ENTOMOLOGY

Outer Space 'Enroached'

What will happen to time senses in outer space? Government entomologists are preparing to find out by making astronauts of cockroaches—By Walter Wingo

See Front Cover

➤ THERE WILL never be parades up Pennsylvania Avenue for them, but among the brightest prospects for future American astronauts are a hardy strain of household cockroaches.

Hard as it is to drum up affection for a cockroach, the insect nevertheless has some admirable qualities for space traveling.

Not only is the cockroach light, compact and rugged, but also it is capable of living for weeks without food or water, explained Government entomologist William N. Sullivan. He is building a "bio-pack," the cockroach's version of a space couch, shown on front cover.

The National Aeronautics and Space Administration is considering putting the three-pound bio-pack in one of its biosatellites. These satellites, designed to study the effects of prolonged space trips, will have on board living plants and creatures. They are scheduled for launching in 1965.

A dozen to 20 roaches, with wires hooked to their tiny legs, are to share each bio-pack. The experiment is aimed mainly at examining how space will affect the roaches' "biological clock," the strange method animals have of telling exactly when to do things.

Mr. Sullivan has collected much data on the activity rhythms of cockroaches on earth. He confirmed that cockroaches are—as some of us who go to the kitchen for midnight snacks know—mostly night lovers.

What would happen to the cockroach's routine while orbiting in outer space, where a day and a night have nothing to do with our familiar 24 hours?

Preparing to find the answer, Mr. Sullivan, who works in the U.S. Department of Agriculture's research center at Beltsville, Md., already has conducted some high-altitude tests with cockroaches.

He taped some to the side of jet fighters and bombers to find out if the insects could survive low temperatures, pressure and humidity. Most did not.

However, cockroaches left in canvas bags in bomb bays lived comfortably. Mr. Sullivan concluded that cold, rather than the other stresses, had killed the outside bugs.

Mr. Sullivan has been working on the cockroach experiments since 1959, with research biologist Dr. Samson R. Dutky and chemist Milton S. Schechter, also of Agriculture's entomology research division.

Acknowledging that cockroaches and men react differently in most situations, Mr. Sullivan said his research nevertheless could have great importance to man.

"The cockroach is one of the toughest of all animals—having been around without change for millions of years," he said. "If the rhythm in a roach should change radically or cease in space, it would indicate that the human astronaut, who is basically frailer, might be in plenty of trouble."

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AGRICULTURE

Formula Aids Agriculture

➤ A NEW MATHEMATICAL formula is expected to lead to advances in agriculture and prevention of plant disease—both most important in providing food for the world's increasing population.

Dr. C. H. B. Priestly, chief of the division of meteorological physics, Commonwealth Scientific and Industrial Research Organization, Victoria, Australia, who worked out the formula, deals with the Lilliputian world of micrometeorology, the air just above the ground.

This world is quite different from that four feet above the ground where standard temperatures are measured, Dr. Priestly told SCIENCE SERVICE.

He noted that temperatures at the surface can be up to 40% warmer in the daytime and as much as 40% colder at night than is measured four feet above the ground.

This means that the climate in which plants live and their diseases thrive and prey on them is vastly different from that of humans. Knowledge of the plant climate is the key for improving the world's food supply, Dr. Priestly said.

The surface world is investigated with very special tiny instruments that measure the temperature and evaporation of water, the two sources for the atmosphere's energy. The energy transfer from earth to the atmosphere and turbulence, the agent that brings the energy from earth up into the air, are studied.

Dr. Priestly, chairman of a session on turbulence at the International Union of Geodesy and Geophysics meeting in Berkeley, Calif., said the new formula he worked out represents a confirmation of laws that govern the transfer of heat and momentum in relation to the rate of change of temperature and wind with height.

The formula expresses the relation between heat and vapor by terms of temperature and humidity. This, he said, could be expressed as a curve on a diagram or as a table to which values could be read.

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Martin Company

UNDER GLASS — The "secret of death" may be locked in ordinary barley seeds, being split on a plexiglass table by Dr. Joseph E. Varner of Martin Company in Baltimore, Md. He is exploring a theory that final aging of plant cells is an orderly, self-induced chemical process.

ENTOMOLOGY

Cotton Growers' Enemy Becomes Biology Teacher

➤ COTTON GROWERS are getting a biology lesson from one of their worst enemies—the spider mite.

This tiny red pest, which is neither an insect nor a spider, costs the cotton growers hundreds of thousands of dollars a year because it defoliates entire crops before they reach maturity.

The mite, which can be controlled by insecticides or "miticides," feeds on the underside of the leaf and sucks out the juices of the plant.

Once the cotton plant reaches maturity, the growers want the leaves to fall off so that the sun will open the cotton bolls for harvest more quickly. They spend money for synthetic chemical defoliants, instead of letting nature take its course.

Since many chemical defoliants are not successful, a California entomologist decided to study one of nature's biological defoliants —the spider mite.

By studying the defoliating effects of the pest (all females, since males do not damage), he found they injected a toxic chemical into the leaves which caused them to fall prematurely. The Atlantic spider mite was more poisonous than the other, John N. Simons of the Southern California Laboratories of the Stanford Research Institute, Menlo Park, observed.

His next step will be to grow enough mites in the laboratory to obtain sufficient quantities of the poison for testing. Thus, the cotton grower's worst enemy may become his biggest helper by providing a better chemical defoliant for harvesting cotton.

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