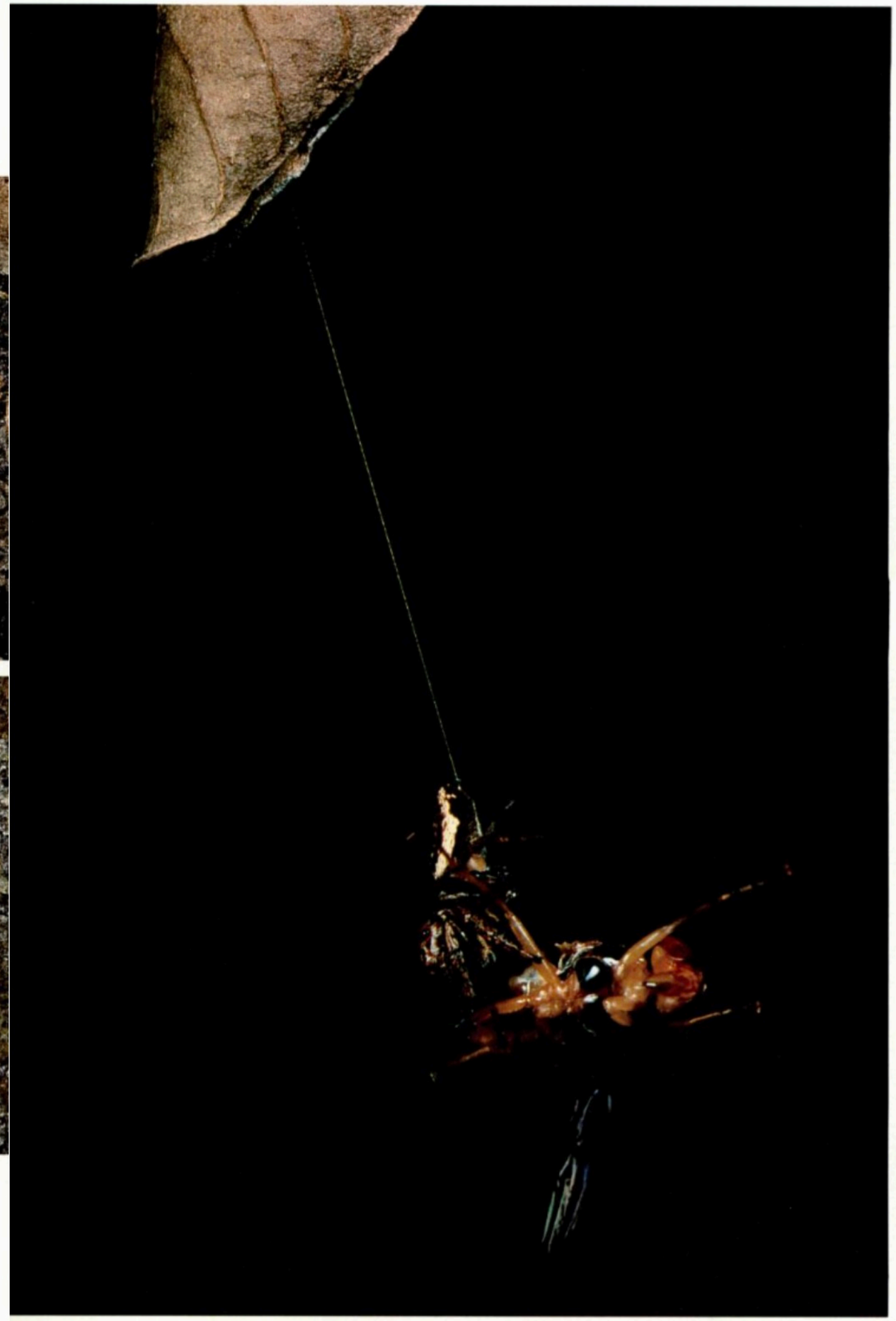
The winner rears up in triumph (left), while the other backs away and scuttles off, a loser with hide intact. These Sri Lankans, like most other jumpers, rarely fight to the death.

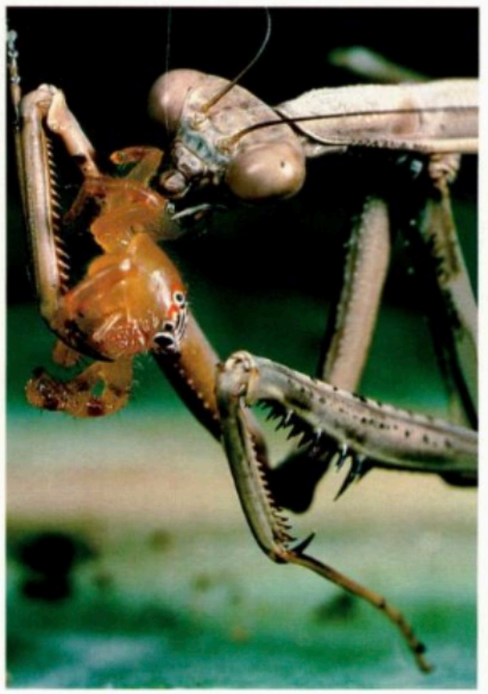
Since jumpers almost never catch prey in webs, they need other tactics. One hides in a leaf, leaps out, and spears flies in mid-air (facing page).

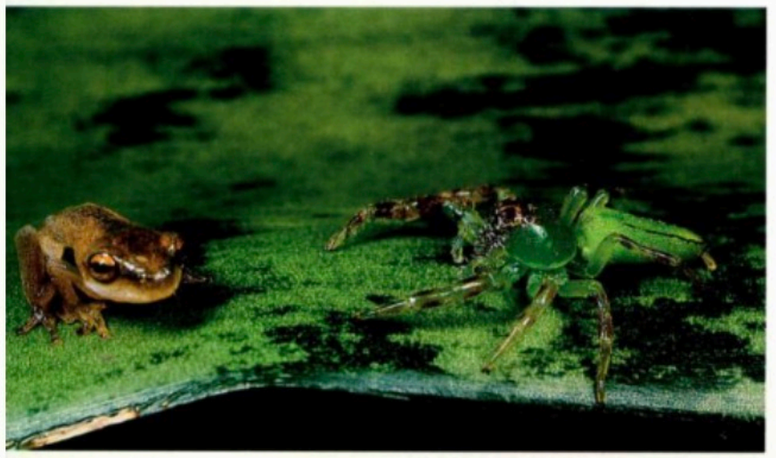
Another is sedentary but so blends into its bark habitat that a moth will

blunder into close range (right).

In turnabout defense, a fruit fly's hindquarters resemble a jumper (above). The real spider reacts cautiously to this decoy, but enough to give his position away.



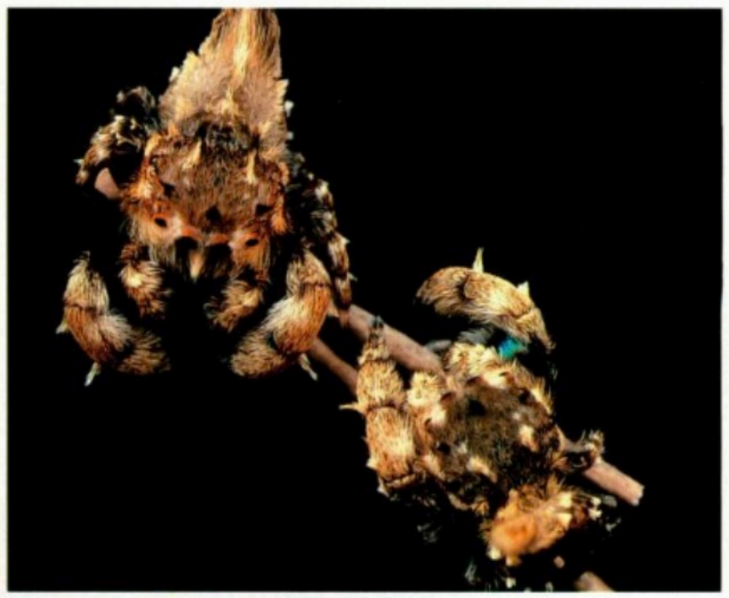




In the big leagues of predation, *Mopsus mormon* plays rough. Stalking along plant leaves near water in Australia, it takes on other fierce predators. A female *Mopsus* strikes a damselfly in the insect's equivalent of the jugular (above), even as the victim attempts a takeoff.

Closely matched as top hunters, praying mantises and *Mopsus* usually treat each other with cautious respect, circling and going their separate ways. But, given a clear chance, they attack. *Mopsus* hits the weakest spot (right top), but sometimes the mantis prevails (right bottom).

Yet set a prey-size frog before a *Mopsus* (right), and the spider makes no attempt to attack. It's as if this little vertebrate is not in the spider's data bank at all, as food or foe.

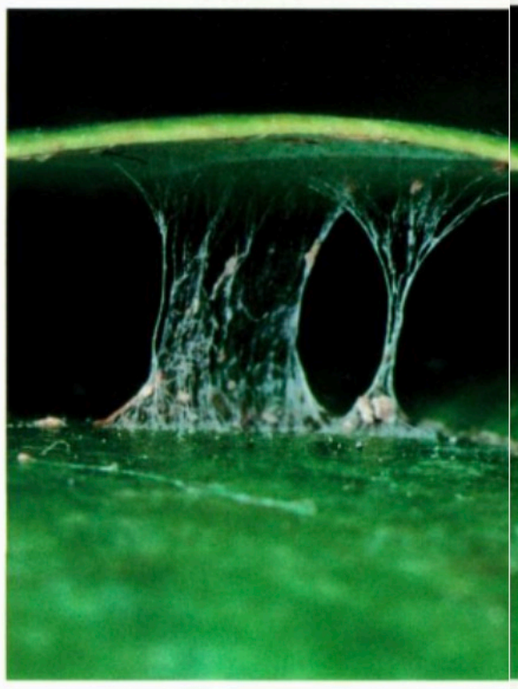


Camouflage takes *Phyaces comosus* on covert missions, infiltrating the nests of other jumpers to eat their young. About two millimeters in size, a *Phyaces* (above, at right) looks like a barely animated piece of dirt, even to the all-eyes mother *Epeus* guarding her nest. As *Phyaces* prepares to devour an egg, the female seems alert but confused, since even *Phyaces'* slow, irregular movements add to the guise of windblown dust. If pretense fails, *Phyaces'* great tufts of hair give a fallback defense. Fangs aimed at the little jumper pierce that hair, not flesh.

Its prey captured, a *Phyaces* (right top) appears to toy with a hatchling much the way a cat plays with a mouse.

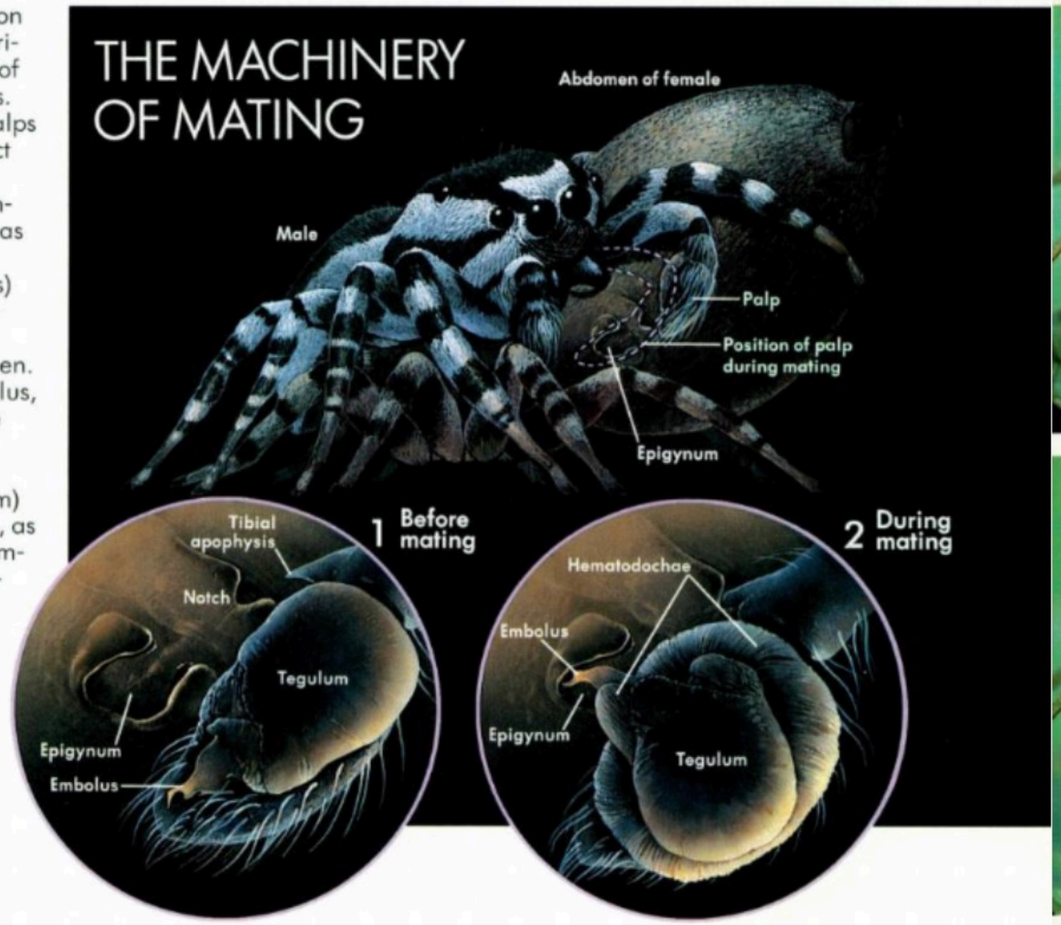
Resident of bamboo, individual *Phyaces* may dispute each other. When females meet on a stem (right middle), one flashes colorful underarm patches and drives the other spider off.

The lives of jumpers seem frantic, but *Ptocasius* of Singapore (right), like most jumpers, spins a nighttime shelter, here by securing leaves with bolts of silk.



Spider procreation requires exact orientation and fit of puzzle-like parts. The two male palps (right) first collect sperm from an abdominal opening. Each palp has two keys. One (tibial apophysis) fits securely into a notch in the female's abdomen. The other (embolus, at the end of the tegulum) moves into the female organ (epigynum) to deliver sperm, as balloon-like membranes (hematodochae) inflate.

ILLUSTRATION BY GREG HARLIN, SRW INC.



Jumper courtship is a complex business. Each species relies on its own suite of visual, tactile, and sometimes vibratory and olfactory signals. The male usually sets out to impress a reluctant female, which is typically larger and relatively drab.

A case in point: *Asemonea tenuipes* (far left, above). In the top panel a dark, narrow male resplendent in psychedelic colors is on the underside of the leaf. The pale, plump female has escaped to the top. The male looks for her, and, feeling her movements through the leaf, he vibrates it, perhaps to telegraph his impending arrival (bottom panel).

If she doesn't run away, he begins the mating dance, which seems submissive, as if he were groveling (above). Finally, the female permits approach. The male rotates his body into a less awkward position and calms her with caresses from his outstretched legs (left, above).

Looking under her abdomen, the male inserts his left palp (left, below) and discharges sperm. He can then mate again with his right palp.

Weaver ants swarm across the top of a leaf in Sri Lanka, while the mimic jumper *Myrmarachne* (with her fake ant-eye spot and fake ant-antennae forelegs) hides under it. She doesn't fool the ants; they operate on smell, not sight, and would eat her in a second if they could. She fools those predators who avoid toxic, nasty-tasting ants.

Another mimic (far left, at center) moves and looks antlike, until you count the legs.

Other jumping spiders, the wolves of their kind, hunt ants. This Singapore jumper (left, above) has just dispatched one. Yet even ant-eaters can be confused. A black jumper in Australia (left, below) mistakes an ant-mimic jumper for the real thing.

In Australia, which has some extraordinarily combative species, two female *Bavia aericeps* meet eye to eye (right). They then roll about in a close approximation of a wrestling match.

Charge! Like rams or goats, horned *Thorelliola ensifera* (above) butt heads for dominance. In this contest, "big horn" on the left rammed the smaller male and knocked him right off the leaf.

With *Mopsus* males (left) aggression is more than show. The one on top has flicked out a fang and fatally stabbed the other in the back.

Whether fighting or courting, jumpers display great color and complexity, often behaving like tiny, eight-legged birds. □

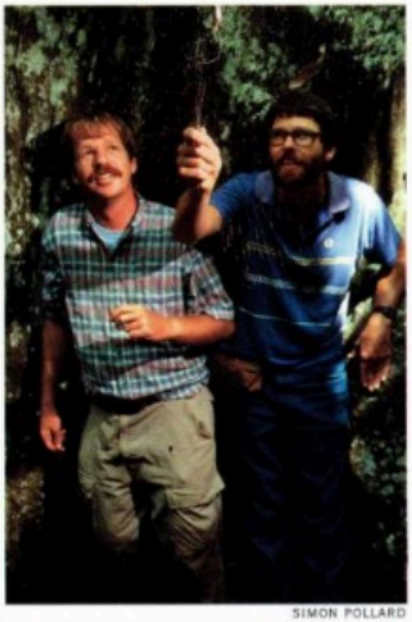
On Assignment

JULIAN AUGUSTIN

"People of my generation growing up in postwar Germany didn't have a feeling of being German," says free-lance photographer GERD LUDWIG, who was born in a village near Alsfeld. "There was nothing to be proud of. We wanted to be known as Europeans."

Covering German reunification on his first assignment for the GEOGRAPHIC was a bittersweet experience for Gerd, who now makes his home in New York City. "If it's going to be a unified country again, it will take another generation to work out all the differences," he says. That next generation gets a push (above), as Gerd joins preschoolers on an outing in Zossen. "I have a three-year-old boy myself. I wanted to test how it feels to have more than one."

The urge to travel seized Gerd early; as a teenager he once hitchhiked as far as Istanbul. Two years of university routine left him bored, and Gerd set out again to see the world. While working on a Norwegian freighter, "I wanted to bring back souvenirs of travel," he says, "but as a dishwasher I didn't have a lot of money, so I started to snap pictures." Back home, his portfolio landed him in the best art school in Germany. Soon he was working for magazines and was part owner of a photo agency. "Why not do for a profession what you like best? I just decided, I will be a photographer."



SIMON POLLARD

Fulfilling a "childhood ambition since about age five" to learn more about jumping spiders, biologist-photographer MARK W. MOFFETT—a frequent contributor to NATIONAL GEOGRAPHIC—traveled the tropics in pursuit of those eight-legged jewels.

In Australia with Robert Jackson, the top expert on jumper behavior (left, at right), Mark observes a web-making species that is itself preyed upon by jumpers. This huge female *Nephila maculata*—the largest web-weaving spider in the world—can ignore *Portia* jumpers, but the tiny male she carries on her back is not so lucky. *Portia* feed on the males, after traversing the deadly web—a web so strong it has been used in New Guinea to catch birds and fish. The hunting prowess of the *Portia* jumping spider is a story yet to be told in Mark's ongoing chronicles of high drama in the lives of small creatures.

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