

PUBLIC HEALTH

On Guard Against Germs

Airplanes Must be Watched for Invading Enemies That May Carry Deadly Disease in Slender Insect Bodies

By JANE STAFFORD

THE housekeeper's vacuum cleaner and insect spray gun have been adapted for use as weapons of defense against disease-bearing stowaways of the air. It might seem humorous if the situation were not so grim.

These domestic tools, in a form specially designed for the purpose, are being used by the U. S. Public Health Service's quarantine officers to keep mosquitoes carrying yellow fever or malaria from riding the airliners into the United States.

Yellow fever seems remote and unimportant to most of us living in the United States today. You may remember hearing your father or grandfather speak of the dreaded Yellow Jack, and you have thrilled to the drama of its conquest by a team of U. S. Army doctors. But that was over thirty years ago—ancient history. And as for malaria—if you live in certain regions of the South you take it for granted, and if you live in the North it seems almost as remote and unimportant as yellow fever.

The secure feeling that comes from thirty years' freedom from yellow fever is rudely shocked by the knowledge that this disease is only two days away and is raging uncontrolled at that two-days-off locality. Public health authorities are seriously concerned over the situation and even more worried over the malaria problem.

New Carrier

Here is the picture they see: Yellow fever, wiped out of our country, and beaten back from Central America, was at its last stronghold in the northeast of Brazil. It was thought to be rapidly disappearing from the South American continent as a result of anti-mosquito services in a few of the larger cities. Then came reports from the International Health Division of the Rockefeller Foundation stating that "yellow fever is widely disseminated over the continent east of the Andes and north of Paraguay."

Brazilian jungle fever, the "fever of the engaged men" as it is known locally, has turned out to be the old dreaded

Yellow Jack. (It got its romantic local name because it chiefly attacks young, about-to-be-married men who have gone into the jungle to build homes for their prospective brides.) The Rockefeller Foundation scientists, down there in an attempt to clean up the last traces of yellow fever, stumbled on this discovery and on another unpleasant one: the jungle yellow fever is carried by a different kind of mosquito than *Aedes aegypti*, the classical yellow fever mosquito, and has different breeding habits. This complicates the fight against it considerably, since entirely new methods may have to be developed. There is scant hope at present of conquering or even controlling it.

Malaria Approaching

To U. S. health authorities, an even more serious aspect of the picture is the malaria problem. An African malaria mosquito, a rank foreigner, has gained a foothold in Brazil, two days away from us by plane. If this mosquito should be carried to the United States it would present a problem in malaria control far greater than any we have ever faced and one for which our present methods of malaria control would be totally inadequate. On top of this, there is Hawaii to be thought of. This delightful vacation spot has had some disease problems of its own but malaria is not one of them because there are no *Anopheles* mosquitoes on the island to spread the disease. Health authorities are greatly concerned over the possibility of even one or two of these malaria-bearing mosquitoes being taken to the islands from the mother country which is now only eighteen hours away by plane.

Officers of the U. S. Public Health Service, entrusted with the job of protecting us from importation of disease, realized as soon as commercial air travel started between the United States and Central and South America that they had a new problem on their hands. There are really two problems, or two parts of the problem. One relates to danger from human passengers and the other to danger from mosquito stowaways. It is for the latter that Drs. C. I. Williams and W. C. Dreessen adapted

the housekeeper's tools into effective defensive weapons that do not interfere with the speed and comfort of the new fast method of transportation by air.

Infected Passengers

In the case of the human passenger, air travel brings him from one continent to another so quickly that he might leave South America perfectly well but harboring yellow fever germs from an unsuspected mosquito bite, and arrive in this country, still apparently well, only to develop the disease days after his arrival. He might then be the means of spreading the disease to others, since the mosquito that carries yellow fever still exists in this country, though, without any yellow fever patients to bite, it cannot get and spread the infection.

If a yellow-fever-infected mosquito hopped an airliner for a stolen ride into this country and disembarked undetected, it and its brothers and sisters already here could infect enough persons to provide the nucleus of a good-sized epidemic before anyone knew what was up.

That this is actually possible was demonstrated by studies conducted by Drs. T. H. D. Griffiths and J. J. Griffiths of the U. S. Public Health Service, with the cooperation of officials of the Pan American Airways System. They found, in the first place, that there are plenty of places on the planes where mosquitoes can stow away undetected by ordinary observation, and examination of some hundred planes on their arrival at Miami from foreign and insular ports resulted in discovery of a number of mosquito stowaways, among them the yellow fever kind. The next step was



BUSY

The mosquito that spreads malaria, seen in the act of sucking blood.



HEALTH INSPECTION

Quarantine officer of the U. S. Public Health Service at Alameda, Calif., going aboard the China Clipper to look for mosquitoes or other signs of disease that might be imported by air.

to collect a hundred yellow fever mosquitoes—the type capable of spreading the disease, but not infected with it—and paint them yellow by spraying with a yellow dye from an atomizer, for identification purposes. These were placed aboard a plane at San Juan, P.R. Of the hundred mosquitoes, a score were found still on the plane when it landed ten hours later at Miami, 1,250 miles away.

Drs. Williams and Dreessen then took up the problem of keeping these mosquitoes from riding the airlines, or at least from landing in the United States. One way of doing this would be to destroy the mosquitoes on the plane during the flight. For this, it is necessary to have a mosquito-destroyer that will not involve any hazard to passengers or pilots, that is easy to operate and light in weight. One such substance, the public health officers considered, is pyrethrum in kerosene. This is the basis of many insecticide sprays. It is comparatively harmless to humans and in low concentrations in the air it will kill the yellow fever mosquito, *Aedes aegypti*.

Fire Hazard

The disadvantage of this mosquito killer is that it catches fire easily, which makes it unsuitable for use in a plane. So Drs. Williams and Dreessen mixed up an insect spray in which carbon tetrachloride, which is not only not inflammable but is used as a fire extinguisher, was substituted for kerosene.

This mixture was sprayed into a sealed room in which cages of pure-bred *Aedes aegypti* were placed. When enough of the mixture was sprayed to reach a concentration of between 40 and 60 parts per thousand cubic feet of air, it killed the mosquitoes, but was irritating to the men who stayed in the room during the spraying to watch the effect on the mosquitoes. So this spray had to be abandoned as impractical for use in passenger planes.

Safe Mixture

The next step was to test various mixtures of two kinds of sprays, pyrethrum-in-carbon-tetrachloride and pyrethrum-in-kerosene. To their surprise, the experimenters found that when the kerosene portion of the mixture was as little as one-fifth, the spray was just as effective in killing the mosquitoes as when much larger proportions of kerosene were used. This proportion sprayed into the air at a concentration of only a few drops per thousand cubic feet of air killed all the mosquitoes in the experimental room within five minutes. There is so little kerosene in the mixture that there is no danger of its catching fire and so little carbon tetrachloride that it is not irritating to man. It is a little heavier than similar insect sprays so it must be sprayed under slightly higher pressure.

Present practice is to spray the planes with this mixture, using a spray gun such as the housekeeper uses in her war

on moths, flies and other insects. A more effective method might be to supply the planes with a very small aluminum pipe, enabling the pilot automatically to spray the plane periodically. Increased pressure could be obtained by using compressed air from the airstream of the propeller. In a research laboratory at Miami, public health engineers, working in cooperation with the airline, are trying to work out the best method of using the spray on the planes.

Vacuum Cleaner

This spray mixture of pyrethrum, kerosene and carbon tetrachloride should do the mosquito-killing job effectively, and with no hazard or discomfort to pilots or passengers. One difficulty, however, is to get the spray into every enclosed space on the plane. Spraying the cabin and the pilot's compartment is not sufficient, as the mosquito stowaways can hide in the closed parts of the wings and fuselage. The vacuum cleaner feature comes into use at this point, in order to test the efficiency of the spraying done en route.

When the plane lands, it as well as its passengers must be inspected by the quarantine officer of the U. S. Public Health Service. To help in the search for mosquito stowaways, a sanitary inspector goes over every bit of the plane with a vacuum hose covered with a screen of cotton. Any lurking mosquitoes that escaped the spray will likely be caught by the vacuum line and will show up on the cotton screen. If more than one mosquito is found on ten planes of any one airline company, the company will be warned by the U. S. Public Health Service that it is not doing the mosquito-killing job thoroughly enough. If mosquitoes are persistently discovered, the federal health officers will hold the plane, immediately on its arrival, for mosquito search and destruction, before mail or passengers may be taken off. So far, however, these drastic steps have been unnecessary, as the airlines have been extremely cooperative about the disease-fighting measures.

Human to Mosquito

Keeping yellow-fever-infected persons out of the country is another problem. There is no way of telling that a person has been infected with this disease until he comes down with it six days later, which gives plenty of time for him to reach one of the Southern cities where the majority of the native mosquitoes are the yellow fever kind. Some of them are pretty sure to bite him and suck up the yellow fever virus which

they will pass on to their next victim. Health officials in other countries are just as concerned as our own about this problem. The British in India are especially worried, since the yellow fever centers in Africa have been brought so close by air travel. India also has countless numbers of the yellow fever mosquito. In addition her millions of people have probably no resistance at all to the disease, which has never appeared in that country, and it is impossible to enforce throughout the country sanitary regulations such as screening of houses and isolation of the sick. Importation of one yellow-fever-infected human or mosquito would probably mean disaster in India.

International Pact

To avoid such catastrophe, Great Britain along with the United States and about twenty other nations have signed an International Sanitary Convention for air travel. The signatories have agreed to keep persons from yellow fever areas under surveillance, before they board a plane, for a long enough period to determine whether or not they have been infected and are about to develop yellow fever.

While these precautions are in effect, scientists are at work seeking still better methods of protection against yellow fever. This search has gone on almost ever since Walter Reed and his men found what is still the only practical method of prevention: blocking the route between yellow-fever mosquitoes and man. Even this method, which is also a malaria preventive measure, is only practical in settled regions. In the African and South American jungles it is practically impossible to apply anti-mosquito measures.

A protective vaccine against the disease is what scientists have hoped for. The search for this has been shadowed by tragedy. Despite all precautions, the men engaged in the research ran a fearful risk. Over a score suffered attacks of yellow fever, and five gifted scientists, Adrian Stokes, Hideyo Noguchi, William A. Young, Paul A. Lewis and A. Maurice Wakeman, lost their lives. The search went on, however, other scientists picking up the work where the last martyr had unwillingly dropped it.

Eventually success crowned the brave and daring efforts. A successful vaccine was developed by Drs. W. A. Sawyer, S. F. Kitchen and Wray Lloyd, working in the laboratories of the International Health Division of the Rockefeller Foundation. The trick was turned by mixing yellow fever virus, greatly weakened by passage through hundreds of mice, with human immune serum, that is, blood serum of persons who had recovered from yellow fever. This vaccine was used successfully on members of the Rockefeller staff engaged in yellow fever work, and since its development no more cases of the disease have been acquired in the course of research on it, either in the laboratory or in the field.

Disadvantages

This vaccine had certain disadvantages. One, resulting from the fact that the virus had to be weakened by passage through mice, has been overcome by development of a method of growing the virus on tissue cultures outside the animal body. The other pertains to the human immune serum used in preparing the vaccine, and is the feature which still makes it impossible to vaccinate humans against yellow fever on a large scale. The serum must be purchased from donors, which makes the cost of a single vaccination high. In addition, the protective property of the serum does not remain at a high level for long after the person has recovered from the disease. Consequently there is a rather limited supply. Efforts to obtain immune serum from immunized animals, such as is done in the case of other protective vaccines, are now under way at the Rockefeller Foundation's laboratories.

This article was edited from manuscript prepared by Science Service for use in illustrated newspaper magazines. Copyright, 1936, by EveryWeek Magazine and Science Service.

Science News Letter, November 7, 1936

White gold being scarce in Germany, dentists there are using more white metal alloys for crowns, fillings, and other dental work.

ARCHAEOLOGY

Digging Up India's Past Reveals "Modern" Houses

AMERICAN archaeologists have unearthed a buried city in India, showing more vividly than ever before what the most ancient civilization of India was like.

The ruins, found under mounds of earth at Chanhu-daro, northwestern India, date back five thousand years in their oldest era. The modern world can find much to wonder at, in ruins and relics of the dead city.

Chanhu-daro had homes of burnt brick, and the brick was of well-fired clay and well shaped. The houses had bathrooms and drains that are pronounced superior to the sanitary arrangements in cities of other civilizations of their time. The people were industrious at many lines of skilled labor. They made toys for children of cities around the country. They were workers in bronze and copper. They turned out quantities of beads, making some so tiny that forty to an inch could be strung, and boring holes so fine that nothing coarser than a hair would thread these beads.

As Chanhu-daro was on a trade route, the goods of the city were dispatched by ox-load or peddler's pack to other, distant cities.

The picture of a trade town of ancient India, as old as the famous ruined city of Mohenjo-daro, is the result of excavation by two institutions, the Boston Museum of Fine Arts and the American School of Indic and Iranian Studies. It is only within three years that the Indian government has changed its law, to permit outside universities and archaeological organizations to dig in this region.

The Indus Valley, where Chanhu-daro stood, had its trouble with floods, like Ur of the Chaldees and many another ancient town. The field director of the expedition, Ernest Mackay, finds that at least three great floods attacked the city. After such a flood, the people

16 Eminent Scientists Trace the False Leads in the Stages of Science

THE STORY OF HUMAN ERROR

Edited by Joseph Jastrow. A lively and interesting volume covering the erroneous beliefs and false goals that have hampered the progress of every field of modern science. The contributors: Joseph Jastrow, James Harvey Robinson, Harlan T. Stetson, Kirtley F. Mather, John Leighly, William F. G. Swann, Eric T. Bell, Charles A. Browne, Howard M. Parshley, Homer W. Smith, C. Judson Herrick, Ralph Linton, George M. Stratton, Harry Elmer Barnes, Howard W. Haggard, Abraham Myerson. Illustrated. \$3.50

At All Booksellers

D. APPLETON-CENTURY COMPANY
35 West 32nd Street, New York

● RADIO

November 10, 5:15 p.m., E.S.T.

HOW MUCH?—Ralph W. Smith of the National Bureau of Standards.

November 17, 5:15 p.m., E.S.T.

A CENTURY OF INVENTIONS—Thomas Midgley, Jr., Chairman, Executive Committee, Centennial Celebration of the American Patent System.

In the Science Service series of radio discussions led by Watson Davis, Director, over the Columbia Broadcasting System.