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Artikel Asli/*Original Articles*

Field Evaluation of the Efficacy of the Mosquito Killing System
(Penilaian Lapangan bagi Keberkesanan Sistem Pemusnahan Nyamuk)

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ABSTRACT

A preliminary field study was undertaken to evaluate the efficacy of a mosquito trap; Mosquito Killing System (MKS) in capturing mosquitoes and other insects. MKS has an automatic activation by the use of a photocell. It is also supplemented with carbon dioxide and heat as attractants for mosquitoes and other insects. Three units of MKS were employed at three different locations within two study sites for ten days. The mosquitoes and other insects that were trapped in MKS were collected and morphologically identified daily in the laboratory. A total of 1,928 mosquitoes and other insects were trapped in all units of MKS. High numbers of mosquitoes (93.05%), particularly Aedes sp. and Culex sp. were captured from MKS. Among these, Culex quinquefasciatus (91.81%) was most abundant species collected. Only 0.84% of Aedes aegypti and Aedes albopictus trapped in MKS. Female mosquitoes (83.44%) were found to be more attracted to MKS compared to male mosquitoes of various species. These findings illustrated the potency of MKS utilization in surveillance and control activities of Cx. quinquefasciatus; a nuisance mosquito and also potential vector of urban brancroftian filariasis in Malaysia.

Keywords: Mosquitoes; field efficacy; mosquito traps; Culex; Aedes

ABSTRAK

Satu kajian lapangan awal telah dijalankan untuk menilai keberkesanan sebuah perangkap nyamuk; Sistem Pemusnahan Nyamuk (SPN) dalam penangkapan nyamuk dan serangga lain. SPN mempunyai pengaktifan automatik melalui penggunaan sel foto. SPN juga dilengkapi dengan karbon dioksida dan haba sebagai daya penarik bagi nyamuk dan serangga lain. Tiga unit SPN telah dipasang di tiga lokasi berlainan dalam dua kawasan kajian selama sepuluh hari. Nyamuk dan serangga lain yang terperangkap di dalam kesemua unit SPN telah dikutip dan dikenal pasti setiap hari. Sejumlah 1,928 nyamuk dan serangga lain telah terperangkap di dalam kesemua unit SPN. Bilangan nyamuk yang tinggi (93.05%), khususnya Aedes sp. dan Culex sp. telah ditangkap di dalam SPN. Daripada jumlah tersebut, Culex quinquefasciatus (91.81%) adalah spesis yang paling banyak ditangkap. Hanya 0.84% Aedes aegypti dan Aedes albopictus yang terperangkap di dalam SPN. Nyamuk betina (83.44%) didapati lebih tertarik kepada SPN berbanding nyamuk jantan daripada pelbagai spesies. Penemuan ini menunjukkan potensi penggunaan SPN dalam aktiviti tinjauan dan kawalan bagi Cx. quinquefasciatus; nyamuk pengganggu dan juga vektor yang berpotensi dalam penyebaran filariasis brancroftian bandar di Malaysia.

Kata kunci: Nyamuk; keberkesanan lapangan; perangkap nyamuk; Culex; Aedes

INTRODUCTION

Mosquitoes remain as the most important vectors worldwide. They are capable of transmitting various types of viruses and parasites that cause diseases to humans and animals. *Aedes aegypti* and *Aedes albopictus* are the principle vectors for dengue, dengue haemorrhagic fever (DHF) and chikungunya occurring worldwide including Malaysia (Russell et al. 1969; Chan et al. 1971; Jumali et al. 1979; Harinasuta 1984; Diallo et al. 1999; Tome et al. 2014; Williams et al. 2014). On the other hand, *Culex quinquefasciatus* is one of the main vectors for human lymphatic filariasis in many tropical countries of the world (Harwood & James 1979; Lane & Crosskey 1993; Sucharit 1988; Hamdan et al. 2005) although it is so far only a nuisance mosquito in Malaysia (Low et al. 2012).

Owing to the ability of mosquitoes in spreading these vector-borne diseases, different methods have been developed in controlling mosquito populations. These include source reduction, physical control, chemical control and biological control. Mosquito trapping is one of the most popular alternatives in the physical control of mosquito populations. An ideal mosquito trap is also crucial for the use in adult vector surveillance (Sivagnaname & Gunasekaran 2012).

There are numerous mosquito traps available in the market. Each of these mosquito traps has almost similar aim of controlling the mosquito populations but using different attractants and trapping systems. Mosquito attractants used in these trapping devices include carbon dioxide, heat, light, dark colour and olfactory lures. Traps with attractants have become as an option to chemical control of mosquitoes (Kline 2002). Increased costs of chemical registration process, insecticide resistance development in mosquitoes and the rise of awareness on the danger of chemical pollution against the environment are among important factors that trigger the invention and use of traps (Kline 1999).

There is no mosquito trapping device that is effective worldwide against all species in all conditions (Blackmore & Dahl 2002). Each trapping device has different sensitivities and efficacies against diverse mosquito species (Luhken et al. 2014). Therefore, field studies are essential to be conducted so that the efficacy of these mosquito traps could be evaluated individually. Hence, the purpose of this study is to evaluate the efficacy of a commercially available mosquito trap, Mosquito Killing System (MKS) in controlling the population of mosquitoes.

EXPERIMENTAL METHODS

MOSQUITO KILLING SYSTEM

Three units of Mosquito Killing System (MKS) were utilized in this study. MKS is designed to be meteorological conditions proof for outdoor use (Photo 1). Each MKS is equipped with a 3-prong ground plug and needs to be connected to a power source as it requires about 220 Volts throughout the operation. MKS is recommended to be placed approximately 20 feet away from all outdoor activities but not under direct sunlight or outdoor lighting to avoid the stoppage of the photo sensor operation.

According to the manufacturer, MKS is equipped with carbon dioxide (CO_2) and heat to mimic respiration and body temperatures of humans, horses, livestock, poultry and domesticated pets. Both carbon dioxide and heat are the main cues that attract the mosquitoes to MKS which acted as a host for the blood meal of the mosquitoes. The blood meal is required by female mosquitoes for the development of their eggs (Phasomkusolsil et al. 2013).

A photocell is attached on each MKS which activates MKS at dusk and powers off at dawn (Figure 1). In the evening, as the surroundings become dark, the photocell closes and automatically activates or powers on MKS. A running MKS mimics the host by releasing the heat and warmed carbon dioxide to its surroundings. As the mosquitoes attracted to MKS probe the skin of it, they are vacuumed into the unit at the point of entry and forced through the unit to be electrocuted. These dead mosquitoes are then discharged from the bottom of MKS to the ground. However, a removable capture net could also be attached to the unit for the monitoring works of the mosquitoes being captured by MKS.

DESCRIPTION OF STUDY SITES

Ten (10) days monitoring were conducted in this study which took place from 8th April 2010 until 18th April 2010. A total of three (3) units of MKS were set up at three (3) different locations which represented three replicates to avoid bias. Two units of MKS were placed within the surrounding area of the Medical Entomology Unit, Infectious Diseases Research Centre (IDRC), Institute for Medical Research (IMR), Jalan Pahang, Kuala Lumpur. The first MKS unit (Replicate 1) was positioned behind the Southeast Asian Ministers of Education Organization Regional Tropical Medicine and Public Health Network (SEAMEO-TROPMED) Centre while the other MKS unit (Replicate 2) was sited behind the insectarium of the Medical Entomology Unit which was about 100 metres from the first MKS unit. The temperature recorded in all

PHOTO 1. Mosquito Killing System (MKS)

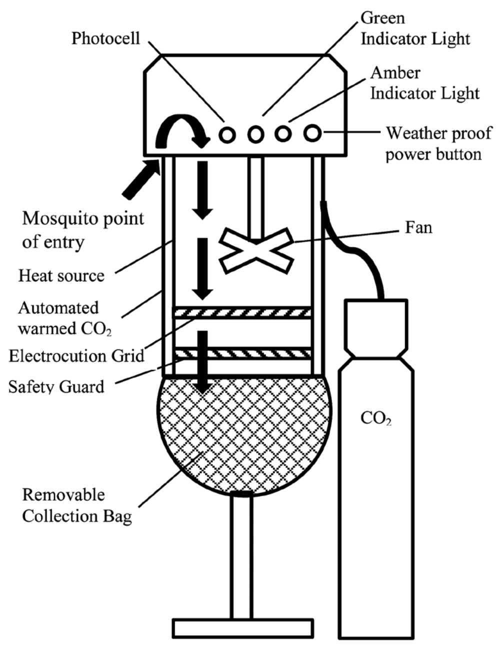

FIGURE 1. A schematic diagram of Mosquito Killing System (MKS)

locations throughout the study was 26-37ºC with relative humidity of 63-94%. Since MKS is targeted to be used by public consumers, all study sites of this study were selected randomly based on easy accessibility and the power source availability for MKS operation.

Meanwhile, the third MKS unit (Replicate 3) was placed within the surrounding area of the hostel of the Medical Laboratory Technologist (MLT) College, Jalan Tun Razak, Kuala Lumpur. The hostel consists of two blocks of three-storey building occupied by about six hundred students. It is located at about 3 km from IMR.

Both study sites selected in this study consist of well-planned buildings with proper garbage disposal and drainage systems. There are also many ornamental plants and vegetation within these areas which offer ideal breeding places for mosquitoes.

DETERMINATION OF THE NUMBER AND SPECIES OF MOSQUITOES TRAPPED IN MKS

All units of MKS used in this study were operated continuously throughout the 10-day trial period. Mosquitoes and other insects that were trapped in each MKS unit were collected and morphologically identified daily in the laboratory using pictorial keys for mosquito identification (Choeng & Mahadevan 1970) and the Keys of Triplehorn & Johnson (2005).

DATA ANALYSIS

Results obtained from monitoring activities using MKS were analysed using the statistical software (SPSS v23) as follows - 1) Mean number of mosquitoes per unit of MKS for each day = Total number of mosquitoes trapped in all MKS units per day / 3 units of MKS 2) Mean number of mosquitoes per unit of MKS per day ± Standard Error (S.E.) = Mean number of mosquitoes per unit of MKS for each day / 10 days of monitoring activities

RESULTS AND DISCUSSION

Figure 2 shows the total number of mosquitoes and other insects captured by three units of Mosquito Killing System (MKS) throughout ten-day studies. A total of 1,928 mosquitoes and other insects were captured by all units of MKS utilized. Out of these, 1,794 were mosquitoes belonging to the genus of *Aedes* and *Culex* mosquitoes. Other than that, MKS was also able to collect other types of non-mosquito insects especially Chironomidae (chironomids / non-biting midges) and Psychodidae (Moth flies / Sewer flies / Drain flies). For the mosquitoes trapped in all MKS units, only 96 of the *Aedes* and *Culex* mosquitoes were not identifiable to species due to damages on the specimens caused by the vacuuming and electrocution of the mosquitoes and other insects captured by MKS. Other identified mosquitoes were *Aedes aegypti* (number captured = 3), *Ae. albopictus* (12), *Culex gelidus* (2), *Cx. quinquefasciatus* (1,647), *Cx. tritaeniorhynchus* (1) and *Cx. vishnui* (33). These results indicated that MKS was able to attract and trap large number of *Cx. quinquefasciatus*. A total of 1,497 identifiable mosquitoes belonging to all mosquito species captured by the MKS were females, while only 201 mosquitoes were males (Figure 3). These findings indicate that MKS is effective against female mosquitoes especially *Culex* species.

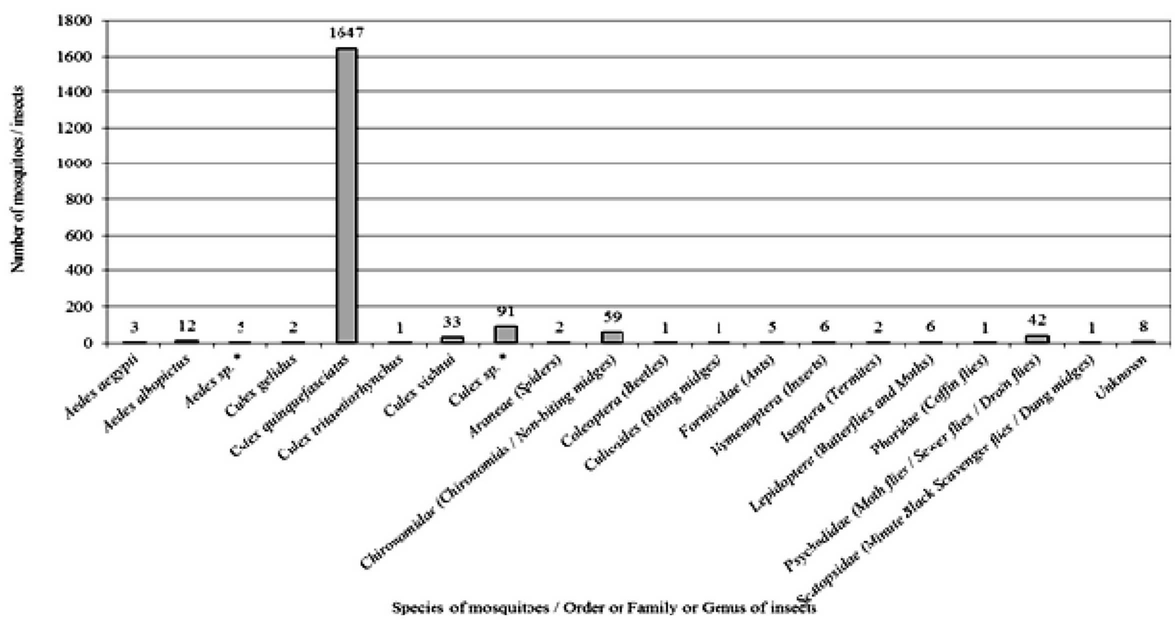

FIGURE 2. Total number of mosquitoes and other insects captured by three units of Mosquito Killing System (MKS)

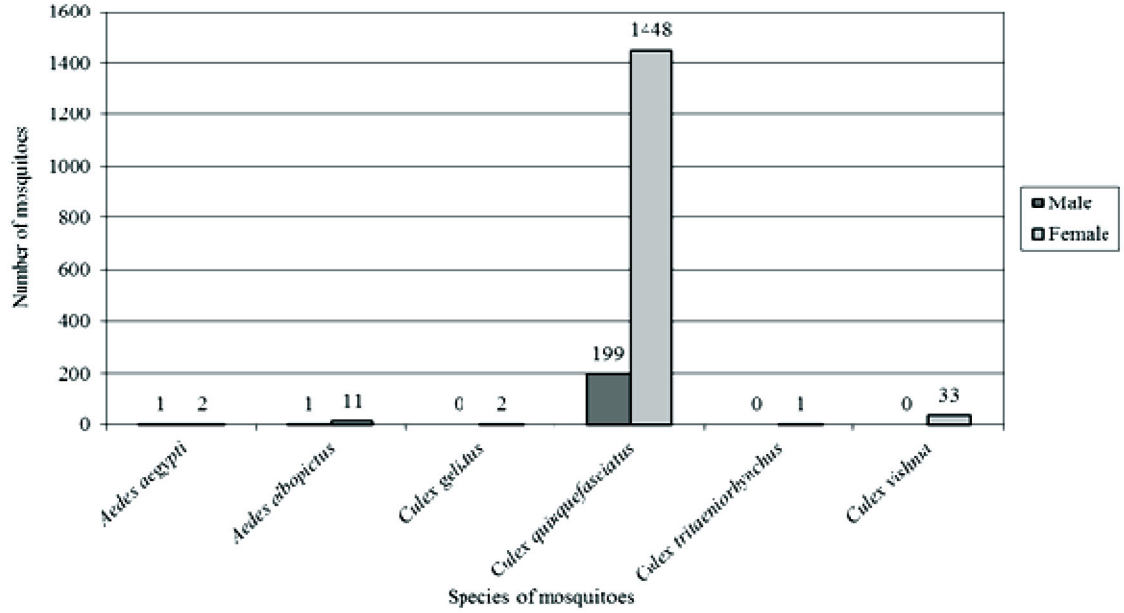

FIGURE 3. Total number of male and female of identifiable mosquitoes captured by three units of Mosquito Killing System (MKS)

Table 1-3 show the number of mosquitoes and other insects trapped in each unit of MKS utilized, respectively. Replicate 1 which was represented by the MKS unit placed behind the SEAMEO-TROPMED Centre in IMR captured the highest number of mosquitoes (1,293) and other insects (75) (Table 1). This was followed by MKS unit placed behind the insectarium of the Medical Entomology Unit, IMR (Replicate 2) with 313 mosquitoes and 39 non-mosquito insects (Table 2). Replicate 3 of MKS unit which was sited at the hostel of the Medical Laboratory Technologist (MLT) College captured only 188 mosquitoes and 20 non-mosquito insects (Table 3).

Table 4 shows the total number of mosquitoes and other insects captured daily by MKS. The mean number of mosquitoes captured by three units of MKS operated every day ranged from 34.33 to 90.33 mosquitoes. Meanwhile, the mean number of mosquitoes captured by each unit of MKS per day was 59.80 ± 6.08 mosquitoes.

High numbers of *Culex* mosquitoes trapped in MKS than any other mosquito species and non-mosquito insects. These results are consistent with some previous studies done worldwide on the efficacy of mosquito traps in capturing mosquito vectors and thus, controlling these mosquito populations after a long term use. For instance, back in 1986, the use of CDC Gravid Mosquito Traps by Reiter et al. captured 135,724 mosquitoes with 99% of them were *Culex* mosquitoes as well as significant numbers of *Ae. aegypti* and *Ae. triseriatus*. Higher numbers of *Cx. quinquefasciatus* compared to *Ae. aegypti* were also obtained from the use of BGS-Trap in Rio de Janeiro (Maciel-de-Freitas et al. 2006). Moreover, the use of another commercially available trap; the Liberty Plus Mosquito Magnet had showed a reduction of about 32% in the mean number of adult mosquitoes collected each day at Brae Island Regional Park, Canada which suggested its efficacy in controlling nuisance mosquitoes after certain period of its use (Jackson et al. 2012). Later in 2013, Barrera et al. (2013) reported on significant numbers of *Ae. mediovittatus*, *Cx. quinquefasciatus* and *Ae. aegypti* collected from a modified trap of adult mosquitoes; BG-Sentinel traps (BGS traps) in Puerto Rico.

Based on this study, *Culex* mosquitoes had been found to be more attracted to MKS compared to *Aedes* mosquitoes. This phenomenon could be associated with the fact that most *Culex* mosquitoes including *Cx. quinquefasciatus* are nocturnal feeding mosquitoes (Siriaut et al. 2005) and commonly found near vegetation areas (Meyer et al. 1991). In contrast, *Ae. albopictus* usually has a bimodal and diurnal biting activity (Lima-Camara et al. 2014). Therefore, it is not surprising that *Ae. albopictus* is difficult to be captured by adult mosquito traps especially night-operating traps as presented in this study.

These findings are in agreement with the study by Burkett et al. (2004) that showed low numbers of *Ae. albopictus* captured in their CDC light traps. In Goa, India, a commercial trap, Mosquito Magnet Pro (MM-PRO) had caught many *Cx. quinquefasciatus* (47.78%) and *Cx. vishnui* (26.0%) but only 0.04% *Ae. albopictus* (Korgaonkar et al. 2008). However, Unlu & Farajollahi (2014) who utilized the Biogents Sentinel (BGS) trap for a 5-year surveillance of *Ae. albopictus* had successfully trapped more than 52,000 mosquitoes throughout the period with *Ae. albopictus* (54.4%) as the most abundant species.

In addition, it is shown that more female mosquitoes were attracted and trapped in MKS compared to male mosquitoes of different species. Therefore, MKS could be considered as a promising monitoring device since only adult female mosquitoes are involved in the transmission of numerous mosquito-borne diseases (Sivagnaname & Gunasekaran 2012).

Mosquito Killing System (MKS) is supplemented with carbon dioxide as one of its mosquito attractants. Carbon dioxide (CO_2) is frequently used in many traps to enhance their trapping efficacies (Ferreira de Azara et al. 2013). CDC traps baited with CO_2 captured many *Aedes* mosquitoes during field studies conducted in Upper Rhine Valley, Germany (Becker et al. 1995). Pombi et al. (2014) also demonstrated the importance of CO_2 in the use of their BG-Sentinel trap to increase the number of captured *Ae. albopictus*. Other than that, another study by Oli et al. (2005) at the Institute for Medical Research (IMR), Kuala Lumpur, Malaysia as well showed that CDC light traps equipped with CO_2 attracted *Cx. quinquefasciatus*, *Stegomyia albopicta* (*Ae. albopictus*) and *Armigeres subalbatus*.

Nevertheless, responses of different mosquito species towards CO_2 released from traps are diversified. Studies by Kline & Mann (1998) showed variety of pattern in terms of collection size for different mosquito species when CO_2 release rates of their traps were increased. Meanwhile, Russell (2004) reported that there was no significant difference in the mean number of *Ae. aegypti* and *Ae. polynesiensis* collected in traps supplemented with CO_2.

The use of CO_2 as an attractant of traps could also be the reason of increasing number of captured female mosquitoes. Studies by L'Ambert et al. (2012) showed that regardless of the traps' locations, CO_2 traps caught various mosquito species, particularly females. In another studies by Ferreira de Azara et al. (2013), the use of CO_2 traps captured female *Culex* spp. at six folds higher than traps without CO_2.

According to Luhken et al. (2014), CO_2 source either from gas cylinders or dry ice, the amount of CO_2 released and the type of device for CO_2 dispersal should not cause significant differences among trapping devices. For example, Burkett et al. (2001) reported that there was no significant difference in the number of mosquitoes caught in dry iced-baited traps or traps with CO_2 from compressed

TABLE 1. Number of mosquitoes and other insects trapped by Mosquito Killing System (MKS) placed behind the SEAMEO TROPMED Centre, IMR

Type of insects	Mosquitoes										Other Insects					
Species of mosquitoes captured / Day	*Aedes aegypti* (Female)	*Aedes albopictus* (Male)	*Aedes albopictus* (Female)	*Aedes* sp.*	*Culex gelidus* (Female)	*Culex quinquefasciatus* (Male)	*Culex quinquefasciatus* (Female)	*Culex tritaeniorhynchus* (Female)	*Culex vishnui* (Female)	*Culex* sp.*	Chironomidae (Chironomids / Non-biting midges)	Coleoptera Beetles)	Isoptera (Termites)	Lepidoptera (Butterflies and Moths)	Psychodidae (Moth flies / Sewer flies / Drain flies)	Unknown
1				2		10	101		4	4	6				3	1
2						32	107		2	3	2			1	2	
3						8	55									2
4					1	31	84	1	1	3	5		1		3	1
5			1			9	119			6	3	1				1
6	1					18	75			2	2			1	5	2
7						3	68		1	8	3				1	
8	1					13	138		4	13	9			2	5	
9		1	2		1	20	139		3	14	5				3	
10						19	155		4	6	3				2	
Total	2	1	3	2	2	163	1041	1	19	59	38	1	1	4	24	7
Subtotal						1293								75		
Grand total								1367								

*Species of the mosquitoes captured were unable to be identified due to damaged mosquitoes.

TABLE 2. Number of mosquitoes and other insects trapped by Mosquito Killing System (MKS) placed behind the Insectarium of Medical Entomology Unit, IMR

Type of insects	Mosquitoes							Other Insects						
Species of mosquitoes captured / Day	*Aedes aegypti* (Male)	*Aedes albopictus* (Female)	*Aedes* sp.*	*Culex quinquefasciatus* (Male)	*Culex quinquefasciatus* (Female)	*Culex vishnui* (Female)	*Culex* sp.*	Araneae (Spiders)	Chironomidae (Chironomids / Non-biting midges)	Formicidae (Ants)	Hymenoptera (Insects)	Isoptera (Termites)	Lepidoptera (Butterflies and Moths)	Psychodidae (Moth flies / Sewer flies / Drain flies)
1		1		1	18	1	12							3
2		1		1	12	1								3
3		1			23				2	3		1		3
4	1			2	19	1								
5				5	38		1		6					2
6		1			28		2							1
7				2	21		2		2					2
8			1	6	24			1	3					1
9			1	3	35		2		1		1			
10		1		5	33	2	5				1		1	2
Total	1	5	2	25	251	5	24	1	14	3	2	1	1	17
Subtotal				313							39			
Grand total								352						

*Species of the mosquitoes captured were unable to be identified due to damaged mosquitoes.

gas cylinders. Almost 10 years later, Bhalala et al. (2010) also stated that there was no significant difference in the mosquito numbers trapped in BG-Sentinel traps with or without CO_2 nozzle.

Besides CO_2, 1-octen-3-ol or well known as octenol is another common attractant used in mosquito traps. Studies by Qualls & Mullen (2007) showed high collections of *Ae. albopictus* (75% - 89%) in the Mosquito Magnet Pro™ trap equipped with octenol which were placed at three different field sites.

Not only that, many studies had demonstrated on the use of CO_2 in combination with octenol as trap attractants. Changes in CO_2 concentration detected by sensory neurons in mosquito maxillary palps and the presence of octenol sensitive neurons in female mosquito antennae enhance mosquito response to these attractants (Laporta & Sallum 2011). In Malaysia, Vythilingam et al. (1992) reported on higher numbers of *Cx. tritaeniorhynchus* were attracted to the CO_2 + octenol- baited trap. However, in general, there was no significant difference found in their studies between the mosquito numbers captured in their CO_2-baited light trap and the light trap supplemented with both CO_2 and octenol.

Another study by Hoel et al. (2007) demonstrated significant numbers of *Ae. albopictus* captured in traps baited with a combination of octenol and lactic acid than in traps baited with octenol alone. However, they observed high numbers of other mosquito species collected in the latter traps. In contrast, Mboera et al. (2000a) found that traps baited with CO_2 collected larger number of *Cx. quinquefasciatus* significantly compared to traps baited with octenol, acetone or butyric acid in Tanzania. Moreover, interestingly, their studies also suggested that human foot odour could act as stimuli to attract these *Cx. quinquefasciatus*.

Less numbers of mosquitoes were captured in Replicate 3 of MKS. This scenario could be due to the high density of human hosts available in the hostel which certainly contributed to high level of CO_2 in the environment and thus, attracted mosquitoes to search for their blood-feeding there. In contrast, CO_2 released from MKS could only be able to attract mosquitoes within a short-range distance (Ferreira de Azara et al. 2013) which affected the number of mosquitoes trapped in it.

Light is also considered as the trap attractant. The response of mosquitoes towards lights varied among

TABLE 3. Number of mosquitoes and other insects trapped by Mosquito Killing System (MKS) placed at the hostel of the Medical Laboratory Technologist (MLT) College

Type of insects	Mosquitoes						Other Insects										
Day \ Species of mosquitoes captured	*Aedes albopictus* (Female)	*Aedes* sp.*	*Culex quinquefasciatus* (Male)	*Culex quinquefasciatus* (Female)	*Culex vishnui* (Female)	*Culex* sp.*	Araneae (Spiders)	Chironomidae (Chironomids / Non-biting midges)	Culicoides (Biting midges)	Formicidae (Ants) (Male)	Formicidae (Ants) (Female)	Hymenoptera (Insects)	Lepidoptera (Butterflies and Moths)	Phoridae (Coffin flies)	Psychodidae (Moth flies / Sewer flies / Drain flies)	Scatopsidae (Minute Black Scavenger flies / Dung midges)	Unknown
1				9	1												1
2	1			10		2		2									
3	1			15				1									
4	1			5										1		1	
5				1				1	1	1		2					
6		1		4				1			1	1	1				
7				26			1	1									
8			2	15	2	2						1					
9			8	41	1										1		
10			1	30	5	4		1									
Total	3	1	11	156	9	8	1	7	1	1	1	4	1	1	1	1	1
Subtotal	188						20										
Grand total	208																

*Species of the mosquitoes captured were unable to be identified due to damaged mosquitoes.

different species and closely related to their feeding and resting behaviours. As such, Mboera et al. (2000b) reported that more *Cx. quinquefasciatus* were collected significantly with the use of CDC trap with light-off than with light-on. Therefore, the absent of light in MKS could had enhanced the chances of capturing high numbers of mosquitoes.

Besides that, it is believed that the location of traps play an important role in ensuring their efficacies. According to Meyer et al. (1991), CO_2 traps located within high vegetation area attracted more female mosquitoes compared to CO_2 traps sited in the open to less density of vegetation area. Another study by Crepeau et al. (2013) proved that the placement of their trap; the Biogents Sentinel (BGS) trap in shaded locations instead of under the full sun had increased the number of *Ae. albopictus* mosquitoes at 3-folds.

Other than that, small non-target insects were also captured by MKS. Since most of these insects were collected at very low frequencies, it is suggested that these insects could be trapped into MKS by chance and not because of being attracted to MKS (Blackmore & Dahl 2002).

CONCLUSION

In conclusion, MKS tested in this study exerted trapping effects against some species of *Aedes* and *Culex* mosquitoes especially *Cx. quinquefasciatus*. MKS was also able to capture various types of non-mosquito insects. The use of MKS equipped with CO_2 is beneficial for *Culex* mosquitoes studies but it might be worthless in studies aiming for *Aedes* mosquitoes trapping due to high costs and operational labour in CO_2 supplies from compressed gas cylinders. The need of electricity to operate and its bulky size are also operational constraints of MKS. The location of MKS seemed to be restricted to the electricity line source. Further investigations on MKS should be carried out to evaluate its performance in longer period of operation, covering wider areas, assessing parity status of female mosquitoes captured as well as its efficacy in comparison to CDC light trap or any other commercially available mosquito traps. Comprehensive studies are essential in order to establish an optimum effectiveness of MKS through appropriate placement and use of MKS.

TABLE 4. Total number of mosquitoes and other insects captured daily by Mosquito Killing System (MKS)

Species of mosquitoes	Day										Total
	1	2	3	4	5	6	7	8	9	10	
Aedes aegypti	0	0	0	1	0	1	0	1	0	0	3
Aedes albopictus	1	2	2	1	1	1	0	0	3	1	12
Culex gelidus	0	0	0	1	0	0	0	0	1	0	2
Culex quinquefasciatus	139	162	101	141	172	125	120	198	246	243	1647
Culex tritaeniorhynchus	0	0	0	1	0	0	0	0	0	0	1
Culex vishnui	6	3	0	2	0	0	1	6	4	11	33
Aedes sp. *	2	0	0	0	0	1	0	1	1	0	5
Culex sp. *	16	5	0	3	7	4	10	15	16	15	91
Total number of mosquitoes per day (A)	164	172	103	150	180	132	131	221	271	270	1794
Number of MKS operated in the study site	3	3	3	3	3	3	3	3	3	3	3
Mean number of mosquitoes per unit of MKS	54.67	57.33	34.33	50.00	60.00	44.00	43.67	73.67	90.33	90.00	598.00
Mean number of mosquitoes per unit of MKS per day ± Standard Error (S.E.)					59.80 ± 6.08						
Number of other insects captured by MKS per day (B)	14	10	12	12	18	15	10	22	11	10	134
Total number of mosquitoes and other insects captured by MKS per day (A) + (B)	178	182	115	162	198	147	141	243	282	280	1928

*Species of the mosquitoes captured were unable to be identified due to damaged mosquitoes.

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