and July while SLE virus appeared early in June to late September. There was no evidence of Venezuelan equine encephalitis virus activity in the border region of Southern California in 1972.

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DOES ARIZONA NEED A MOSQUITO ABATEMENT PROGRAM?

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When most of us think of Arizona, almost a common picture comes to mind. We visualize an arid land of mountains, plains, canyons and valleys. We visualize sand, clumps of grasses and cacti. What we never visualize is water.

If there is no water, then there can be no mosquitoes. A recent study by McDonald *et al.* (1973) revealed that there are at least 43 species of mosquitoes in Arizona. If there are mosquitoes, there must be standing water. Where is this water and where does it come from? Much of the water originally found or naturally occurring was found along the rivers. Naturally, the river areas became centers of the state's population. Irrigation has become rather concentrated along such rivers as the Verde, the Gila, the Colorado, and the Santa Cruz. Similarly located along these rivers are cities such as Phoenix, Coolidge, Tucson, Yuma, Wallton, and Gila Bend.

None of us has any illusions about the fact that man is the cause of many of his own problems with respect to mosquitoes. True, the white man did not bring all of Arizona's mosquitoes to Arizona, but he has intensified the problem. As early as 1871, Camp Goodwin, Arizona had to be moved to higher ground to avoid the malaria and mosquitoes which appeared near the original site.

Population growth in Arizona has been astronomical. In 1870 the population of the entire State was only 9,658 people. Since that time, the rate of population growth in Arizona has been faster every decade than the growth of the United

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States as a whole. In 1970 the population of Arizona had reached a total of 1,771,000 people, a 36 percent increase over the total population of 1,302,000 just 10 years earlier in 1960. As more people moved into Arizona, they brought with them their usual poor attitude toward environmental sanitation.

The vast majority of the people coming to Arizona moved into the urban areas of Phoenix and Tucson. Seventy-nine percent of the people in Arizona live in urban areas and 85 percent of these live in either Phoenix or Tucson. Along with the population growth came the demand for more and more land to be placed under irrigation. By 1960, 1,263,673 acres of Arizona's land were devoted to crops. Most of this land was under irrigation.

Standing water in fields, caused by overwatering, broken pipes or leaky ditches, livestock water tanks that are never cleaned or drained and ornamental fish ponds without fish are all ideal mosquito breeding sites. These, plus the lack of human attention to environmental sanitation, provokes and augments growth of the mosquito populations.

Rainfall is rather sparse and infrequent in Arizona. There is an average annual precipitation of only 3.39 inches in Yuma to 24.70 inches in Kingman. Nevertheless, when the rains do come, in many places such as Tucson and Phoenix, most of the entire year's precipitation may come in two or three "monsoon" storms. The deserts cannot soak up all these sudden surges of water, thus what doesn't run off, often stands in pools for many days. These monsoon pools, too, produce astronomical numbers of mosquitoes.

A further complication in the state mosquito problem is that southern Arizona is blessed with very mild winter temperatures. The average temperatures in Phoenix range from an annual minimum of 55.7° to an annual maximum of 84.6°. Tucson's annual minimum and maximum temperatures range from 52.4° to 82.4°. Studies conducted by me since October of 1972 have shown that small but consistent catches of *Culiseta inornata, Culex pipiens quinquefasciatus* and *Culex tarsalis* can be taken in ordinary New Jersey type mosquito light traps all through Tucson's coldest months of November, December, January and February. Thus in these urban areas, temperatures are continually within a range to permit mosquitoes to smolder in smaller maintenance populations during the "off" seasons. As the ambient temperatures in these become warmer, the formerly smoldering mosquito populations can now reproduce explosively.

Aside from being pests, Arizona's mosquitoes are a significant threat as vectors to both the human and equine populations. Smith (1960) pointed out that due to the presence of both *Anopheles pseudopunctipennis* and *An. maculipennis freeborni,* outbreaks of malaria could occur if infected persons infected these mosquitoes. He also pointed out that there was probably a considerably higher incidence of human arthropod-borne encephalitis than was recognized, due to subclinical infections. A later study by Smith *et al.* (1969) over a period of 6 years showed that there were consistent isolations of both St. Louis encephalitis virus (SLE) and western equine encephalitis (WEE) from *Culex quinquefasciatus* and *Culex tarsalis* mosquitoes in the Tucson area. These authors concluded from their study that "the repeated demonstration of encephalitis viruses in mosquitoes over a period of years in this area (Tucson) appears to point up a definite threat of epidemic virus encephalitis to the human populations."

Magy (personal communication, 1973) advises that personnel of the Bureau of Vector Control of the California State Health Department collected a high percentage of *Culex tarsalis* mosquito pools that were positive for St. Louis, western, and Turlock encephalitis near Imperial Dam in 1972.

There is no doubt that to date the urban areas of Arizona are most fortunate in not having experienced outbreaks of mosquito-borne encephalitis of epidemic proportions. However, with no proven effective vaccines for human immunization against SLE and WEE, the only highly effective and fool-proof means of averting a mosquito-borne encephalitis disaster in Arizona is through highly efficient and effective mosquito control programs. One must conclude that mosquito abatement programs in Arizona are a "must" even if they are confined to the major urbanized areas of the state. Fortunately, these are relatively small areas which are, for the most part, confined to river valleys.

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ULTRA LOW VOLUME DISPERSAL EQUIPMENT FOR MILITARY HELICOPTERS[1]

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INTRODUCTION. The Navy has directed its efforts toward development of equipment for ULV insecticide dispersal by rotary and fixed wing aircraft for both routine and combat insect control application for the past ten years. In 1962, the Navy Disease Vector Ecology and Control Center used an H–2 helicopter for investigation of this new dispersal method. The equipment initially built consisted of a 60-gallon fiberglass tank, an electric motor-driven aircraft fuel pump, and two externally mounted booms. The booms were used to support three nozzles on each side. Plastic tubing from a tee on the pump supplied insecticide to the nozzles. This prototype, with improvements in design and efficiency, was the forerunner of the unit presently in use (Fig. 1). Much of the early developmental work was done to determine simple methods of installing the equipment in helicopters, to establish new methods of handling and loading concentrated insecticide, and to become familiar with other procedures involved with the application of ULV insecticides.

Although the performance of the equipment for ULV dispersal was satisfactory, the installation was mechanically and operationally unsatisfactory. Externally mounted booms required special fittings to be installed on the aircraft on a semi-permanent basis. This procedure restricted the use of the equipment to a

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