groove and then retracts several times within half a second.

To measure tongue extension, Muchhala encouraged bats to sip sugar water from drinking straws. He started with test tubes but switched when the small, agile bats plunged in up to their shoulders. Other local nectar bats reached down 4 cm. The new species more than doubled that depth, Muchhala reports in the Dec. 7 *Nature*. "I was amazed." he says.

By studying newly identified museum specimens, Muchhala found that the prodigious tongue attaches within a tube of tissue that originates in the bat's chest between the sternum and the heart and extends to the back of the mouth. Circular muscles within the tongue tighten to rapidly increase its length.

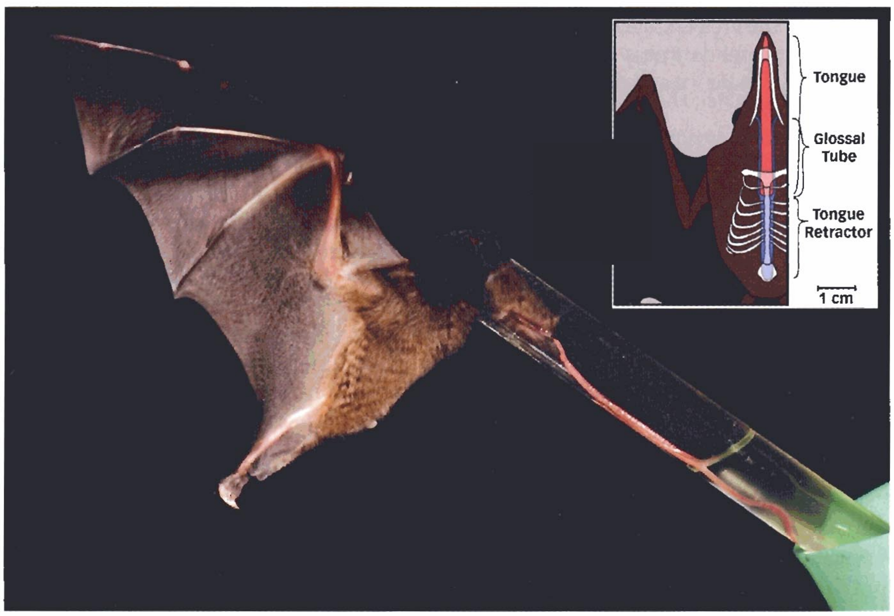
Some of the pollen grains that Muchhala collected from the bats' fur came from *Centropogon nigricans*, a pale-green, trumpet-shaped flower. Nectar collects at the bottom of these blossoms, which average about the length of the tube-lipped bat's tongue extension.

When Muchhala videotaped such flowers, day and night, for more than a week, bats were the only visitors. He never found the flower's pollen on other bat species, so he proposes that only tube-lipped bats pollinate that flower.

Other tropical plants cater to single pollinators, notes Scott Mori of the New York Botanical Garden. Those flowers tend to be more specialized than their pollinators, which will visit other flowers after their private nectar reserves have been depleted.

Bat systematist Nancy Simmons of the American Museum of Natural History in New York City welcomes the report of the new tongue structure as "a fabulous discovery." She says that anteaters are the only other animals that she knows to have tongues in their chests. Other observers have reported that scaly anteaters extend their tongues about 50 percent of their body length.

The anteaters' supertongues probe ant nests, which present a problem similar to that posed by deep flowers. Simmons says that the anteaters and bats independently evolved tongues that met that challenge. —S. MILIUS



LONG DRINK A tube-lipped nectar bat from Ecuador sticks out its tongue to drink from a glass cylinder. Between sips, the lower part of the tongue will retract into a sheath that runs from the back of the bat's mouth down into its chest (inset diagram).

M. COOPER; (INSET) MUCHHALA

Dim Harvest

Asian air pollution has limited rice yields

Thick clouds of air pollution over southern Asia and increased concentrations of greenhouse gases in the atmosphere worldwide have restricted rice harvests in India for the past 2 decades, a new analysis suggests.

Aerosols, such as volcanic ash and industrial soot, typically cool Earth's surface by reflecting some solar radiation back into space. This phenomenon somewhat counteracts the planet-warming effect of increased concentrations of gases such as carbon dioxide, says V. Ram Ramanathan, a climate scientist at the Scripps Institution of Oceanography in La Jolla, Calif.

However, after reviewing crop records and past research, Ramanathan and his colleagues suggest that the cooling action of the so-called Asian brown cloud that hangs over much of India hasn't countered global warming's negative consequences on rice harvests. For one thing, the cooling effect occurs at the wrong time of day, they say.

Increased concentrations of greenhouse gases raise nighttime temperatures, says Ramanathan. But air pollution blocks radiation only in the daytime, he notes.

In previous studies, each 1°C increase in average nighttime temperature decreased rice yield in the Philippines about 10 percent *(SN: 7/10/04, p. 29)*, and in India, the air pollution was shown to reduce rice yields between 6 and 17 percent.

Beyond their cooling action, thick clouds of high-altitude pollution tend to stifle precipitation. The abundance of small particles in the atmosphere results in water droplets that are too tiny to fall as rain *(SN: 3/11/00, p. 164)*. Furthermore, says Ramanathan, the clouds of pollution decrease evaporation at ground level and thereby reduce the amount of water vapor available to form rain.

The reduction in rainfall both decreases rice yield per acre and cuts the number of acres that can be farmed. "This shows that air pollution isn't just an urban problem," says Ramanathan.

He and his colleagues have analyzed India's rice harvests since 1966. They report in an upcoming *Proceedings of the National Academy of Sciences* that after improvements in agricultural techniques sparked dramatic yield increases in the mid-1960s, the annual growth of yields dropped to around 3 percent in the mid-1960s and has been stagnant since 2000. Although factors such as soil degradation and falling rice prices may have played a role in this decline, air pollution and greenhouse gases have contributed substantially, the researchers contend.

If the Asian brown cloud hadn't been present over India, increased precipitation would have boosted rice harvests by 10.6 percent each year between 1985 and 1998, the scientists say

Rice yields would have been another 3.8 percent higher if atmospheric concentrations of greenhouse gases had remained stable during those years, says Ramanathan.

The new findings "combine several aspects of climate change and give a better idea of how crop yields might change in the future:' says Lew Ziska, a plant physiologist with the Agricultural Research Service in Beltsville, Md. 'When you look at climate change, it's not just about warming."

Says Peter Timmer, an agricultural economist at the Washington, D.C.-based Center for Global Development, "Brown-cloud pollution has already cost India millions of tons of food production." —S. PERKINS