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Komunikasi Pendek/*Short Communication*

The Effectiveness of A Floor Gully with Grating to Prevent the Oviposition of *Aedes* (*Stegomyia*) *Aegypti* (Linneaus): A Laboratory Study

(Keberkesanan Penutup Paip Pembentung Berjaring untuk Mencegah Pembiakan Nyamuk *Aedes* (*Stegomyia*) *Aegypti* (Linneaus): Satu Kajian Makmal)

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ABSTRACT

This study was conducted to evaluate the effectiveness of a floor gully come with grating to prevent the oviposition of Aedes aegypti in the floor trap. In order to conduct the test, two containers were placed into a mosquito cage (30 cm × 30 cm × 30 cm). Both containers were filled with declorinated seasoned tap water and covered with floor gully c/w grating and normal floor gully, respectively. A total of 50 gravid Ae. aegypti females were then released into the cage and left for a week. All the eggs obtained from the test were allowed to remain inside the containers for the eggs to hatch. The number of hatched larvae was counted and recorded. Five replicates were conducted concurrently. There was a significant difference of Ae. aegypti larvae obtained between container with floor gully c/w grating and normal floor gully ($p < 0.05$). A total of 96.41% reduction of Ae. aegypti larvae was obtained in the container with floor gully c/w grating compared with the normal floor gully, indicating that the floor gully c/w grating used in this study was able to prevent oviposition of Ae. aegypti in holding water.

Key words: Floor gully come with grating, Aedes aegypti, Oviposition, Percentage of reduction, Environment management

ABSTRAK

Kajian ini dijalankan untuk menilai keberkesanan penutup paip pembentung berjaring untuk mencegah pembiakan nyamuk Aedes aegypti di dalam paip pembentung. Untuk menjalankan kajian ini, dua bekas diletakkan dalam sangkar nyamuk berukuran 30 cm × 30 cm × 30 cm. Kedua-dua bekas diisi

dengan air paip yang telah dinyahklorinasi dan masing-masing ditutup dengan penutup paip pembentung berjaring dan penutup paip pembentung biasa. Sejumlah 50 ekor nyamuk betina Aedes aegypti gravid dilepaskan ke dalam sangkar and dibiarkan selama seminggu. Semua telur nyamuk yang diperolehi dalam kajian ini dibiarkan di dalam bekas-bekas tersebut sehingga menetas. Bilangan larva yang menetas telah dikira dan direkodkan. Sejumlah 5 replikasi kajian telah dijalankan secara serentak. Terdapat perbezaan yang bermakna bagi bilangan larva Ae. aegypti yang diperolehi daripada bekas dengan penutup paip pembentung berjaring berbanding dengan bilangan larva Ae. aegypti yang diperolehi daripada penutup paip pembentung biasa ($p < 0.05$). Sejumlah 96.41% penurunan direkodkan untuk bilangan larva Ae. aegypti yang diperolehi daripada bekas dengan penutup paip pembentung berjaring berbanding dengan bilangan larva Ae. aegypti yang diperolehi daripada penutup paip pembentung biasa. Ini menunjukkan bahawa penutup paip pembentung berjaring yang digunakan dalam kajian ini berupaya menghalang pembiakan nyamuk Ae. aegypti dalam air bertakung.

Kata kunci: Penutup paip pembentung berjaring, Aedes aegypti, Pembiakan, Pengurangan peratusan, Pengurusan persekitaran

Mosquitoes are two-winged flying insects that suck blood from humans and animals. In many parts of the world their biting is a considerable nuisance. More importantly, they are carriers of a number of diseases such as dengue/dengue haemorrhagic fever, malaria, filariasis and Japanese encephalitis, mostly in the tropics, causing illness and death on a large scale. Table 1 (Rozendaal 1997) shows the diseases transmitted by each group.

TABLE 1. Diseases transmitted by mosquitoes

Mosquitoes	Diseases
Aedes	Dengue, dengue haemorrhagic fever, yellow fever, other viral diseases, lymphatic filariasis
Culex	Lymphatic filariasis, Japanese encephalitis, other viral diseases
Mansonia	Lymphatic filariasis
Anopheles	Malaria, lymphatic filariasis

Mosquito breeding places in and around houses can be divided into two main types, (1) breeding sites with clean water: mainly in humid tropical areas which are suitable breeding sites for some *Aedes* species, and (2) Breeding sites with polluted water: mainly in on-site sanitation systems and bodies of stagnant and polluted water favored by *Culex* species (Rozendaal 1997).

Breeding sites for *Aedes* mosquitoes can be found in and around houses in flower vases, pot plants, pot-plant saucers etc. The breeding of *Aedes* can be avoided by adding salt or temephos sand granule and changing water in the flower vases (Rozendaal 1997). However, in the bath room or kitchen and in the vacant houses, breeding of *Aedes* or *Culex* mosquitoes may occur in the floor drainage system/pitfall, in which waste water maybe trapped in the floor traps (Rozendaal 1997; Maxwell et al. 1990; Subra et al. 1984). Thus, a new type of floor gully is needed to avoid the breeding of mosquitoes.

This study was conducted to evaluate the effectiveness of a floor gully come with grating to prevent the oviposition of *Aedes aegypti* in the floor trap.

Ae. aegypti mosquitoes (F1006) used in this study came from the colony maintained in the insectarium of the Medical Entomology Unit, Institute for Medical Research, Kuala Lumpur, Malaysia. The colony was established about 30 years ago.

Normal floor gully comprises grating which is a component fitted at floor level and body which is installed below the slab. The upper surface (grating) of the normal floor gully contains apertures to receive waste water (Wade 2005). The apertures are openings in a grating which contains holes measuring 0.8 cm in diameter. Waste water can flow into the gully body directly.

The floor gully c/w grating was provided by Region Global Resources Sdn. Bhd. namely Region™ floor gully c/w grating. The Region™ floor gully is revolutionary in its engineering design, which addresses the common pitfall of the conventional floor gully system. Region™ floor gully c/w grating consists of gully cover, drainage funnel, filtering bucket and gully frame (Figures 1 and 2). The top access removable filtering bucket ensures easy and convenient maintenance. Debris or valuables accidentally washed down can be easily cleared or safely retrieved by opening up the cover and lifting up the filtering bucket that acts as a retainer. The water seal in the filtering bucket prevents the transmission of foul odour from the embedded piping system to the interior of the building. The punched holes in the filtering bucket are uniquely created to prevent cockroaches from entering it from the piping system. Under other types of gully system without the holed filtering bucket, such pest can migrate from the drainage system and resides on the sides of the under cover of the floor grating. This will cause cleaning a very intimidating process.

The oviposition containers consist of 2000 mL plastic container. The opening and base of the container measures 12.7 cm in diameter and the container is 12.0 cm in height. Two containers described above were filled with 1000 mL seasoned tap water and covered with floor gully c/w grating and normal floor gully, respectively. Both containers were placed into a mosquito cage (30 cm × 30 cm × 30 cm). A total of 50 laboratory bred 5 days old *Ae. aegypti* was provided a blood meal earlier on by feeding on a guinea pig. The gravid females were then released into the cage and left for a week. For all tests, 10% sugar solution was provided inside the cage. At the end of the week, both containers were removed and kept

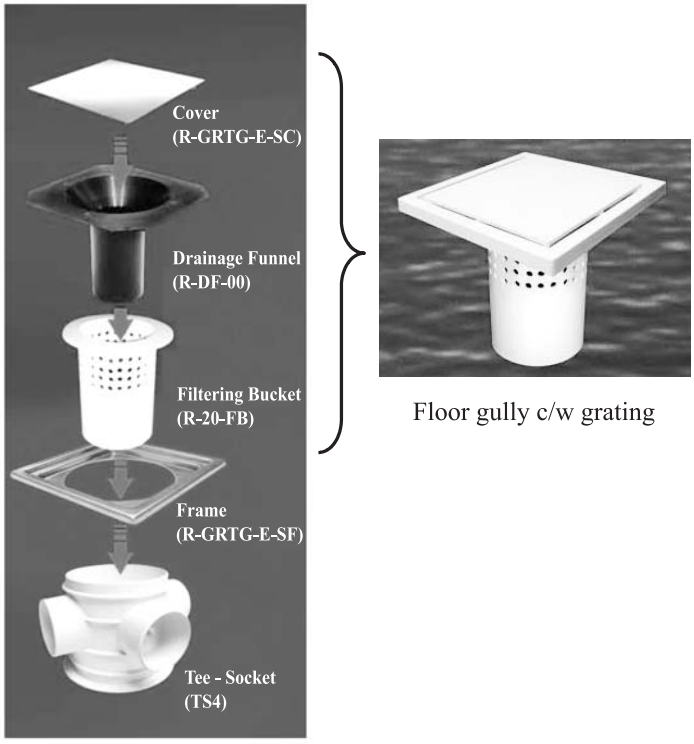

FIGURE 1. Region™ floor gully c/w grating consists of gully cover, drainage funnel, filtering bucket and gully frame
(Source: *Region Global Resources Sdn. Bhd.*)

in the laboratory. All the eggs obtained from the test were allowed to hatch inside the containers. The number of hatched larvae was counted and recorded. Five replicates were conducted concurrently.

T-test analysis (SPSS v.10) was used to determine the significant difference of the larvae obtained from container with floor gully c/w grating and normal floor gully. All levels of statistical significance were determined at $p = 0.05$.

Figure 3 shows the percentage of *Ae. aegypti* larvae obtained from containers with floor gully c/w grating and normal floor gully. The majority of gravid *Ae. aegypti* was able to oviposit their eggs in containers with normal floor gully, which accounted for 96.54% of the total collection in both types of container covered with floor gully c/w grating and normal floor gully.

The numbers of larvae obtained from containers with floor gully c/w grating and normal floor gully were ranged from 4 – 19 and 144 – 397, respectively. The

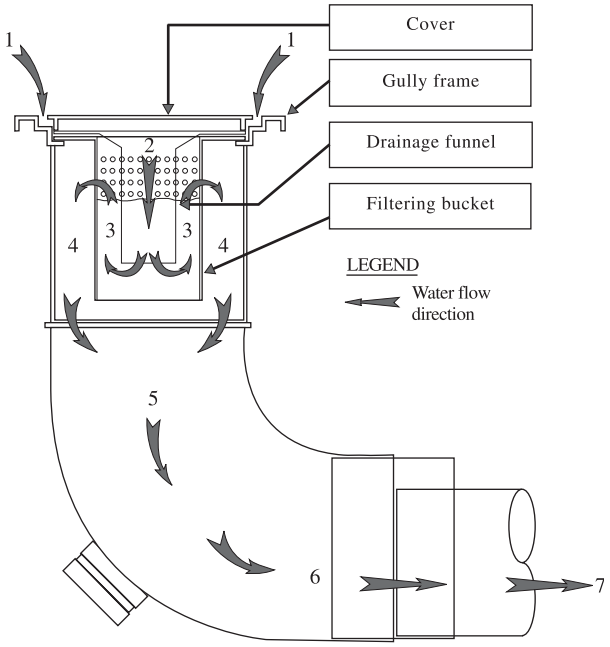

FIGURE 2. Technical plan for water direction of Region™ floor gully c/w grating (Source: *Region Global Resources Sdn. Bhd.*)

results obtained from this study showed that the mean number of larvae obtained from container with floor gully c/w grating and normal floor gully were 10.40 ± 2.58 and 290.00 ± 41.48, respectively (Table 2). There was a very significant difference of *Ae. aegypti* larvae obtained between container with floor gully c/w grating and normal floor gully ($p \leq 0.05$). A total of 96.41% reduction of *Ae. aegypti* larvae was obtained in the container with floor gully c/w grating compared with the normal floor gully, indicating that the floor gully c/w grating used in this study was able to prevent oviposition of *Ae. aegypti* in holding water.

The use of floor gully c/w grating can be defined as a form of environment management of mosquito breeding. The WHO Expert Committee on Vector Biology and Control defined environmental management for vector control as "the planning, organization, carrying out and monitoring of activities for the modification and/or manipulation of environmental factors or their interaction with man with a view to preventing or minimizing vector propagation and reducing

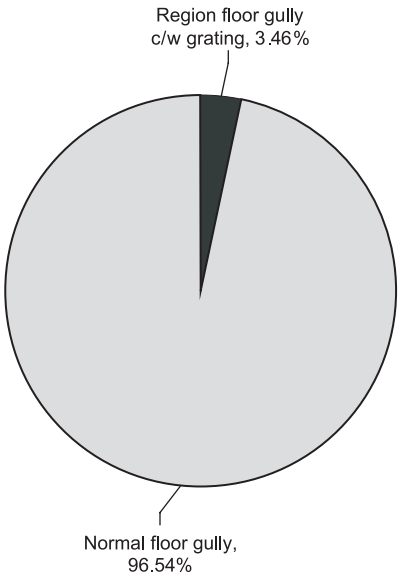

FIGURE 3. Percentage of *Ae. aegypti* larvae obtained from the containers covered with Region™ floor gully c/w grating and normal floor gully

TABLE 2. Comparison of *Ae. aegypti* larvae obtained from the containers covered with Region™ floor gully c/w grating and normal floor gully

Container	Number of larvae						Percentage of reduction
	Replicate No.					Mean ± SE	
	1	2	3	4	5		
Region™ floor gully c/w grating	8	4	19	9	12	10.40 ± 2.58	96.41
Normal floor gully	397	308	144	277	324	290.00 ± 41.48	

*$p < 0.05$ Significant difference using independent sample *t*-test

man-vector-pathogen contact" (WHO 1980). Environment management for vector control includes those procedures that specifically modify the habitats of target vector or humans to make those habitats unfavorable for vector, or otherwise reduce human-vector-pathogen contact.

Mosquitoes also can be controlled by management of the environment. These effective measure have been reviewed by WHO (1982), Mitchell (1996), Rozendaal (1997) and Lee (2000), and concluded as: (a) drainage, to remove

water favourable to mosquito breeding, (b) filling, to remove depressions that collect water, (c) stream improvement to promote water flow, (d) vegetation control, (e) relocation of human settlements to mosquito-safe areas, (f) mosquito-proofing of houses, (g) use of mosquito nets, and (h) better management of containers.

Environment management measures generally are not intended to replace other control measures but rather to complement them and contribute to the development of integrated control strategies. Integrated vector control, thus is "the utilization of all appropriate technological and management techniques to bring about an effective degree of vector suppression in cost-effective manner" (WHO 1983). Integrated control strategies will be more promising to consider. In most effort environmental sanitation and hygiene is always the norm for a long term and sustainable approach. The mosquito populations can be suppressed but only temporarily, unless they are being discouraged from propagating.

Region™ floor gully c/w grating used in this study was able to prevent or reduce the oviposition of *Ae. aegypti*. However, further studies on the floor gully c/w grating should be carried out under field conditions to confirm its effectiveness.

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