BOTANY

Don't coevolve with a dodo

A sad, romantic, evolutionary ballad should be written about the tree *Calvaria major*. Once common on the Indian Ocean island of Mauritius, now fewer than 13 old specimens remain. The species is pining away for the dodo bird, University of Wisconsin ecologist Stanley A. Temple believes.

The scheme that Temple proposes is that while the dodo bird thrived, *Calvaria* evolved an extremely thick-walled seed to protect its embryo from destruction when the dodo ate the seed. The coat eventually became so tough that no embryo could force its way out unless the pit was first battered, as by the stones contained in the dodo gizzard. Although no cases are known where passage through a gut is absolutely necessary for a seed to sprout, for many plant's germination rates are extremely low without such treatment.

Temple's evidence, described in the Aug. 26 SCIENCE, is varied. Fossil *Calvaria* pits have been found among skeletal remains of dodos. Calculations of dodo gizzard force (based on the ratio of body weight to force measurements in existing birds) indicate that the pits would have not been totally demolished. Finally in an attempt to recreate the dodo effect, Temple force-fed fresh *Calvaria* pits to turkeys whose gizzards also contain stones for crushing food. After being excreted or regurgitated, three of the seeds germinated. "These may well have been the first *Calvaria* seeds to germinate in more than 300 years," Temple says. The dodo—*Calvaria* link, according to Temple, would be the first example of extinction of an animal species causing decline of a plant.

A step toward nitrogen-fixing crops

Agricultural scientists have long dreamed of eliminating farmers' dependence on fertilizer by providing crops with the genes that allow certain bacteria and blue-green algae to convert atmospheric nitrogen into ammonia. As a first step in such a genetic transfer, researchers have been moving the nitrogen-fixing genes (called *nif*) among bacteria. Using standard techniques researchers were able to move the genes into small rings of DNA, or plasmids, that could transfer genes among a range of bacteria. Frank C. Cannon of the University of Sussex and Gerard E. Riedel and Frederick M. Ausubel of Harvard University have now used recombinant DNA techniques to insert some of the *nif* genes into a much smaller plasmid, which gets copied more rapidly in bacterial cells. The investigators expect this technique, reported in the July PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, to allow them to purify large quantities of the genes for biochemical studies and provide the starting material for sophisticated genetic elements which could express *nif* genes in plant cells.

Tolerance is simple—genetically

Survival of the tolerant could be a subsidiary rule of natural selection. Any organism that can thrive where others cannot will have an advantage. Among plants, one such tolerance is the ability to grow in the presence of metals that normally interfere with many cellular reactions. Because each enzyme would have to adapt to resist the metal's interference, scientists expected many genes to be involved in the evolution of metal-tolerant plants. M. R. Macnair, however, reports in the Aug. 4 NATURE that only two genes are responsible for most of the copper tolerance observed in yellow monkey flowers. In his work at the University of Liverpool, Macnair crossed tolerant and nontolerant plants and then backcrossed the offspring to the parent types. His data can be most simply explained by interaction of just two different genes. If so few genes are involved, Macnair concludes, the tolerance is probably due to a compound that binds copper and keeps it out of the cell machinery, rather than to alterations of numerous enzymes.

ZOOLOGY

Circumspect mates of raped ducks

A kind of male chauvinism, it seems, is alive and well among mallard ducks. A zoologist has observed that a male mallard will react to the attempted rape of his mate by trying to intervene to prevent the act, by trying to forcibly copulate with her himself if the rape was successful or both.

Eighty-nine rapes were witnessed by David P. Barash of the University of Washington at the school's arboretum, during 558 hours of observation. Given the mallard population there, this figures out to about 0.03 rapes per female per hour. (The similar figure for American females according to U.S. statistics for 1975 is about 0.0001.)

An event was interpreted as rape by Barash if the sexual act was preceded "by vigorous struggle and escape behavior" and occurred without the normal precopulatory courtship displays. Sixty-four of the rapes were perpetrated by gangs of two to nine (and an average of 3.8) males.

In 31 cases, the male mallard attempted to rescue his mate from the rapist's bid, and always succeeded except once.

More intriguing, however, are the remaining 58 cases, when no such rescue effort was undertaken. In some of these, Barash reports in the Aug. 19 SCIENCE, the male may have perceived that his mate could defend herself—such as in 20 instances when the besieged female flew away to (ultimately unsuccessfully) avoid being victimized. In 47 cases of the 58, the attack was effected by a gang, whose formidability might have discouraged the male mate's heroic impulse.

Following 39 of the total number of assaults, the raped female's companion coercively attempted intercourse with her. Barash notes that in most cases this occurred within ten minutes after the rape. The male's rationale, Barash believes, is that he quickly introduce his sperm into the female "so as to compete with those of the rapist's."

Barash claims that the variety of male responses are consistent with, even predictable from, the premises of natural selection. In each instance, the male mate behaved "so as to maximize the difference between the benefits and costs associated with any potential act."

Loudmouthed gibbons aid their survival

Speaking of natural selection (above), two scientists believe they know why Kloss's gibbons have evolved the ability to articulate two particularly loud distress calls. The calls—sirening and alarm trills—may have developed to warn relatives in nearby territories of danger, according to Richard R. Tenaza of the University of the Pacific and Ronald L. Tilson of the University of California at Davis.

Kloss's gibbons, exclusively indigenous to the Mentawai Islands off the coast of Sumatra, Indonesia, are known to possess a 10-call repertoire. Sirening and alarm trills are among the loudest and are apparently strictly reserved for signaling human presence. With the possible addition of reticulated pythons, humans are the gibbons' only predators.

It may seem paradoxical that the animal would evolve an ability to produce loud, protracted calls (an average bout lasts 9.4 minutes) that easily betray its exact location to the very enemy about which it is warning others. In fact, a Kloss's gibbon does not further endanger itself this way, the authors note in the July 21 NATURE, partly owing to its remarkable agility, which frequently outmatches a local hunter's primitive bow and arrow.

Furthermore, the calls are an effective warning that humans are afoot and greatly reduce the chance of an antagonist's sneak attack on neighbors, which observation has shown are often relatives. Thus there is an evolutionary advantage, the authors surmise, for the gibbons' resounding calls—namely, one that promotes survival of a signaler's genetic relatives (kin selection).