

EVOLUTION

'Toadness' a Key Feature for Global Spread of These Amphibians

It takes a special kind of toad to hop around the world, colonizing continent after continent. And Ines Van Bocxlaer knows the secret to that success. Through an extensive analysis of 228 toad species, the graduate student at the Free University of Brussels (VUB) has come up with a list of traits that made such a worldwide spread possible. On page 679, she and her colleagues reveal what enabled some toads to leave South America, where the first toads originated, for places far afield. "This study elegantly analyzes specific morphological traits and correlates them with successful range expansion," says Jennifer Pramuk, a herpetologist at the Bronx Zoo in New York City.

That global spread may have accelerated speciation of this group of toads, says Franky Bossuyt, Van Bocxlaer's adviser. The team's work also suggests one way to evaluate if toads newly introduced to a location will become pests. "It's a really good start to thinking about what kinds of attributes make for an invasive," says Darrel Frost, a systematist at the American Museum of Natural History in New York City.

In 2009, using a combination of nuclear and mitochondrial DNA, Van Bocxlaer and her colleagues built a family tree that encompassed 86 toad species. Until that time, most systematists assumed that the *Bufo* genus of so-called true toads, which includes the cane toad, common toad, western toad, and others with short legs and warty, thick skin, belonged on the same branch. But "they didn't fall together," Bossuyt recalls.

Instead, this quintessential "toad" form has emerged multiple times on multiple evolutionary branches. Moreover, when the researchers looked at where toads with this characteristic look were distributed across the globe and when these amphibians first appeared in a particular place—fossils and other evidence provided that timing—they saw that this

kind of toad tended to be the first toad to arrive, and thrive, in a new continent or region.

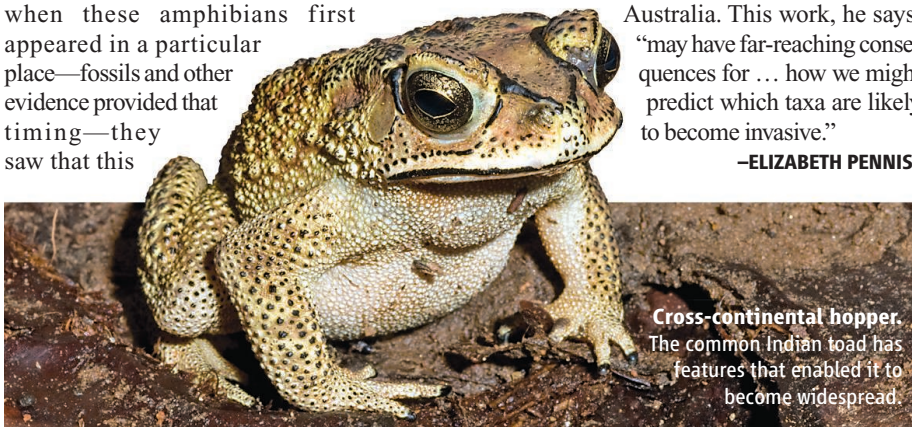
Bossuyt and his colleagues began to wonder if the *Bufo* "look" represented a suite of traits that equipped those toads for global exploration. They came up with a list of seven traits that might help the toads expand their reach. For example, one was the ability to live away from water instead of being dependent on high-humidity, damp, and even wet places to survive. "If you need constant high humidity, you can't go far," says Bossuyt.

Other traits that favored spreading included the possession of poison glands, to deter predators, and internal fat-storage bodies, for energy reserves. Large size likely helped as well, the researchers concluded. Toads that were flexible in where they lay eggs and could make use of temporary wet spots had an edge, too. Large clutch sizes, consisting of thousands of eggs, would also be beneficial, as would be larvae that could feed off the environment rather than have to rely on energy stores provided by the mother.

To see whether toads that dispersed had all these traits, Bossuyt's team added another 142 species to the toad family tree, so that it comprised 43% of all known toad species. At the same time, they compiled the ranges of each species from published records. The results are convincing, says Pramuk: "Genera of toads with the typical 'toad' morphology were ideally adapted for surviving and, apparently, colonizing the globe."

Knowing what kind of toads spread in the past should help us understand which ones will survive if accidentally transported into a new environment, adds Ben Phillips, an evolutionary biologist at the University of Sydney in Australia. This work, he says, "may have far-reaching consequences for ... how we might predict which taxa are likely to become invasive."

—ELIZABETH PENNISI



Cross-continental hopper.
The common Indian toad has features that enabled it to become widespread.

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Foster Care for Chimps

When Victor's mother died from anthrax, Fredy came along and adopted him. He shared his home with Victor every night, carried him on his back, and even gave him some of his precious food. Such altruistic behavior is one of the noblest attributes of our species. But Fredy and Victor aren't humans—they're chimps. A new study of these primates in the wild suggests that they are far more selfless than scientists have given them credit for, though some researchers have their doubts. <http://bit.ly/orphanchimps>

A Master Blueprint for Making Stars

It's a puzzle that has bedeviled astronomers and theorists for years: Do massive stars form in the same way as our sun or by some other process? Now a team of researchers has gone a long way toward providing the answer by catching a massive star in the act of condensing. Their verdict is that this massive star, at least, seems to follow the same mechanism as smaller stars. <http://bit.ly/starblueprint>



How Carnations Conquered Europe

The humble carnation in your Valentine's Day bouquet may be cheap, but it rivals the most exotic of tropical plants in evolutionary spectacle. New research reveals that the flower's 300 species emerged at a record rate. Many of these varieties arose in Europe, suggesting that the continent may have been more of an evolutionary hot spot than scientists thought. <http://bit.ly/europeancarnations>

The Shocking Truth About Running Shoes

Haile Gebrselassie, the world's fastest marathoner, once said of his early career, "When I wore shoes, it was difficult." A new study reveals why: Humans run differently in bare feet. Researchers have discovered that sneakers and other sports shoes alter our natural gait, which normally protects us from the impact of running. <http://bit.ly/noshoesneeded>

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