Table 1), absorption of repellent through the skin is a significant factor of loss.

INFRA-RED SPECTRA OF INSECT REPELLENTS: It has been suggested (Miles and Beck, 1947) that a substance is odorous because its vapor passing among the olfactory hairs selectively absorbs in the infra-red spectral region so as to disturb the thermal equilibrium in the olfactory region. This disturbance is thought by Miles and Beck to initiate olfaction.

Since repellency must in part be related to the olfactory sense, we have partially tested this hypothesis by examination of the infra-red spectra (25μ—16μ) of the substances listed in Table 1 for which boiling point, refractive index, and density are reported. The Baird spectrograph used by Dr. Charles Hubely of the Defense Research Board (to whom we are indebted for these spectra) is not equipped for study of vapors, so that it must be assumed that spectra of the liquids are indicative of those in the vapor state. With this limitation we can affirm that no absorption band is present among these substances that is common to them all, or that is related to intensity to the observed insect repellencies of the compounds.

SUMMARY: A method of screening compounds as insect repellents with guinea pigs as the test animals is described. The repellency values obtained with the guinea pig are approximately the same as those obtained from human arm tests. The advantages of this technique are that a smaller quantity of the candidate material is required for each test and toxicity to the host is not a major consideration. In tests of dimethyl phthalate with guinea pigs more repellent was lost by absorption through the skin than by evaporation. Infra-red spectrographic analyses of several compounds in liquid form were of no value in predicting their effectiveness as insect repellents.

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MOSQUITO SURVEY OF GUAM

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Since Hawaii became a crossroads for planes as well as the many ships of the Pacific, the island of Guam is only twelve hours away from our Territory. Hawaii is only nine hours by plane to California. Faster transportation increases the danger of the spread of diseases as well as of the vectors of diseases from the Pacific region to our West Coast.

A survey trip was taken from July 11 to August 18, 1952 to Guam and the Trust Territory.

On the way to Guam, brief stops were made on Midway and Wake Island. Both of these islands were once infested with mosquitoes until Hawaii's mosquito control personnel started a clean-up campaign for the Civil Aeronautics Administration.

No mosquito was found during my stay on these stepping stones in the Pacific.

Guam constitutes our first line of defense in the screening of diseases and disease vectors from the Orient. Unfortunately, the island suffered so much from the destruction of the Pacific war that reconstruction has to be undertaken on a massive scale. The capital city of Agana was practically flattened to the ground and the population there was scattered. A new and better city is in the process of being built and the health program is gradually being enlarged.

A mosquito-borne disease from the Orient, Japanese B encephalitis, apparently overcame the ocean barrier of 2,000 miles and broke out as an epidemic on Guam in 1947. According to Dr. W. M. Hammon (1949), this highly fatal form of sleeping sickness has leaped from Japan to Guam.

Large epidemics of dengue have occurred on Guam. The last outbreak in 1944 resulted in several thousand cases among military personnel.

Along with the apparent introduction of a new mosquito-borne disease to Guam during the last war, two new species of mosquitoes which are potential vectors of epidemic diseases were introduced as well.

The Central Pacific-Micronesian area has always been considered an *Anopheles* malaria free area, until the *Anopheles subpictus indefinitus* was found by the Army to have established itself in the southern part of Guam by early 1948, according to Hull (1952). Within a year, it has spread throughout the island, according to a survey by Reeves and Rudnick (1951). This mosquito was able to spread so fast because it has a wide range of breeding places, from highly saline water along the beaches to many types of ground water. I collected the larvae from puddles, pools and hoof prints. I found them breeding in abundance in low lying land of empty lots in the midst of built-up sections.

Anopheles subpictus indefinitus prefers feeding on animal blood. However, if domestic animals are not available as sources of blood, it will attack man. It has been incriminated as the main vector in an epidemic of malaria in Celebes. It is a potential vector of the disease on Guam, especially with the recent importation of large numbers of laborers from malaria endemic areas to the island.

The second new mosquito introduced into Guam during the war was *Aedes albopictus*. It was first found in Guam in 1944 by Lt. Comdr. A. B. Weathersby of the Marines, according to Hull (1952). It was reported by Reeves and Rudnick (1951) to be widely distributed in 1948 except on the southern end of the island. Since then, it has spread to the southern end as well.

During my survey, I examined the mosquito larvae in 92 containers from various parts of the island. *Aedes albopictus* larvae were found in 73 per cent of them, *Culex quinquefasciatus* in 25 per cent and *Aedes guamensis* in the remaining two per cent. The need for storing rainwater collected from roofs in 50-gallon drums and various other storage receptacles at many of the houses in the rural districts increases the number of breeding places available to *Aedes albopictus*.

Since its recent introduction into the island, *Aedes albopticus* has become so abundant and widespread that it is becoming a serious pest as well as a health menace. It is a potential vector of dengue, yellow fever, and Japanese B encephalitis.

Aedes aegypti has practically been exterminated from Guam by the anti-dengue campaign of 1944–45. Reeves and Rudnick (1951) did not find any in 1948–49, nor did Hull (1952) of the Navy who made a survey in 1951. None were seen during my survey. Our experiences in Honolulu also indicate the relative ease with which *Aedes aegypti* can be eradicated. We have failed to find any of this strictly domestic mosquito in Honolulu for the last two years. It is quite a different matter with *Aedes albopictus*, which has a much wider range of breeding places and is more adaptable to environmental changes. This more versatile species has replaced *Aedes aegypti* on

Guam, as it has already done in Honolulu. It is doubtless breeding in greater abundance there, with increased danger as a potential vector of diseases.

Culex annulirostris marianae was found breeding in ground pools together with *Culex quinquefasciatus* at the village of Piti.

Aedes vexans nocturnus was found in the water of a puddle at Umatac.

Larvae of *Aedes guamensis* were found in water from the leaf base of Pandanus plants as well as in a coconut tree hole at Tumon Bay.

The adults of *Aedes pandani* are fierce biters when one is in the vicinity of the Pandanus. Bohart and Ingram (1946) reported their breeding place in the water of the leaf axils of Pandanus. Their flight range appeared to be rather short as I was not bothered by them at Tumon Bay until I was within about 100 yards of their breeding places. They then attacked in numbers, so that I could hardly collect them fast enough from my arms.

Other species reported for Guam which I failed to collect during my short survey are *Culex sitiens* and *Culex littoralis,* reported to be breeding in brackish water along the shore. *Aedes oakleyi* was reported as a rare species breeding in tree holes and containers.

There are altogether eleven species of mosquitoes reported for Guam by Reeves and Rudnick (1951). Seven of them were collected during my brief survey.

Mosquito control in Guam is being carried on by Dr. C. J. Wynberg, Chief of Public Health in Guam. Thomas Curran, Sanitarian, is in charge of field work.

I was informed that the mosquito control program for Guam will be expanded with a team of about fifteen men in the field staff. They will receive laboratory training from George D. Peterson, Jr., who is Entomologist with the Guam Department of Agriculture. My survey in Guam was carried out with the kind cooperation of both Peterson and Curran.

We need to be on our guard in Hawaii against the possible introduction of Japanese B encephalitis since two of our three local mosquitoes, *Culex quinquefasciatus* and *Aedes albopictus* are potential vectors. We are also on our guard against the further migration of *Anopheles subpictus indefinitus* to our part of the Pacific. In these days of fast air transportation, distant areas become close neighbors, and our health is linked to the rest of the Pacific region.

Hawaii is the last screen through which mosquitoes and mosquito-borne diseases from the Orient as well as the South Pacific may continue on their way to the West Coast. We hope to do a good job on our home base so that Hawaii may do her part in protecting the rest of the country. Furthermore, we are doing what we can to promote mosquito control in the rest of the Pacific region.

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