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ABUNDANT OF FLIES (DIPTERA) IN CLOSED AND OPENED HOUSE COMMERCIAL CHICKEN AND DUCK FARMS IN KINTA DISTRICT, PERAK, MALAYSIA

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ABSTRACT

Malaysian commercial poultry production systems are highly integrated with intensive production techniques that result in constant manure accumulation, which supports the development of several serious fly pests. Hence, field sampling was conducted to determine fly distributions in closed and open house commercial chicken and duck farms in Kinta district, Perak, Malaysia. The distribution of dipteran flies was analyzed at 14 commercial poultry farms. A total of 7,993 flies captured belonged to nine families namely Muscidae, Calliphoridae, Sacrophagidae, Ulidiidae, Phoridae, Stratiomyidae, Sciaridae, Fannidae and Syrphidae. *Musca domestica* was the predominant fly species and it represented 74.12% (open house) and 72.42% (closed house), while *Megaselia scalaris* was the second most abundant species constitutes (21.69% in open house and 26.52% in closed house farming system). *Physiphora clausa*, fungus gnat, *Fannia* sp., *Atherigona orientalis* and *Lucilia cuprina* were only encountered in open house poultry farms. However, the lowest flies's families were Syrphidae and Sciaridae, constituting only 0.01% of all collected flies in both open and closed house farms.

Keywords: Poultry farm, open house system, closed house system, Diptera, *Musca domestica*

ABSTRAK

Sistem pengeluaran unggas komersial di Malaysia dijalankan secara bersepadu dengan mengamalkan teknik pengeluaran intensif yang mengakibatkan pengumpulan tinja secara berterusan, yang mana mendorong kepada kadar pembiakan pelbagai spesies Diptera yang

serius. Oleh yang demikian, pensampelan lapangan telah dijalankan untuk menentukan taburan lalat di ladang ayam dan itik komersial tertutup dan terbuka di daerah Kinta, Perak, Malaysia. Taburan serangga Diptera telah dianalisis di 14 buah ladang unggas komersial. Sebanyak 7,993 lalat telah ditangkap dan dikategorikan kepada sembilan famili iaitu Muscidae, Calliphoridae, Sacrophagidae, Ulidiidae, Phoridae, Stratiomyidae, Sciaridae, Fannidae dan Syrphidae. *Musca domestica* merupakan spesies serangga yang paling dominan (sebanyak 74.12% dari sistem reban terbuka dan 72.42% dari sistem reban tertutup. Manakala *Megaselia scalaris* merupakan spesies kedua terbanyak (21.69% dari sistem reban terbuka dan 26.52% dari sistem reban tertutup). Tatkala, *Physiphora clausa,* fungus gnat, *Fannia* sp., *Atherigona orientalis* dan *Lucilia cuprina* hanya ditemui di sistem reban terbuka. Namun demikian, Syrphidae dan Sciaridae merupakan famili serangga yang paling kurang ditemui (0.01%) di kedua-dua sistem reban terbuka dan tertutup.

Kata kunci: Ladang unggas, sistem reban terbuka, sistem reban tertutup, Diptera, *Musca domestica*

INTRODUCTION

On-going residential development on formerly agricultural or open lands near poultry facilities has resulted in increasingly frequent land use conflicts between farms and their relatively new suburban neighbours. Generally, the high abundance of flies in poultry facilities becomes a source of annoyance not only to the workers but also to the nearby residents (David et al. 2013; Miller et al. 1993; Winpisinger et al. 2005) and often violate Poultry Enactments (Mullens et al. 2001). Poultry manure serves as favourable growth material for manure breeding flies, as the fresh manure is typically warm and moist making it very attractive to adult flies (Axtell 1986; Kaufman et al. 2000).

Filth flies are dipteran flies that are entrenched as the major pests in poultry farms (Anderson & Poorbaugh 1964; Zchori-Fein et al. 1992). However, the housefly, *Musca domestica* is the most abundant fly species associated with poultry manure (Axtell 1986; Conway 1973; Toyama & Ikeda 1976) and partly with little housefly, *Fannia cannicularis* (Axtell 1970; Fatchurochim et al. 1989; Wilhoit et al. 1991). In Malaysia, common synanthropic species that are of significant public health importance are from the families Calliphoridae, Muscidae and Sarchophagidae (Nurita et al. 2008). The muscoid flies, especially those of Muscidae, Fanniidae and Anthomyiidae families, are major pests on poultry farms (Anderson & Poorbaugh 1964; Zchori-Fein et al., 1992). This diptera are most associated with human and animal production environments (Rezende et al. 2017).

Following the emergence of the adult fly, it is mainly active during daytime, where it breeds and eats. Nevertheless, it may also adapt their activity somewhat to artificial lighting schedules. Adult flies may have an activity range of 0.8–3.2 km (0.5–2.0 miles). However, houseflies can travel much further by 'hitching a ride' in a travelling vehicle (m 2011). As for the role of the poultry farms as centre point of flies' dispersion, 60% of the flies which are bred in the manure stay nearby the facilities; 13% move to other breeding facilities (other livestock farms and households); while 27% move out to areas of least abundant breeding. At night and any time when they are not eating or breeding, adults are considered roosting. They have often seen roosting on any stable surface they can find (for example, floors, walls, ceilings, furniture, plants, fences, and garbage cans), preferring locations close to breeding or feeding sites. Excessive numbers of houseflies in poultry farms cause unacceptable annoyance to farm workers, besides attacking the nearby residential areas and public facilities. Consequently,

constitute a violation of poultry enactments and other relevant regulations. Houseflies cannot be eliminated, but the farm producers must take necessary action to keep the entire population under acceptable levels (Tucci 2011). Hence, this study was conducted to determine the abundant of fly species in closed and open house commercial chicken and duck farms.

MATERIALS AND METHODS

Location and Sampling Size

This study was carried out in 14 closed and opened house commercial chicken and duck farms from all four directions from Perak State Department of Veterinary Services Headquarters, within the vicinity of Kinta district, Perak, Malaysia. Geographically, Kinta is located at latitude 4°35′N and longitude 101°05′E and has a tropical rainforest climate. Farms were randomly selected and permission to carry out sampling was acquired before the study. The study period took up 16 months in total, from February 2021 to June 2022.

Flies Sampling

The sampling of dipteran flies was conducted in six locations in 14 commercial chicken and duck farms. Considering the nature of tropical rainforest climate, sampling was conducted at a frequency of four months once to cover the wettest and driest months of the year. Fly populations were monitored using commercially available fly paper in each designated farm. The fly paper used in this study was a commercial brand (Sell®) and did not consist of any sort of fly attractants on it. The traps were placed in the selected locations to maximize house fly capture. These traps were thoughtfully positioned within the chosen farms to optimize the capture of houseflies', as illustrated in Figure 1A and 1B. As to enhance the quality of dipteran flies captured for species identification, commercially available ranch fly traps (brand: J® Zhang Pei Zhen) were used upon completion of sampling with fly paper. Ranch traps consisted of fly bait (Acetamiprid 2.5%) which needed to be poured onto the plate and fixed under the ranch trap. Three ranch fly traps were placed in each farm and the trapped dipteran flies were collected after 3 days (Figure 1C).

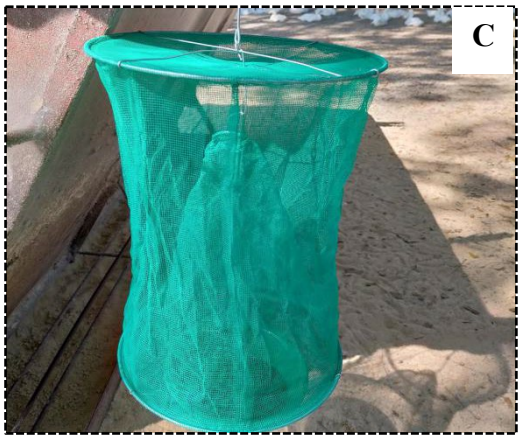

Figure 1. A. Placement of fly paper; B. Fly paper with trapped insects; C. Ranch trap

Species Identification

The captured dipteran flies from both techniques were kept in airtight plastic tubes containing 70% ethyl alcohol for taxonomic identification. Insect families were identified using the taxonomic keys by the Division of Medical Entomology, IMR, Kuala Lumpur, Malaysia (Aziz et al. 2016). Besides that, the taxonomic and pictorial keys of Alikhan et al. (2018); Carvalho and Mello-Patiu (2008) were also used for general flies identification. As for detailed identification for genus and species classification, specific key of Couri et al. (2012) and Moonphayak et al. (2011) were used for Muscidae. While, taxonomic keys of Whitworth (2010), Marshall et al. (2011), Bunchu et al. (2012), Akbarzadeh et al. (2015), Williams and Villet (2014) and Al-Shareef (2016) were used for Calliphoridae identification. Phoridae were identified by referring to the Biodiversity of Singapore (2018). Taxonomic key of Thompson (1999) was used to identify Syrphidae. Sarcophagidae was identified by using the key from Sukontason et al. (2010). Fannidae was identified to species by referring to the pictorial key of Bugguide, Iowa State University (2019), while Ulididae was identified with reference to the taxonomic key of Kameneva and Korneyev (2010). Sutou et al. (2012) was referred to identify Sciaridae; while Stratiomyidae was identified according to Woodley et al. (2001).

Data Analyses

The number of flies counts using fly paper was subjected to Microsoft Excel 2003. Data set was subjected for a normality test. The fly species distribution for chicken farms and duck farms (disrespective of type of housing system) were subjected to independent samples T-test (IBM SPSS analysis version 27) to determine if significant differences present between chicken and duck farms. While fly species distribution between chicken farms with open house and closed house farming systems were subjected to independent samples T-test (IBM SPSS analysis version 27) to determine if significant differences present between open house chicken and closed house chicken farms. Significance for all tests was observed at $\alpha = 0.05$ level.

RESULTS

A total number of 7,993 dipteran flies were collected from the study site. The results of this study revealed that 7,993 flies belonging to 14 different species, 13 genera and nine families: Muscidae, Calliphoridae, Sacrophagidae, Ulidiidae, Phoridae, Stratiomyidae, Sciaridae, Fannidae and Syrphidae were recorded (Table 1). From the total 7,993 dipteran flies, 5,236 were collected from open house poultry farms, while 2,757 flies were collected from closed house poultry farms. *Musca domestica* was the predominant fly species and it represented

74.12% (open house) and 72.42% (closed house) of the total respective collection. *Megaselia scalaris* was the second most abundant species constitutes (21.69% in open house and 26.52% in closed house farming systems).

Table 1. Distribution of adult flies collected from fly paper at the study site

Family	Species	No. of Flies (% of total)
Muscidae	*Musca domestica*	5,757 (72.13)
	Hydrotaea sp.	25 (0.31)
	Musca sorbens	12 (0.15)
	Atherigona orientalis	117 (1.47)
Calliphoridae	*Chrysomya megacephala*	51 (0.64)
	Lucilia cuprina	1 (0.01)
	Hemipyrellia liguariens	1 (0.01)
Sarcophagidae	*Sarcophaga dux*	6 (0.08)
Ulidiidae	*Physiphora clausa*	7 (0.09)
Phoridae	*Megaselia scalaris*	1,977 (24.77)
Fanniidae	*Fannia* sp.	17 (0.21)
Stratiomyidae	*Hermetia illucens*	8 (0.10)
Sciaridae	*Pnyxiopalpus roslii*	1 (0.01)
Syrphidae	*Helophilus* sp.	1 (0.01)
Total		7,981

The other fly species in the order of abundance in open house farming system are *Atherigona orientalis* (2.24%), *Chrysomya megacephala* (0.82%), *Hydrotaea sp*. (0.40%), Fannia sp. (0.33%), *Physiphora clausa* (0.13%), *Hermetia illucens* or Black Soldier Fly (0.11%), *Musca sorbens* (0.08%), *Sarcophaga dux* (0.04%), *Pnyxiopalpus roslii* / Black Fungus gnat (0.02%) and *Lucilia cuprina* (0.02%). While in closed house farming system, the other fly species in the order of abundance are *Musca sorbens* (0.30%), *Chrysomya megacephala* (0.30%), *Sarcophaga dux* (0.15%), *Hydrotaea* sp. (0.14%), *Hermetia illucens* (0.07%), *Hemipyrellia ligurriens* (0.05%) and *Helophilus* sp. (0.01%).

However, *P. clausa*, fungus gnat, *Fannia* sp., *A. orientalis* and *L. cuprina* were only encountered in open house poultry farms. Among them, *A. orientalis*, *Fannia* sp. and *P. clausa* were the predominant species. On the other hand, *Helophilus* sp. and *H. liguariens* were the uncommon ones found in the closed house poultry farms. From the current dipteral distribution study, the open house system had double the flies captured in the closed house systems. However, in both production systems, *M. domestica* and *M. scalaris* took the first two most abundant positions respectively. Nevertheless, *A. orientalis* was the third most captured species in the open house farming system. Contrarily, *M. sorbens* and *C. megacephala* were recorded as the third most abundant species captured in the close house system.

The most numerous family is Muscidae (26.67%) followed by Calliphoridae (20.0%) and the rest of the family only carries 6.67% abundance of the total 15 different species from 10 dipteran families that have been captured. A total number of 5,911 specimens collected belongs to the family Muscidae; this had a diverse group of filth flies with four species: *Musca domestica* (97.39%), *Atherigona orientalis* (1.98%), Hydrotaea sp. (0.42%) and *Musca sorbens* (0.20%). Meanwhile, the lowest flies' families are Syrphidae and Sciaridae which constitutes only 0.01% each of all collected flies in both open and closed house farms. Since *M. domestica* was the most predominant species encountered in both farming systems, we contemplate on the weightage of this species centered on the type of poultry species-based production category. In relation to that, open house broiler chicken farms exhibited the highest *M. domestica*

population, which made up to 25.24% (1453 heads) out of a total 5,757 of *M. domestica* species sampled from all 14 farms.

By sequence, the *M. domestica* abundance in closed house broiler chicken farms was 23.64%. Followed by open house broiler duck farms (22.37%), open house layer chicken farms (16.45%), closed house breeder chicken farms (7.49%), open house breeder duck farms (2.78%), closed house layer chicken farms (1.56%) and open house broiler village chicken farms (0.47%) out of the total 5757 of *M. domestica* species sampled.

Whereas, dipteran species distribution data in this study was statistically significantly different from the normal distribution. The results for dipteran species distribution among chicken and duck farms are shown in Table 2. Houseflies were the most abundant Diptera that were found predominantly at both chicken and duck farms; where, the mean values of *M. domestica* in chicken farms were 391.73±126.87flies, whereas in duck farms were 482.7±218.02 flies. However, there was no significant differences seen in dipteran species (except *A. orientalis*) distribution among chicken and duck farms.

Table 2. Independent t-test analysis for dipteran species distribution at chicken and duck farms

Dipteran Species	**Mean±SE Chicken Farm**	**Mean±SE Duck Farm**	**Independent t-test**	**Significance Level of t-test (*P*)**
Musca domestica	391.73±126.87	482.67±218.02	t(12)= -0.337	0.742
Sarcophaga dux	0.55±0.24	0	t(12)= 1.118	0.285
Physiphora clausa	0.64±0.55	0	t(12)= 0.593	0.564
Hydrotaea sp.	2.27±1.44	0	t(12)= 0.800	0.439
Hermetia illucens	0.74±0.38	0	t(12)= 0.962	0.355
Pnyxiopalpus roslii	0.09±0.09	0	t(12)= 0.507	0.621
Musca sorbens	1.09±0.69	0	t(12)= 0.798	0.441
Chrysomya megacephala	4.36±3.12	1.00±0.00	t(12)= 0.547	0.595
Megaselia scalaris	179.73±81.88	64.0±27.32	t(12)= 1.113	0.287
Fannia sp.	1.55±1.55	0	t(12)= 0.507	0.621
Atherigona orientalis	0	39.00±11.02	t(12)= -7.687	0.000
Lucilia cuprina	0.09±0.09	0	t(12)= 0.507	0.621
Hemipyrellia liguariens	0.09±0.09	0	t(12)= 0.507	0.621
Helophilus sp.	0.09±0.09	0	t(12)= 0.507	0.621

On the other hand, the results for dipteran species distribution among open house farms and closed house farms are shown in Table 3. Houseflies were abundantly found in open house farms (476±129.66 flies) as compared to closed house farms (173.67±41.88flies). However, no significant differences were seen in dipteran species distribution among open house and closed house chicken farms.

Table 3. Independent t-test analysis for dipteran species distribution at open house and closed house farms

Dipteran species	**Mean±SE Open House Farm**	**Mean±SE Closed-House Farm**	**Independent t-test**	**Significance Level of t-test (*p*)**
Musca domestica	476±129.66	173.67±41.88	t(14)= 1.179	0.261
Sarcophaga dux	0.5±0.33	0.67±0.33	t(14)=- 0.286	0.781

Physiphora clausa	0.88±0.74	0	t(14)= 0.698	0.503
Hydrotaea sp.	3.13±1.92	0	t(14)= 0.963	0.503
Hermetia illucens	1.0±0.41	0	t(14)= 1.184	0.361
Pnyxiopalpus roslii	0.13±0.13	0	t(14)= 0.592	0.267
Musca sorbens	0.63±0.50	2.33±2.33	t(14)= -1.11	0.296
Chrysomya megacephala	4.45±3.11	0.67±0.67	t(14)= 0.618	0.548
Megaselia scalaris	223.13±110.02	64.0±27.32	t(14)= 0.854	0.415
Fannia sp.	2.13±2.13	0	t(14)= 0.592	0.568
Atherigona orientalis	10.64±6.07	0	t(14)= 0.881	0.391
Lucilia cuprina	0.13±0.13	0	t(14)= 0.592	0.568
Hemipyrellia liguariens	0.13±0.13	0	t(14)= 0.592	0.568
Helophilus sp.	0.13±0.13	0	t(14)= 0.592	0.568

Hence, based on high *M. domestica* species abundance in broiler chicken farm with open house farming system; it can be concluded that respective regulatory bodies (Department of Veterinary Services, Malaysia, local councils, etc.) should concentrate more on houseflies' management and control in this farming system.

DISCUSSION

There were 14 species of flies which consist of nine families collected in this study (Muscidae, Calliphoridae, Sacrophagidae, Ulidiidae, Phoridae, Stratiomyidae, Sciaridae, Fannidae and Syrphidae). The most common species captured were *M. domestica, M. scalaris* and *A. orientalis. Musca domestica* was the most abundant species compared to other fly species. This finding is similar to a study carried in a poultry farm in Sungai Buloh Selangor by Ho (1990) and *M. domestica* also was ranked first in a survey of pest importance in California caged layer poultry farm conducted by Hinkle and Hickle (1999). In this study, the house fly is the predominant dipteran fly species found at the study site. This is because they preferred to breed in poultry waste, spilled feed and other moist, warm decaying organic matter (Walker & Stachecki, 1996). Even though, fly development depends on temperature, multiple generations per year are possible in tropical and temperate regions due to their peridomestic habits (Merchant et al. 1987).

Apart from *M. domestica*, *M. scalaris* is the phorid of most medical importance. *Megaselia scalaris* may also be identified by a noteworthy characteristic that is brown and yellowish in colour with some black marks on the abdomen. It is barely 2 mm long and a holometabous insect with four separate phases of development including egg, larva, pupa, and adult (Hsien 2014; Zuha & Disney 2018). In general, scuttle fly larvae and adults feed on diverse rotting animal tissues in the wild. *Megaselia scalaris* has been found in forensic and medical cases across the world, including Malaysia, and past research indicates that this species is mostly found indoor. As a result, in indoor forensic investigations, this species may be able to assist in determining the minimal post-mortem delay (Zuha et al. 2017).

In present study, the third most abundant species was *A. orientalis.* It is always referred as tomato fly or the pepper fruit fly. It has been recorded to lay eggs at the oviposition sites of other insects, and the larvae of *A. orientalis* are thought to feed on the larvae of *Bactrocera* sp. and *Dacus sp.* (Herawani et al. 2019). *Atherigona orientalis* is a polyphagous species. Larvae feed on decaying plant materials, excrement, and carrion to grow (Grzywacz & Pape 2014).

Atherigona orientalis is thought to be a key species in the spread of faecal pathogens and filth-borne illnesses due to its dietary preferences and abundance (Herawani et al. 2019). *Musca sorbens* and *Hydrotaea* sp. were the remaining two other species of family Muscidae which were relatively fewer in number than *M. domestica* and *A. orientalis.* Mau (1978) reported that dog, cat, cattle and chicken dung were tested for their suitability for *M. sorbens* larval development and found that chicken dung was not suitable for this species. According to Moon (2002), *M. sorbens* was detected reproducing at dairies only in undisturbed individual dung pats in uncrowded pens or pastures. Dung pats were trampled and rendered unsuitable for reproducing in typically packed enclosures. For eating and oviposition, this fly was solely attracted to fresh dung pats.

Hydrotaea sp. is a predator that does not generally exist in great numbers on farms. Researchers and poultry owners are becoming more interested in this predator due to the fly's capacity to efficiently manage populations of house flies in high-rise cage layer houses when persistent augmentative releases of this predator are performed. Adults of various species, including *H. irritans*, have been known to cause pain to humans and cattle due to the flies' persistent propensity of seeking to feed on skin, eye, nose, and lip secretions (Greenberg 1971; Huckett 1954). Adults of *Hydrotaea* sp. are small (6 mm), shiny, bluish-black flies. *Hydrotaea aenescens* and *H. ignava* has the common names of black dump flies and black garbage flies, respectively (Axtell 1986). All *Hydrotaea* species are hemisynanthropic to eusynthropic, and prey on other coprophagus Dipterous larvae. In many places of the world, *Hydrotaea* sp. may be found in poultry manure (Dillon 1994). According to Dillon (1994), researchers have identified the possibility of employing *H. aenescens* as a biological control agent for *M. domestica*.

Following that, *C. megacephala* is commonly called as blow fly or the oriental latrine fly. Large populations of *C. megacephala* may inhabit human settlements, livestock farms, and adult flies are attracted to moist foodstuffs and decaying organic matters, including carcasses. Blow flies may breed abundantly in dead fish, dead carcasses, poultry excrement, fruits and sweets. On the other hand, *S. dux* (Sarcophagidae) which is commonly known as a flesh fly is also a species of medical importance in many parts of the world (Cherix et al. 2012). Adults' flies are dull grey with three longitudinal black strips on the mesonotum, while the abdomen possesses a checkered or spotted pattern. The body length of male *S. dux* is medium to large size (7–12 mm). Since *S. dux* is a forensically important flesh fly, we have no surprised as theyprefer to lay eggs in dead carcasses, livestock, and human excrement/faeces.

Besides that, *Physiphora clausa, Pnyxiopalpus roslii,* and *Hermetia illucens,* were also trapped in a small volume in this study. *Physiphora clausa* is a common manure-breeding fly yet is not known to be a nuisance to cattle or humans and its presence in collections is often not reported. While the larvae live usually deposited in compost are believed to infest also rotting palms. Adult flies are also known to get attracted to livestock manure (Hogsette et al. 2012). *Hermetia illucens* infests chicken dung naturally, and as minimum of 10 larvae can become prevalent in the manure under confined laying hens. The larvae in the manure provide an ugly state, exacerbate the problem of unpleasant odours, and occasionally cause the dung to spill onto the sidewalks. In such instances, the manufacturer may try to implement control measures (Axtell & Edwards 1970). While *Pnyxiopalpus rosli* is known as a fungus gnat. This fly belongs to the family Sciaridae, generally dark, delicate-looking flies similar in appearance to mosquitoes. Fungus gnats often remain near potted plants and rest on growing media, compost, decomposing organic matter and wet areas. Their presence is primarily considered a nuisance. However, no information was retrieved pertaining to the unidentified species'

biology and life cycle. Nevertheless, it can be assured that the unidentified species are substantially present in poultry farms as they were captured in both types of poultry production systems.

In contrast, two members of the family Calliphoridae, *H. liguariens* and *L. cuprina* and a member of the family Syrphidae (*Helophilus* sp.) were found in the least number at the sampled farms. Basically, *Hemipyrellia ligurriens* breeds in dead animals, garbage, and human and animal faeces. It is a species of forensic importance as it has been collected from human corpses (Sukontason et al. 2008). In addition to its forensic significance, *H. ligurriens* may be a nuisance in markets and gardens, and adults are potential disease carriers because of their propensity to human excreta near human-occupied places (Bunchu et al. 2012). Besides that, it is also of sanitary importance, especially in areas around open markets, landfills, and livestock farms due to its attraction to faeces.Whereas *L. cuprina* is an extremely common blowfly in Australia (Waterhouse & Paramonov 1950). Based on the literature review, these two species should present in reasonable volume in poultry farms. However, the capture rate in this study was low and this finding could be derived from the sampling technique itself where baits (manure/decaying organic matter) were not used. Since *Helophilus* sp. are a diverse genus of moderate to large hoverflies that appear somewhat bee-like and they are some of the most prolific pollinators. Their presence in poultry farms might be only limited to the flower plants in farms (Horiuchi et al. 2022). Thus, the low yield of this Syrphidae is acceptable in the context of the present study.

Comprehensively, many flies were collected at the study site, yet *Fannia* sp. capture was low. To be specific, only one open house poultry farms out of the total 14 farms trapped *Fannia* sp., given the fact that, *F. canicularis* is the second most abundant pestiferous fly species following *M. domestica* that are present in the poultry farms (Mullens et al. 2002). Hence, the most likely reason for the low yield of little flies could be either a significantly low population of *Fannia* sp. at the study site or a possible misidentification of *M. domestica* despite little flies, as these two species are quite similar in appearance.

CONCLUSIONS

In conclusion, a total of nine dipteran flies families namely Muscidae, Calliphoridae, Sacrophagidae, Ulidiidae, Phoridae, Stratiomyidae, Sciaridae, Fannidae and Syrphidae were captured in both closed and open house commercial poultry and duck farms in Kinta districts, Perak, Malaysia. *Musca domestica* was the most abundant species captured in both open and closed house systems. Thus, it can be deduced that houseflies remain a predominant concern in both farming systems, despite the adoption of contemporary technologies to preserve microclimates in closed-house poultry farms. Adherence to good animal husbandry practices can help reduce the harboring of pestiferous flies in poultry farms.

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AUTHORS DECLARATION

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Conflict of Interest
The authors declare that they have no conflict of interest.

Ethics Declarations
No ethical issue is required for this research

Data Availability Statement
This is a Master of Science Project and the data are currently in MSc. thesis Navanithakumar A/L Ballakrishnan (2024).

Authors' Contributions
Navanithakumar Ballakrishnan (NB), Hasber Salim (HS), Hadura Abu Hasan (HAB) and Hamdan Ahmad (HA) conceptualized this research and designed experiments; NB, HS and HAB participated in the design and interpretation of the data; NB wrote the paper and HS and HAB participated in the revisions of it. All authors read and approved the manuscript.

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