Why Are Migrating Birds Killed at Tall Structures?

A large number of birds reside in Illinois only during the summer, migrating here from their tropical homes to breed and to grace our landscape with their songs and beautiful colors. A still larger number of birds pass through Illinois twice each year to reach breeding grounds to the north. The great majority of migrants travel at night, for reasons that are not fully understood but probably involve security from the sun's heat and from flying predators.

However during the last 30 years man has erected a danger to migrating birds from which evolution has not had a chance to protect them—lighted television towers and buildings tall enough to be encountered by birds flying hundreds of feet above the ground at night. In the morning after a cloudy night in the fall, one can often find many dead or injured birds beneath a tall tower. Occasionally hundreds of birds may be killed at one tower in one night. The birds are usually killed by colliding with the structure or with guy wires, although at lighted television towers most of the mortality probably occurs from the guy wires. Incidents occur on nights with low clouds, not on clear nights.

An important step toward understanding these annual tragedies was taken some years ago when Natural History Survey scientists Richard Graber and William Cochran conducted studies of killed birds, and even augmented these studies with intrepid observations conducted by climbing a tower at night. They found that birds, once near the tower, behaved as if they were reluctant...
to fly away from it, turning back again and again to expose themselves to the danger of hitting a part of the structure. Graber likened the birds' behavior to that seen indoors at night, when birds refuse to leave a lighted room to fly into a darker place. (Zoo aviaries use this principle to keep birds in lighted exhibit areas and away from darkened visitor areas.) Cloud plays a part by creating a relatively bright, diffusely lit zone near the tower—a zone of danger the birds are not equipped to handle.

Survey scientist Ronald Larkin recently had the opportunity to provide a different outlook on the problem of "tower kills" by using radar near a tall tower at night. On many nights with clear or broken cloud, the radar-tracked birds ignored the tower completely as they flew by it straight and level. However, one night in September a thin but unbroken light cloud enveloped the tower and descended almost to ground level, whereupon some birds started to show unique and bizarre behavior. Approaching the tower to a distance of 100 meters (about 100 yards) or more, they exhibited a tendency to circle it slowly in the night, maintaining their distance as if they were tethered on a long string. At the center of each arc or near circle was the tall tower.

The radar could not track birds close to the huge metal tower, so that very small circles within the guy wires could not have been observed had they occurred; however, no dead birds were found beneath the tower the next morning, indicating that there had not been a severe kill. Therefore, we suppose that the cloud was too thin to entrap birds so close that they struck the tower, but was thick enough that some birds became "trapped" in the zone of dim red light created by its lights. Wingbeats were recorded by the radar unit, so there was no doubt that small birds rather than insects were responsible for the strange tracks.

The radar observations lend strong support to Graber's ideas and provide further clues to what happens on a cloudy night at tall towers. First, there was no evidence that the towers exerted an attraction to the birds from a distance. Rather, the birds that circled the tower simply seemed to happen upon it during the course of a long flight. Second, the near circular tracks may mean that the birds try to stay in light of a certain brightness corresponding to a certain distance from the tower. This implies that it may be productive to study the night vision of birds in the laboratory, to give the field observations a basis in physiology. And it now seems possible that strobing lights or lights of a color other than red might be safer for the small birds that come upon a huge metal structure in the night.

By Ronald P. Larkin, Section of Wildlife Research

New Tick in Illinois

On November 20, 1987, Illinois Natural History Survey entomologist John K. Bouseman and Dr. Carl E. Kirkpatrick of the University of Illinois College of Veterinary Medicine searched for ticks on white-tailed deer brought by successful hunters to the Illinois Department of Conservation check station in Jo Daviess County. Two deer were infested with single engorged females of the deer tick *Ixodes dammini*. These two records constituted the first for this species of tick in Illinois. The specimens were identified by Bouseman and his determinations were confirmed by Dr. James Keirans of the Smithsonian Institution, Washington, D. C.

Investigators in other areas have determined that the deer tick has a two-year life cycle. Tiny, six-legged larvae hatch from eggs deposited in the spring and attach to small mammals such as field mice or to birds for their first blood meal. After overwintering, the larvae molt into a second juvenile stage, the eight-legged nymph. The nymphs, which are about the size of a pinhead, attach to larger animals such as dogs, horses, deer, and to man for their second meal sometime during spring or summer. They then molt to the adult stage and attach again to large mammals, usually deer. They mate on this host and after another blood meal, the females drop off and lay their eggs.

The detection of *Ixodes dammini* in Illi-
Female tick, *Ixodes dammini*, measures about 2.5 mm, roughly one-half to two-thirds the size of a dog tick (drawing by John P. Sherrod).

*Illinois* is of concern because the deer tick is the vector of Lyme disease, the number one tickborne disease in the United States. The disease is caused by infection with a bacterial agent, the spirochete *Borrelia burgdorferi*. The disease can result in chronic, sometimes debilitating illness resembling rheumatoid arthritis with symptoms ranging from acute headache to neurological impairment. Man can acquire Lyme disease when he enters wild areas during the warmer months of the year.

A team of researchers from the Illinois Natural History Survey and the University of Illinois College of Veterinary Medicine has begun a collaborative effort to determine the distribution of *Ixodes dammini* and *Borrelia burgdorferi* in *Illinois*. Readers of Survey Reports who might want to submit ticks for identification may send them in alcohol to John K. Bouseman, Section of Economic Entomology, Illinois Natural History Survey, 607 East Peabody Drive, Champaign, Illinois 61820.

By John K. Bouseman, Section of Economic Entomology; and Dr. Carl E. Kirkpatrick, College of Veterinary Medicine. Dr. Kirkpatrick is also an affiliate of the Survey’s Section of Wildlife Research.

**Drought Stress and Plant Disease**

Dry weather or lack of rain may have many adverse effects on plant health. Water normally moves into plant roots from the soil and is drawn upward through the vascular system by the tension that is created when evaporation occurs through small pores or stomates in leaf surfaces, a process called transpiration. Plants attempt to regulate water loss by opening and closing these stomates. On a summer day when transpiration rate is higher than water uptake by roots, stomates close early to limit water loss. Since roots continue to absorb water at night, the loss is replenished each day if soil moisture is adequate. When soil moisture becomes depleted during a drought, water tension in the plant increases until the plant becomes stressed. A mild stress may merely reduce photosynthesis and result in a slight yield reduction, while more severe stress may cause permanent damage to the plant. Plants weakened by stress often lose their ability to resist attack by disease organisms that rarely damage healthy plants.

Soybean plants inoculated with a root rot fungus after being subjected to controlled drought stress (photo by Don Schoeneveld).
Although the relationship between drought and disease is well known, few meaningful research articles have been published on the influence of drought on disease susceptibility. The lack of information is due to the difficulties encountered in trying to subject plants to drought stress under experimental conditions. Since it is nearly impossible to wet a soil to less than saturation, no good method has been developed to artificially adjust soil moisture to levels low enough to cause drought stress. The most common methods used in disease research have been to either withhold water until plants wilt, or to water at intervals of days or weeks so that plants alternate between stress and recovery. Neither method, however, is comparable to drought under field conditions, where plants become increasingly stressed over time with less and less recovery at night.

To overcome these difficulties, Survey plant pathologist D.F. Schoeneweiss constructed a series of stress chambers, based on a design developed for physiology research but modified for studies on stress/disease interaction. Plants are placed on top of a column of porous material and water stress is imposed by lowering the water level in the columns, thus creating a tension on the system. The stress chambers, made of PVC pipe, are placed inside a growth chamber so that the environmental factors, light, temperature, humidity, and soil moisture can be controlled and measured. Both soybean seedlings and rooted cuttings of woody plants have been maintained in these stress chambers for several weeks with normal, vigorous growth. The development of water stress in the plants is monitored at regular intervals with a diffusion porometer that measures stomatal resistance, and with leaf hygrometers that measure plant water potential or water tension in the plant.

Susceptibility of soybeans to a common and economically important root rot fungus did not increase under drought stress, contrary to reports in the literature that were based mainly on field observations. In contrast, a woody shrub species subjected to drought stress became susceptible to attack by a stem canker fungus, while nonstressed control plants remained resistant. Measurements of plant water stress confirmed that the stress chamber technique more closely simulates drought conditions in the field than any technique previously developed. This should enable researchers to obtain new information on how and why drought stress causes plants to become susceptible to certain diseases.

By Don Schoeneweiss, Section of Botany and Plant Pathology