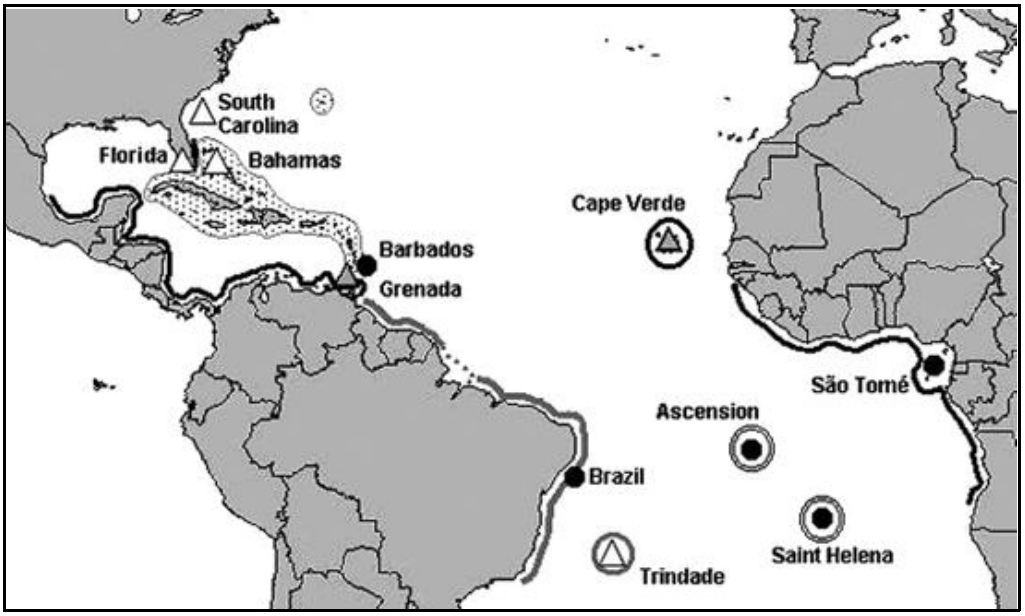
Smithsonian Tropical Research Institute
Weekly Update and Forecast
September 29, 2003

Scientific excellence

Forty percent of the world cacao crop (read: chocolate supply) succumbs to diseases caused in large part by fungi. Spraying young cacao leaves with fungi that do not cause disease provides some protection. New work presented in the journal *Mycologia* (vol 95, no. 3) by Elizabeth Arnold from the University of Arizona and STRI staff scientist Allen Herre shows that fungi completely colonized the leaves of cacao plants placed in the tropical forest understory within two weeks. The resulting fungal colonists may be particularly adapted to growth on cacao. Within the forest, an estimated 36,000 spores rain down on an average cacao leaf in a given day, compared to only about 1100 spores per leaf in a forest clearing away from overhanging trees. Fungi enter cacao leaves from the environment. New seedlings grown from seed are fungus free. By keeping the leaves dry researchers were able to maintain fungus free plants. When fungus free cacao plants were placed both in the forest understory and in a clearing, fungi colonized all of the plants to the same extent, regardless of their age, leaf toughness and leaf chemistry. Leaves of plants in the forest environment were colonized more quickly than leaves in the clearing, presumably because they were exposed to more spores in the forest. Fungi isolated from inside mature cacao leaves grew faster on artificial media containing cacao leaf extracts than on media containing extracts from other common tree species. This suggests that, of all the spores that rain down on the leaves, leaf chemistry may influence the resulting assemblage of fungi that grow on cacao. For more information, contact Allen Herre at herrea@bci.si.edu



Marine Biology (online) published "Ancient divergences and recent connections in two tropical Atlantic reef fishes *Epinephelus adscensionis* and *Rypticus saponaceous* (Percoidei: Serranidae)" by STRI marine biologist D. Ross Robertson and colleagues J.L. Carlin from Whitman College and B.W. Bowen from the University of Hawaii. Reef habitats of the tropical Atlantic are separated by river outflows and oceanic expanses that may preclude larval dispersal or other population connections in shorefishes. To examine the impact of these habitat discontinuities on the intraspecific phylogeography of reef-associated species the authors conducted range-wide surveys of two amphi-Atlantic reef fishes that have dispersive pelagic larval stages. Based on 593 bp of mtDNA cytochrome b from the rock hind *Epinephelus adscensionis* and 682 bp from the greater soapfish *Rypticus saponaceous* (n=109 and 86, respectively), the researchers found evidence of relatively ancient separations as well as recent surmounting of biogeographic barriers by dispersal or colonization. Rock hind showed slight but significant population genetic differentiation across much of the tropical Atlantic Ocean (ST=0.056), but deep divergence between the southeastern United States and seven other localities from the Bahamas to the south, central and east Atlantic (mean pairwise d=0.040, overall ST=0.867). The geographic distribution of the two rock hind lineages is highly unusual in genetic studies of Caribbean Sea reef fishes, because those lineages are separated by less than 250 km of open water within a major biogeographic region. In contrast, highly significant population genetic structure was observed among greater soapfish from the SW Caribbean, Brazil, and mid-Atlantic ridge (ST=0.372), with a deep evolutionary separation distinguishing putative *R. saponaceous* from West Africa (mean pairwise d=0.044, overall ST=0.929). Both species show evidence for a potential connection between the Caribbean and Brazilian provinces. While widespread haplotype sharing in rock hind indicates that larvae of this species cross oceanic expanses of as much as 2000 km, such a situation is difficult to reconcile with the isolation of populations in Florida and the Bahamas separated by

only 250 km. These findings indicate that populations of some species in disjunct biogeographic zones may be isolated for long periods, perhaps sufficient for allopatric speciation, but rare gene flow between zones may preclude such evolutionary divergence in other species. See the article in the attachments. For more information please contact D. Ross Robertson at drr@stri.org

Public impact

STRI and the Canopy Raft Consortium (CRC) from France began work on San Lorenzo in the Caribbean coast of Panama on September 22, to host 30 entomologists from 15 countries participating in the project "Investigating the Biodiversity of Soil and Canopy Arthropods" IBISCA 2003-2005. Recently, STRI and CRC signed an agreement to join efforts in canopy biology research for this project.

Of the 10 million plus species thought to exist on this planet, a mere 2 million are known to science. Others dwell in inaccessible locations—deep sea vents or hard-to-reach tropical treetops. To collect the best information available to date on tropical forest insects and their habitats, the researchers will use state-of-the-art canopy access techniques to sample nine 400m2 patches of Panamanian rainforest from September 22-October 31, 2003.

SAN director Máximo Carrizo, STRI fellow Yves Basset and Bruno Corbara from Canopy Raft Consortium supervised the launching of the Solvin-Bretzel canopy raft into the air yesterday, Tuesday, September 30th at 9:50am in San Lorenzo, Colon. On the ground, Corbara coordinates with colleagues.

Biologists will dangle from the gondola of a 56m tall construction crane, hang sticky traps from the booms of a massive treetop raft, slide along through the trees suspended from a helium balloon and perch in a tree house. They will fog with insecticide, shake and hand pick the greenery and collect leaf litter and soil samples from the forest floor to understand the vertical stratification of insects throughout the dark understory, striving subcanopy and emergent canopy.

The IBISCA 2003-2005 five-week project, "Investigating Biodiversity of Soil and Canopy Arthropods", lead by STRI fellow Yves Basset, and Bruno Corbara, Canopy Raft Consortium with a seven member technical team, is sponsored by Solvin-Bretzel (makers of PVC) and STRI. The Panamanian government is also providing support to this project through SAN (Servicio Aéreo Nacional) helicopters. STRI's Sherman Canopy Crane, in operation since 1997, is the site of ongoing surveys of tropical plant and animal life, seasonal change and photosynthesis. Three 400m2 sites within the reach of its 54m boom will be sampled by the team. A helicopter will lower the Solvin-Bretzel Canopy Raft, a 400m2 platform of PVC pontoons covered with netting--onto the treetops. The mobility of the raft makes it possible to sample

three additional 400m2 sites during the mission. The Canopy Bubble consists of a seat harness suspended from a helium balloon that moves along a 1 km transect and will be used to reach two more 400m2 sites. And finally, a fixed icosohedral tree house will make an additional sample possible.

The National Museum of Natural History's Terry Erwin first estimated global insect biodiversity some twenty years ago in Panama. Researchers at STRI continued to pioneer canopy research with the placement of the first Canopy Crane system in Panama City's Parque Metropolitano in 1990. IBISCA is one of the first exhaustive attempts to understand the relationship between habitats within the forest.

Unlike the undersea world, now visited by scuba divers, submarines and remotely operated vehicles, gravity works against terrestrial explorers. Francis Hallé, well known for his work on tropical tree architecture, says "it is essential that researchers experience this reality first hand. This technology places us in the treetops where these animals live."
More information at:
http://www.solvinbretzel.com

Information taken from STRI´s posting on *EurekAlert!*

Management excellence

Directors Ira Rubinoff, STRI, and Cristian Samper of the Museum of Natural History (NMNH) are pleased to announce that Dolores Piperno will hold the first joint scientific appointment between STRI and the NMNH, effective October 1st. This appointment is an important step in the implementation of the Science Commission recommendation to strengthen collaboration between Smithsonian bureaus. Piperno, one of the Smithsonian's leading anthropologists, has been a staff scientist at STRI since 1988. She has worked extensively on the origins and development of agriculture and other aspects of prehistoric human ecology, pioneering techniques that use plant remains to reconstruct ancient environments and human diet. She has authored three books and numerous publications on these subjects, including articles in *Science*, *Nature* and other prominent journals. Piperno will be based at the NMNH, and will maintain a laboratory at STRI, where she will continue her research on the ecology of prehistoric humans in the tropics.

Peer reviewed articles

Arnold, A. Elizabeth, and Herre, Edward Allen. 2003. "Canopy cover and leaf age affect colonization by tropical fungal endophytes: Ecological pattern and process in Theobroma cacao (Malvaceae)." *Mycologia* 95(3): 388-398.

Carlin, J.L., Robertson, D. Ross, and Bowen, B.W. 2003. "Ancient divergences and recent connections in two tropical Atlantic reef fishes *Epinephelus adscensionis* and *Rypticus saponaceous* (Percoidei: Serranidae)." *Marine Biology* Online.

Lessios, Harilaos A., Kane, J., and Robertson, D. Ross. 2003. "Phylogeography of the pantropical sea urchin *Tripneustes*: contrasting patterns of population structure between oceans." *Evolution* 57(9): 2026–2036.