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Mosquito Nuisance in Hong Kong Urban Area

Introduction

It is generally considered that nuisance caused by mosquitoes occur mainly at rural areas. While most mosquito species prefer inhabiting environment with vegetation, some of them are able to breed in stagnant water collected in man-made articles or structures. In Hong Kong, those highly adapted to urban environment are among the most commonly seen species.

Common Urban Mosquito Species in Hong Kong

Aedes (Ae.) albopictus is one of the most commonly seen mosquitoes in Hong Kong and is a well-known vector of dengue fever. It breeds in small and relatively clean stagnant water. In addition to natural breeding places such as tree holes and bamboo stumps, it can also lay eggs in water-filled artificial receptacles and structures. *Ae. albopictus* mainly bites in day time at outdoor areas. As *Ae. albopictus* has a short flight range, its presence usually indicates a nearby breeding source.

Culex (Cx.) quinquesfasciatus is another commonly found mosquito in Hong Kong. It can breed in a variety of water bodies, and can tolerate water with certain degree of pollution. In urban environment, it commonly breeds in construction sites and poorly managed surface channels. *Cx. quinquesfasciatus* is a strong flier. It bites actively indoor at night, and hence could cause great nuisance to occupants of houses without proper protective measures.

In addition to mosquitoes that breed in urban environment, the geographic proximity of developed and rural areas in Hong Kong also make people in urban area susceptible to attack by mosquito species which breed in woodlands and with a long flight range. Many *Culex* and *Anopheles* mosquitoes have flight ranges in terms of kilometers.

Common Mosquito Breeding Places in Urban Environment

Generally speaking, any object or structure that can hold stagnant water for a period of time could potentially turn into a mosquito breeding place. Listed below are only a fraction of the more commonly found problems in urban areas of Hong Kong. In order to prevent mosquito breeding effectively, attention should be paid to, but not limited to, the following points.

Surface Channels

Surface channels are often found holding stagnant water due to a number of reasons, including poorly designed or maintained, and choked with things like refuse or fallen leaves (Figs. 1a, 1b). This is one of the most commonly seen mosquito breeding places in urban environment.

Fig. 1a

Fig. 1b

Sand Traps

To perform their function, sand traps are designed to hold standing water. Presence of mosquito breeding could be difficult to be detected in the covered type as shown in Fig. 2. The keyholes on the cover, if filled with water, are also suitable for mosquito breeding.

Fig. 2

Tarpaulin sheets

Large plastic sheets are commonly used to covered different articles at outdoor areas. While the sheets prevent the articles from collecting stagnant water, the sheets themselves may do so (Fig. 3a). Making the situation worse is that people tends to neglect these articles after they are covered, allowing them turning into mosquito breeding places. This phenomenon is also frequently observed on covers for motorcycles (Fig. 3b) and bicycles.

Fig. 3a

Fig. 3b

Covers of Passages and Public Transport Facilities

Although drain holes are present in most of the covers of passages (Fig. 4a) and facilities like bus and railways stops (Fig. 4b), they are usually small and easily blocked by dirt and fallen leaves. Blockage of these holes may lead to accumulation of water. Due to the elevated position, stagnant water held at these covers is frequently overlooked.

Fig. 4a

Fig. 4b

Greenbelts

Flowerbeds and greenbelts in urban areas with dense vegetation (Fig. 5a) could provide resting places for mosquitoes, and can hide refuse capable of holding stagnant water such as bottles and plastic bags (Fig. 5b).

Fig. 5a

Fig. 5b

Construction Sites

Many construction materials, tools, equipment and waste can hold stagnant water (Fig.6). Regardless of the size of construction sites, plenty of mosquito breeding places could form if not properly managed.

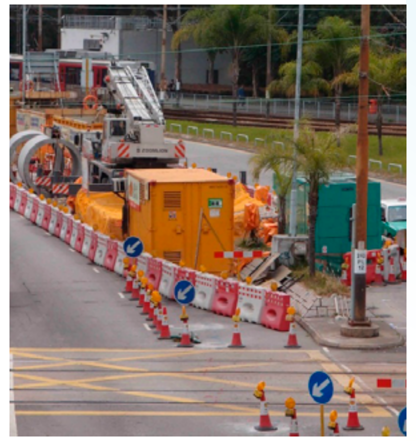

Fig. 6

Accumulated Article and Refuse

Unattended articles and refuse are commonly found accumulated in areas with human activities. These items could be utilized by mosquitoes as breeding places when water is collected. The disused tyres accumulated near a garage as shown in Fig. 7 is an example.

Fig. 7

Prevention of Mosquito Nuisance in Urban Environment

Improvement and modification of structures and different facilities, proper storage of articles and refuse, and regular inspection and clearing of breeding/potential breeding places of mosquitoes can greatly reduce the chance of mosquito nuisance in urban areas. As to the areas with serious nuisance caused by mosquito with unknown or remote breeding source, personal protection like insect repellent and suitable clothing could be used. Proper physical screens could be installed to block the entrance of mosquitoes to indoor. More information on mosquito prevention and control is available at the offices and the website of Food and Environmental Hygiene Department.

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Insect Growth Regulator

Insect growth regulators (IGRs) are substances that adversely affect insect growth and development. Unlike common neurotoxic insecticides, of which the target sites on insects and mammals are similar, the primary target sites of the IGRs that are being developed do not exist on mammals for its selective toxicity. IGRs may therefore be classified according to their selective mode of action as follows: 1) chitin synthesis inhibitors; and 2) substances that interfere with the action of insect hormones (e.g. ecdysteroids and juvenile hormones).

Chitin synthesis inhibitors (CSIs)

Chitin is an important structural component of the cuticle (exoskeleton) and the gut lining of the insect. Chitin is also related to the formation of insect's trachea, reproductive ducts and some gland ducts. It would be lethal to the insect if the formation of the cuticle is disrupted. Insect larvae treated with CSIs will be unable to ecdyse properly due to inhibition of the biosynthesis of the new cuticle. In some situations, the CSIs could change the composition of the cuticle and affect cuticular elasticity and firmness which cause a lethal molting. There are two types of CSIs produced commercially for pest control: 1) benzoylphenyl ureas (BPUs) e.g. diflubenzuron; and 2) buprofezin and cyromazine. BPUs act mainly by ingestion, while in some cases exhibit contact toxicity. They also suppress oviposition and egg fertility in some species. When act as ovicides, they reduce the egg-laying rate or hinder the hatching process by inhibiting embryonic development. Buprofezin have similar action as BPUs. Buprofezin may lead to suppression of ecdysis and adversely affect DNA synthesis. The precise mode of action of cyromazine is not fully known but the effect is similar to BPUs and buprofezin.

Substances that interfere with the action of insect hormones

The growth of insects, i.e. from immature to adult, is regulated by the correct ratio of two main insect hormones: the insect molting hormone ecdysone (ecdysteroid) and the juvenile hormones (JHs). Ecdysone is responsible for the cellular programming of molting to accommodate growth e.g. embryonic molts as the insect embryo grows and larval molts between instars. When the development involves the change from an egg to a larva, from a larva to a pupa or from a pupa to an adult, it is also regulated by JHs.

Juvenile hormone analogs (JHAs)

The major function of juvenile hormone is the maintenance of the larval status in the immature stages. JHs also functions in various aspects of metamorphosis, reproduction and behavior. Many naturally occurring JHAs have been isolated from plants, probably being developed as a natural defense against insect during evolution. JHAs mimic the action of natural JHs and interfere with the functions of JHs. JHAs can be broadly classified into two groups: 1) terpenoid JHAs e.g. methroprene; and 2) phenoxy JHAs e.g. fenoxycarb, with others such as epofenonane classified in-between. JHAs are more effective at the beginning stage of metamorphosis and embryogenesis in insects, such as freshly ecdysed last larval instars, freshly ecdysed pupal instars, and deposited eggs. Treatment of the larva in its last instar with JHAs can induce production of various larval-pupal intermediates that do not survive and in some cases produced supernumerary larvae or adults with significant developmental delays. JHAs are reported to induce sterility in both sexes and termination of diapause that exist in some species. Some JHAs are also shown to suppress egg hatch in some species.

Ecdysone agonists

Nonsteroidal ecdysone agonists are more metabolically stable in vivo than ecdysteroids. They exert the same action as the natural ecdysteroids. They are toxic to susceptible insects mainly by ingestion. Toxicity via topical application is expressed only at very high doses. One example of the nonsteroidal ecdysone agonists is the bisacylhydrazine insecticides. In general, ingestion of bisacylhydrazine induces the effects and symptomology of molting event in susceptible insects, which includes feeding inhibition within hours and preventing further crops damage. The cuticle of the intoxicated larvae may be malformed and the larvae eventually die of their inability to complete a molt, starvation, and desiccation due to hemorrhage.

IGRs are attractive alternatives to neurotoxic insecticides since they are generally more target selective, comparatively less harmful to the environment and non-target or beneficial species. However, there were already some incidents of resistance to some of the IGRs in the last two decades in different pest insects and the action of IGRs to the non-target organisms (e.g. effects of CSIs on crustaceans and JHAs on beneficial insects and to the last instars of aquatic insects) should not be neglected. Selection of pesticide in pest management should be made with great caution.

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