In recent years dengue and yellow fever have appeared as growing problems in the Americas. At the same time many of the national programs for the control and eradication of Aedes aegypti have suffered serious setbacks. As a consequence A. aegypti has reinfested areas where it had been successfully eradicated and invaded others from which it had not previously been reported.

Brazil and Bolivia have recently been reinfested, and A. aegypti appears to be spreading in many countries. A number of factors are probably at play in each situation. However, a general relaxation of surveillance measures has contributed to this spread, for once firmly established it is exceedingly difficult to eradicate again. The figure below summarizes the present A. aegypti situation in the Americas.

Three programs can be cited as examples of adequate surveillance and immediate implementation of eradication measures. In 1977 Manta, Ecuador was found reinfested with A. aegypti. After a concentrated effort of source reduction, larviciding, and adulticiding, this

Figure 1. Status of the Aedes aegypti eradication campaign in the Americas, 1980.

*Eradication carried out according to the standards established by the Pan American Health Organization.
foci was eradicated. Again in 1979 reinfestation occurred in the area of a transportation terminal. Although the mosquito may have come from ships docking in the port, it appears that the means of re-entry were buses coming from Colombia and Venezuela. Once more by using virtually all available means of control, A. aegypti was eradicated. Panama, especially the Caribbean coast ports and small islands, frequently either become reinfested or small boats are found with A. aegypti breeding on them. Late in 1979 Grand Cayman was reinfested in the airport, probably by mosquitoes carried on small private aircraft landing without notice for inspection. This reinfestation was discovered by using ovitraps as one of the surveillance tools. Eradication, although costly, was successful. A second reinfestation occurred early in 1980 in the vicinity of the seaport. Routine larval habitat inspections located this focus. Again, eradication was successful.

In each of the above examples, surveillance has been the key. In the present situation with rapid air and ground transportation as well as the more traditional means for Aedes aegypti spread, the ship, surveillance of A. aegypti-free areas must be strengthened. Of major importance is the location of areas at risk for re-invasion, such as bus terminals near frontiers between free and infested areas, seaports, especially those used by small ships, and airports. Some countries have border inspection of vehicles with insecticide treatment of potential breeding sources such as tires.

Surveillance includes an active inspection and treatment of ships and aircraft. This program is subject to breakdown due to slow communication between harbor or airport management and surveillance staff as well as the routine nature of the duty of inspectors. Continuous education of the importance of surveillance and evaluation of inspections can assist in reducing this danger.

One of the traditional means of surveillance is searching for larval habitats. More recently the placing of ovitraps in and around risk areas has been successfully used. A combination of the two methods is recommended.

The extension of A. aegypti into previously uninfested areas is another serious problem. This situation has been observed in Colombia. Although the exact nature of this rapid extension of range is not known, a number of factors are undoubtedly at work. Man is extending his own environment into new territories. At first he is peripatetic, but eventually villages and then cities are established. Transportation services improve and man soon produces ideal breeding sites for A. aegypti. Thus, the mosquito can arrive and find an environment conducive for colonization. Man's immigration into new areas and the subsequent establishment of suitable habitats for A. aegypti produce a new situation for surveillance.

Dengue in the Caribbean, northern South America, and Central America was characterized by a rapid spread of type I virus reaching epidemic levels in 1977 and 1978 but becoming less pronounced and endemic in some areas by 1979. Nevertheless, in the latter year, there has been a northward movement of the virus along the Pan American Highway in Mexico. Tapachula, Chiapas, suffered an epidemic of dengue (type 1) early in 1979. Ultra-low volume ground and aerial applications of malathion against the adult and temephos sand granule treatment of larval habitats were applied. Following these control endeavors, reported cases declined, only to peak again in July and August. Entomologic surveillance showed an increase in breeding sites in June about a month after the beginning of the rainy season. During 1979 there was a movement of virus activity into the state of Veracruz. There is concern that the movement of dengue will continue northward during the warmer months of 1980. Entomologic surveys show that A. aegypti can be found in the eastern coastal and some of the central areas of Mexico and in 10 of the southeastern states of the United States of America.

Human cases of jungle yellow fever have occurred in recent years in Bolivia, Brazil, Peru, Ecuador, Colombia, Venezuela, and Trinidad. Most of these cases appear to be related to the Haemagogus-monkey jungle cycle. However, in some areas of Colombia, for example in 1979 when yellow fever activity moved northward into the foothills of the Sierra Nevada de Santa Marta, a rural type of yellow fever appeared. In this area and in another in the general vicinity of Cúcuta, cases were reported in agriculturists not working in jungle conditions. The possibility of a reservoir other than monkey and of a new vector is being considered for investigation. Of additional importance is the gradual extension of yellow fever activity into areas infested with A. aegypti producing a potential risk of A. aegypti transmission in rural villages and urban areas.

The epidemic nature of both dengue and yellow fever calls upon the epidemiologist to locate potential risk areas. In addition to knowing the immune status of the population, migration patterns of man, availability of vaccine in the case of yellow fever, the epidemiologist should be familiar with vector surveillance and emergency vector control techniques. As mentioned previously estimates of larval populations is one of the best approaches. Larval surveys should be as extensive as possible and should define the major types of breeding habitats and the distribution and density of the breeding population of Aedes aegypti. Results of surveys are usually expressed in terms of per cent of houses positive for larvae (House Index), per cent of all water-holding containers positive for larvae (Container Index), and the number of positive containers per 100 houses (Breteau Index). It is believed that areas where the House Index is higher than 35, the Container Index exceeds 20, and the Breteau Index is greater than 50 could represent a potential high risk for A. aegypti-transmitted yellow fever.
should the virus be introduced. However, lower indices could promote cases. The situation for dengue is probably similar.

Adult populations of *A. aegypti* may be indirectly assessed by means of ovitraps. These are jars with a capacity of about 500 ml which are painted on the outside with a glossy black paint. The usual size is 130 mm high with a 75 mm diameter. Clean water is added to a depth of 2-3 cm and a hardboard paddle 13 cm by 2 cm fastened to the inside of the jar. The paddles are collected every 5 to 7 days and examined for eggs. Care must be taken in the selection of sites for the traps.

Entomologic surveillance and survey techniques can be adapted for evaluation of either routine operational or emergency control measures. In both cases, the epidemiologist can use the information to evaluate effectiveness of the control program and should attempt to correlate this information with what is happening within the human population.

PAHO has been involved in determining the efficacy of new insecticides and control technology. At present temephos as a formulation of coated sand granules is extensively used as a larvicide even in potable water. It has produced control for 1-3 months. Consequently, many control programs attempt to follow 8-week treatment cycles. Effective treatment centers on finding and treating all containers holding water and the acceptance of the people to allow the insecticide to remain in the container. The musty taste of temephos is disagreeable to some, and a certain degree of health education may be necessary.

Recently an insect growth regulator, methoprene, has been used successfully in small trials and may be considered safe as a larvicide for potable water. It has the advantage of being odorless and tasteless but it has a shorter period of activity and costs more than temephos. Source reduction may be implemented as a control measure.

Some programs supplement larviciding with perifocal adulticiding. With present costs of insecticide and labor, it has not been determined if perifocal spraying is advantageous. Residual spraying of houses, schools, and other public structures is done in routine and emergency situations. It produces a good level of control but is time-consuming, expensive, and is being met increasingly with public opposition. Most insecticides used in malaria control programs, if there is not resistance in the *A. aegypti* population, can be used.

Ultra-low volume (ULV) application of technical grade or special formulations of malathion, dibrom, pirimiphos methyl or fenitrothion have been used against *Aedes aegypti*. Applications can be made with airplanes and helicopters configured with special equipment or with agricultural equipment adapted for public health use. In severe epidemic conditions aerial application should be considered a method of choice. However, many countries have vehicle mounted ULV equipment and thermal foggers as well as potable ULV and thermal equipment in their control programs or in use in agriculture that could be used in emergency control operations. ULV and thermal equipment are of great value for emergency control as they are aimed at bringing the adult vector population to a level sufficiently low to reduce or halt viral activity in the nonimmunized human population. This approach has been used repeatedly during the recent dengue epidemics. In the event of the danger of urbanization of yellow fever, ULV and thermal space sprays could be used as a stop gap until the human population is immunized.

PAHO is preparing manuals for the emergency control of vector-borne diseases and operational control of *Aedes aegypti*. A guide to producing national contingency plans for vector emergencies by an established national disaster and emergency committee will be an important aspect of the manuals.

(Morbidity and Vector Control Program, PAHO)

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**Diarrheal Diseases in Panama, 1970-1978**

Morbidity and mortality data continue to be the best available indicator for evaluating the effectiveness of programs for the control of water-borne diseases, even when the information is not of the best quality and is not received with the desired uniformity and regularity.

Table 1 shows the number of cases and deaths caused by diarrheal diseases in Panama and the rates per 100,000 inhabitants from 1970 to 1978. As will be noted, the diarrheal disease morbidity rate apparently increased, while the mortality rate for diarrheal disease dropped during the period. This may be explained by wider coverage of the health services, which has made it possible to detect morbidity and mortality more precisely, and by better reporting of cases. On the other