Dengue vector surveillance in Hong Kong – 2007

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Abstract

A dengue vector surveillance programme was implemented in the city and port areas in Hong Kong. As a result of the surveillance, only Aedes albopictus was detected to be present in various areas in summer. Aedes aegypti was, however, not detected in any area under surveillance. Although a rather high index of 70.9% was recorded in July, the activity of Ae. albopictus was immediately brought down through concerted efforts of various agencies and the public. The swift response of concerned agencies were facilitated by the use of Geographic Information System (GIS) in the dissemination of surveillance results. Users were able to access the system at any time for the latest results of the surveillance for taking immediate remedial measures. The public was also informed of the results regularly through the Internet and press releases to arouse awareness to prevent and control the local dengue vector.

Keywords: Dengue vector surveillance; Hong Kong SAR, Aedes albopictus; Community efforts; Vector control.

Introduction

Hong Kong is located on China’s south coast (22°20'N and 114°11'E); it is surrounded by the South China Sea on the east, south and west, and borders the city of Shenzhen in Guangdong Province to the north over the Sham Chun river. The territory’s 1104 sq. km (426 sq. miles) land area consists primarily of Hong Kong Island, Lantau Island, Kowloon Peninsula and the New Territories as well as some 260 other islands. Hong Kong has a hilly terrain with steep slopes. Most of the urban development exists on the Kowloon peninsula, along the northern edge of Hong Kong Island and in scattered settlements throughout the New Territories. Hong Kong exhibits a monsoonal climate, in which the south-west monsoon occurs from May to September, characterizing Hong Kong’s hot, wet summers; while the north-west monsoon occurs from November to March, bringing to Hong Kong cold, dry winters. Because of the climatic influence, most of the annual rainfall occurs in summer and the mean air temperature ranges between 25–28 °C. Even during winter, the temperature ranges between 15–21 °C.

Hong Kong is one of the world’s leading financial centres. It is an important centre for international finance and trade with the largest concentration of corporate headquarters in the Asia-Pacific region, and is known as one of the four “Asian Tigers” for its high growth rates and rapid industrialization between the 1960s and 1990s. The territory’s population also increased sharply throughout the 1990s, reaching 6.99 million in 2006.
Dengue fever has been made statutorily notifiable in Hong Kong since 1994[1]. All the infections reported to the Department of Health of Hong Kong Special Administrative Region, China, are investigated to establish their source. The Department of Health works jointly with the Department of Food and Environmental Hygiene of Hong Kong Special Administrative Region, China, which plays the leading role in the control of the disease vector. Between 1994 and 2001, the annual number of notifications ranged from 3 to 17 cases; all these cases acquired the infection from outside of Hong Kong (i.e. imported cases), mostly from South-East Asian countries. In 2002, there were 36 confirmed cases recorded, of which 20 cases were locally infected. There was another local case recorded in 2003 but none since 2004. The number of imported cases remained at 31 from 2004 to 2006 while these increased to 58 in 2007 (Table).

In Hong Kong, a total of 13 Aedes species have been recorded that include Ae. albopictus and Ae. aegypti[3,4]. Ae. albopictus is one of the most commonly found mosquitoes in Hong Kong. It has wide distribution both in urban and rural areas. Ae. aegypti, on the other hand, probably has not been an indigenous species in Hong Kong. It was once discovered on board a vessel from another country in mid-1950s. In 2000, a dengue vector surveillance programme, using ovitraps at selected sites, to monitor and evaluate the effectiveness of dengue vector control work carried out by various agencies, and for making timely adjustments to dengue vector control strategies and measures, was put in place by the Food and Environmental Hygiene Department. The programme was expanded in 2003 with an increase in the areas covered and the frequency of surveillance. The surveillance programme was further extended in 2004 to cover all major port areas, including all seaports. A dengue vector surveillance programme by using ovitraps had already been in place for the Hong Kong International Airport since 1998.

### Methods and materials

The oviposition trap (ovitrap) was used in this surveillance programme as a tool to detect the prevalence and distribution of aedine mosquitoes. The device was locally manufactured as per specification. It comprised of a simple plastic container of approximately 200 ml capacity, painted black inside with a straight and slightly tapered sides. The opening measured 6.5 cm in diameter, the base diameter was 5.0 cm, and the container was 10.0 cm in height. The ovitrap was covered by a black cap with four openings and a grey-colour umbrella-shape raised cover to protect the content inside the ovitrap from contamination by unwanted materials. A brownish wooden tongue depressor was placed diagonally inside the container as an oviposition paddle.
Thirty-eight areas with high human concentration were selected such as housing estates, schools and hospitals. All the 38 areas were surveyed every month to closely monitor the situation of each location and to obtain a territory-wide picture of the vectorial situation. On an average 55 ovitraps were placed at each selected site. The ovitraps were set at a distance of about 100 m from each other for one week and collected back to the laboratory. The percentage of positive ovitraps was recorded as the ‘Ovitrap Index’. To serve as a quick reference for taking prompt follow-up mosquito control actions, each of the ovitrap collected was examined immediately for the presence of mosquito larvae. The larvae found were identified under compound microscope to species level and the Provisional Ovitrap Index (POI) was worked out. The ovitraps were then incubated at room temperature for one week for the eggs in the ovitraps, if any, to hatch out. The number of ovitraps found with *Ae. albopictus* or *Ae. aegypti* in the first and second examination were pooled together for the calculation of the Area Ovitrap Index (AOI). Another index, Monthly Ovitrap Index (MOI), was then calculated by pooling the results of all the ovitraps retrieved in the same month from the 38 areas which reflected the overall vector situation of the month.

A total of 33 land ports, which are categorized into seven groups according to the nature of the ports, were also surveyed. Twenty ovitraps were used at land ports and 650 ovitraps were used in the airport.

### Results

#### Community surveillance

The MOIs of 2007 followed a similar trend as previous years but were generally lower (Figure 1). The MOIs in the first quarter were maintained at a rather low level of 0.2% to 1.4%. However, the indices rose gradually in the second quarter from 7.6% in April to 20.7% in

![Figure 1](image)
in June and reached a peak of 23.1% in July. Although the MOI recorded in July 2007 (23.1%) was the highest recorded in July since 2003 and higher than the average MOI of July from 2000 to 2006 (19.4%), it was lower than the average MOI of June from 2000 to 2006 (23.8%). A marked drop from 23.1% to 11.3% was observed in August and the MOIs declined gradually thereafter and reached the lowest in December (0.2%).

In respect of individual survey areas, only one AOI exceeded 20% in April. The number of AOIs greater than 20% increased sharply to 12 in May and further to 18 in June. Three locations were found to have AOIs greater than 40% in June and increased further to 6 in July. A record high AOI of 70.9% was also recorded in July. After reaching the peak in July, the indices came down rapidly in August. All AOIs recorded in August were lower than 40%. The number of AOIs reaching 20% also decreased from 16 in July to 8 in August and 3 in September. The indices remained at a lower level in the last quarter. Activity of Aedine mosquitoes was not detected in most of the survey areas after November.

**Port surveillance**

In 2007, the Port Monthly Ovitrap Index (PMOI) ranged from 0.0% in January through February to 3.2% in June. The variation in PMOIs showed a similar trend as in previous years (Figure 2). The ovitrap indices of all port groups were below 20.0%. The highest index of 13.8% was recorded in the port group of Cross Boundary Check Points on Land in June. The ovitrap index at the Hong Kong International Airport was also the highest in June (2.6%). In the months of June, July and August, all port groups had records of positive indices.

**Discussion**

The results of the urban and port areas surveillance indicated that *Ae. albopictus* existed in various areas in summer. The breeding places of the vector include a variety of small water bodies such as discarded buckets, empty lunch boxes, sand pits, surface drainage channels, keyholes of manhole covers, bamboo stumps, and saucers underneath plant
High ovitrap indices were recorded repeatedly in some of the areas covered by the surveillance programme, indicating the presence of persistent breeding grounds that needed particular attention. *Ae. aegypti*, the important vector for the transmission of dengue fever and yellow fever, was however not detected in all the areas covered by the urban and port surveillance programmes.

It was well recognized that community participation was the key to success in controlling mosquitoes, particularly dengue vectors, and an annual territory-wide anti-mosquito campaign was organized to promote community participation and forge close partnership of government departments and nongovernmental organizations in controlling the mosquitoes. The dengue vector surveillance programme served as a tool not only to monitor the local dengue vector distribution but also to provide objective information for taking appropriate actions by the community against dengue vectors. The Area Ovitrap Index and Monthly Ovitrap Index numbers were released to the public through press releases and the Internet to arouse awareness in preventing mosquitoes. Government departments were able to access detailed information of the surveillance, including location of positive ovitraps through a Geographical Information System which is accessible by registered users through the government intranet. They are able to target mosquito control action at venues that fall within the 100 m radius of all positive ovitraps under their purviews. The people were also advised to pay particular attention to any water accumulation in and near their residences. A detailed and comprehensive advice on mosquito prevention and control was issued together with the press release. The public was also able to access the information through the Internet.

For operational purposes, the ovitrap indices were classified into four different categories – Level One: for indices less than 5%; Level Two: for indices between 5% and less than 20%; Level Three: for indices between 20% to less than 40% and Level Four: for indices at 40% or above. Different actions were taken based on the levels reached. At lower levels (levels 1–3), control measures mainly relied on source reduction, e.g. proper disposal of disused articles, lunch boxes, containers, etc. Potential breeding sites such as saucers underneath plant pots, surface drainage channels, roadside gully traps or keyholes of manhole covers were inspected weekly and accumulation of water was removed promptly. Larvicides were applied whenever immediate elimination of breeding sources was not feasible. When the Ovitrap Index reached Level Four, space spaying of insecticides was carried out at the resting places of the adult mosquito to contain the mosquito problem.

On health education, health talks were organized for schoolchildren, managements of estates, construction sites as well as local organizations such as area committees to disseminate the message of mosquito prevention and control. Training was also organized for pest control personnel in the government. Operatives of pest control contractors providing mosquito control services funded by the government were also required to receive proper training on general pest control, including mosquito control and dengue fever.

**Conclusions**

According to the results of the dengue vector surveillance in 2007, *Ae. aegypti* was not detected and the activity of *Ae. albopictus* was, in general, under control. The Monthly Ovitrap Indices were mostly lower than the averages of the past few years except in July where a surge in the ovitrap indices was observed.
However, with concerted efforts made and swift actions taken by relevant agencies and the public, the indices were brought down quickly in the following month and maintained at a lower level till the end of the year. This indicates that the vector problem had been put under control in 2007.

Active participation of the government, local organizations and the public were the key to success in controlling dengue vector. The results of dengue vector surveillance were released to the public and other parties concerned through different channels to facilitate prompt remedial actions. Timely target-specific control efforts were achieved through the coordination of district-based anti-mosquito task force led by the government.

References


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