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Species composition surveys of synanthropic fly populations in northern peninsular Malaysia

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Abstract. Three species composition surveys were conducted in a rural location in Kedah and an urban location in Pulau Pinang. Two of the surveys were conducted in November 2003, the first was at the Kedah site and the second was at the Pulau Pinang site. The third survey was conducted at the Pulau Pinang site again on the last week of April 2004. All these surveys were conducted one week prior to field evaluations of commercial chemical fly baits. The predominant species recovered from the surveys was the house fly, *Musca domestica*, which ranked first in prevalence in all three studies. Catches of *Musca sorbens*, *Chrysoma megacephala* and *Lucillia cuprina* were lower than *M. domestica*. *Sarcophaga sp.* was not present at the Kedah site and was only present at the Pulau Pinang site during the survey in April 2004. The other fly species present at the Kedah site were *Megaselia* sp., *Psycoda* sp., *Piophila* sp. and *Fannia* sp. These species were scarce and never exceeded 1% of the total catch.

INTRODUCTION

Flies that have entered the man-dominated ecological community and consequently coexist with man over an extended period of time have been referred to as synanthropic species (Graczyk *et al.*, 2001). Synanthropic flies are abundant in urban areas where unsanitary conditions prevail and are usually scarce when sanitary conditions are enforced (Olsen, 1998). In Malaysia, common synanthropic species that are of significant public health importance are from the families Calliphoridae, Muscidae and Sarchophagidae (Baharudin *et al.*, 2003).

It is important to monitor fly populations in order to be able to make wise control decisions. A visual observation alone is insufficient as it sometimes can be misleading (W.H.O., 1986). Fly surveys help determine the effectiveness of sanitation practices, identify fly breeding sites, determine the need for control measures and identify other insect species that will inadvertently be affected by the chosen control measures. Surveys are also vital in determining baseline fly populations, track the trends in populations and measure the effectiveness of control methods (Crosskey & Lane, 1993). Fly problems may be abundantly apparent even without surveillance. Even so, fly surveillance is still necessary to determine effectiveness of control measures and to identify seasonal fluctuations as well as temporal population trends (Prendergast *et al.*, 2001). This study was conducted to determine the fly species and other insect species present at the study sites before subsequent field evaluations of chemical fly baits were conducted.

MATERIAL & METHODS

Study sites

The species composition surveys were conducted in an urban location in Pulau Pinang and a rural location in Kedah. The urban location chosen for this study was the Medan Suri food court. In the vicinity of the

food court and located adjacent to each other were a small chicken slaughtering facility and a municipal garbage collection point. The rural location chosen in Kedah was a small village sundry shop in Sungai Kechil Ulu, which also doubled as a small market selling fish, meat and vegetables. The fish, meat and vegetable produce were sold in separate stalls located outside the sundry shop.

Survey methods

Two surveys were conducted in November 2003, the first was at the Kedah site and the second was at the Pulau Pinang site. The final survey was conducted at the Pulau Pinang site again on the last week of April 2004. All three surveys were conducted one week prior to a field evaluation study of chemical fly baits. There was no repeat survey in Kedah because there was only one field evaluation that was conducted there.

In each study site, 3 trap locations were chosen. Sticky paper traps were used to sample the flies in the study sites. The sticky trap was used in this study because when it is used as a sampling method it can be quite sensitive to changes in fly populations (Pickens *et al.*, 1972). The sticky paper trap also has the ability to count a much larger number of flies than the grill, which is important at locations with low fly densities (Anderson & Poorbaugh, 1965; Hogsette *et al.*, 1993). Three sticky paper traps, baited with salted fish, were randomly placed at each trap location. Therefore, altogether, there were 9 sticky paper traps placed at each study site. The 3 trap locations chosen at the Kedah site were the stalls selling fish, meat and vegetables. As for the Pulau Pinang site, the 3 chosen trap locations were the food court, the chicken slaughter facility and the garbage collection point.

The bait used in this study was salted fish preserved in oil. In a study by Nurita (2006), salted fish was shown to attract more flies than sugar and milk baits. The salted fish was also chosen because it is cost-effective, easily available and does not emit an offensive odour. The salted fish baits were cut into 1 cm pieces and the pieces were slightly mashed. The baits were applied onto the sticky side of the paper traps, which measured 30x21 cm when opened. Before the bait was placed in the field, the sticky traps were attached to 36x27 cm cardboard bases. The cardboard base was made by cutting out a large cardboard box. After the sticky paper traps were baited with salted fish, they were randomly placed at the designated trap locations. The traps were left at the study sites for 4 hours at a time when fly density was the highest, which was from 12.00 noon to 4.00pm (Habibah, 1997). Traps were retrieved after four hours, brought back to the laboratory and the number of flies caught on the sticky traps was counted. The flies caught on the traps were identified using keys given by McAlpine *et al.* (1981-1989).

RESULTS

Figures 1 and 2 shows the overall percentages of flies caught in three separate species composition surveys conducted in Pulau Pinang and Kedah in November 2003 and April 2004. In each survey, a total of 27 traps were used over 3 sampling days to catch flies in 3 trap locations (3 traps per location). In total, 1690 calyptrate flies were caught on the baited sticky traps in the three surveys. The surveys in Pulau Pinang and Kedah in November 2003 yielded a total of 683 and 335 flies respectively. In the April 2004 survey that was conducted in the Pulau Pinang site again, a total of 672 flies were caught.

The predominant species recovered from the surveys was the housefly, *Musca domestica*, which ranked first in prevalence in all three surveys. The prevalence of this species was greatest at the Kedah site, where a total mean percentage of 69.5 ± 4.0% of flies caught were of this species. *Chrysomya megacephala*, ranked second in relative abundance at the Kedah site (20.0 ± 3.2%), but was ranked third at the Pulau Pinang site in the November 2003 (23.2 ± 3.1%) and April 2004 surveys (7.5 ± 0.8%).

Musca sorbens was the species ranked second in Pulau Pinang during the November 2003 (17.3 ± 1.7%) and April 2004 surveys (21.8% ± 1.8%), however, this species was not

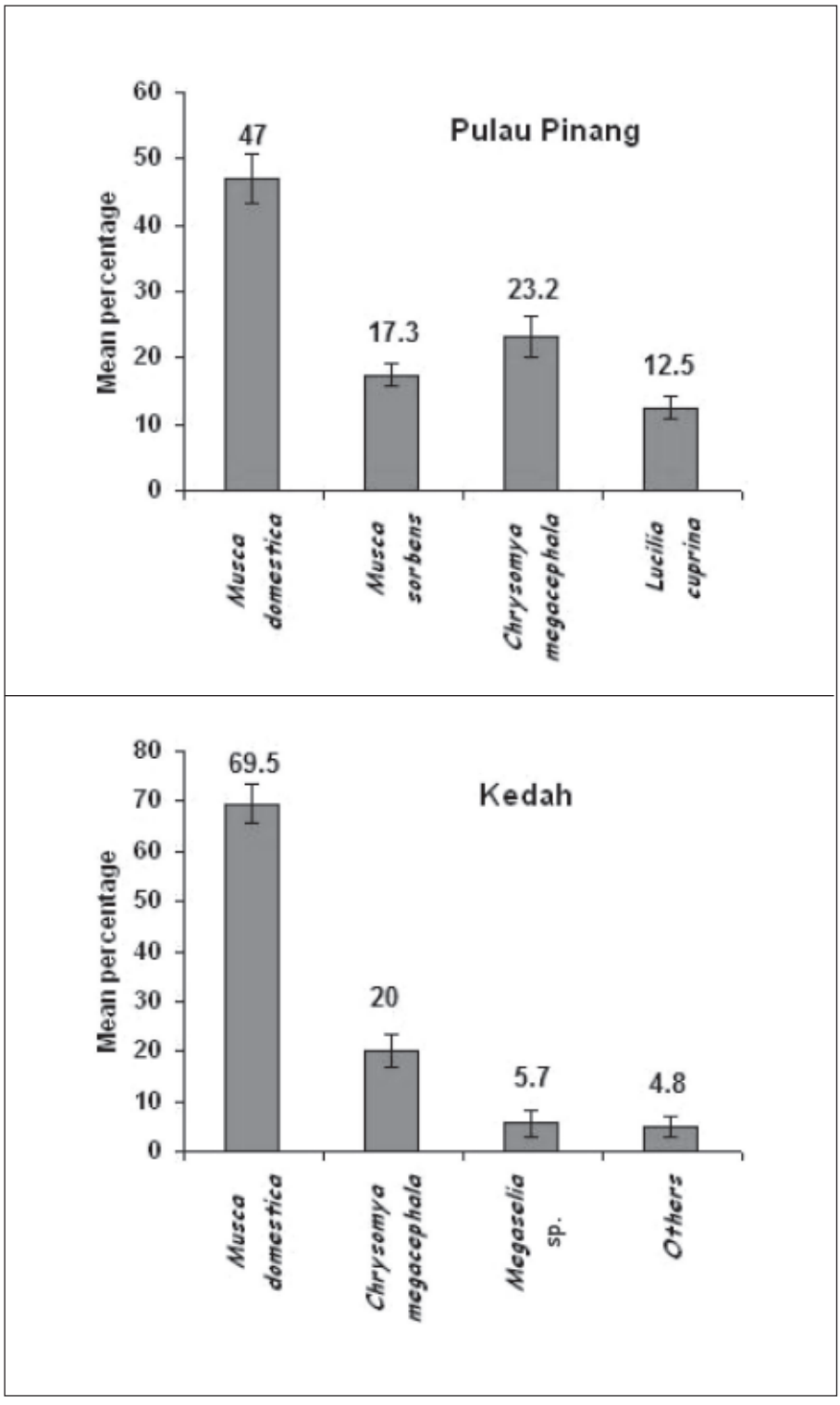

Figure 1. Total mean percentage of flies caught per trap (n = 27) at the Pulau Pinang and Kedah sites in November 2003.

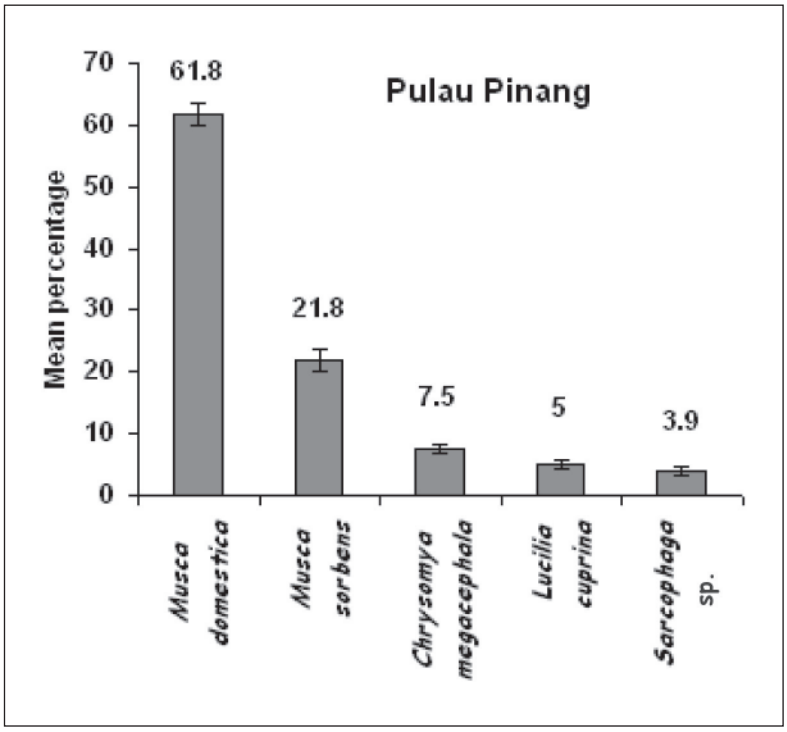

Figure 2. Total mean percentage of flies caught per trap (n = 27) at the Pulau Pinang site in April 2004.

present at the Kedah site. *Lucilia cuprina* had the lowest mean percentage of 12.5 ± 1.7% at the Pulau Pinang site during the first survey in November 2003. However, this was not the case in the April 2004 survey in Pulau Pinang, where the lowest mean percentage of flies recorded was that of *Sarcophaga* sp. at 3.9 ± 0.7%

At the Kedah site, *Megaselia* sp. was ranked third at 5.7 ± 2.6% and *L. cuprina* was not present at all. Catches of *M. sorbens*, *C. megacephala* and *L. cuprina* were relatively lower than that of *M. domestica*. *Sarcophaga* sp. was not present at the Kedah site and was only present in the Pulau Pinang site during the survey in April 2004. Other fly species present at the Kedah site were *Psycoda* sp., *Piophila* sp. and *Fannia* sp. These species were scarce and never exceeded 1% of the total catch.

Figures 3 to 5 show the percentage of fly catches according to trap locations in the Pulau Pinang and Kedah sites. At the Pulau Pinang site, in the survey conducted in November 2003 (Figure 3), the dominant species was *M. domestica* except at the garbage collection point where *C. megacephala* was dominant (41.9 ± 2.0%). *L. cuprina* was recorded lowest at the chicken slaughtering facility and the food court at a mean percentage of 3.8 ± 0.5% and 19.4 ± 3% respectively. However, at the garbage collection point, *M. sorbens* was recorded lowest with a mean percentage of 10.6 ± 1.4%.

In figures 4 and 5 it can be seen that the predominant species recovered from the Kedah site (November 2003) and the Pulau Pinang (April 2004) collections was the housefly, *M. domestica*, which ranked first in prevalence at all the trap locations. *C. megacephala* came second in relative abundance at all trap locations in Kedah. However, the same cannot be said about the *C. megacephala* catches in the Pulau Pinang (April 2004) collections (figure 5), where this species was ranked third in relative abundance. The highest mean percentage of *C. megacephala* recorded in Pulau Pinang in April 2004 was at the garbage collection

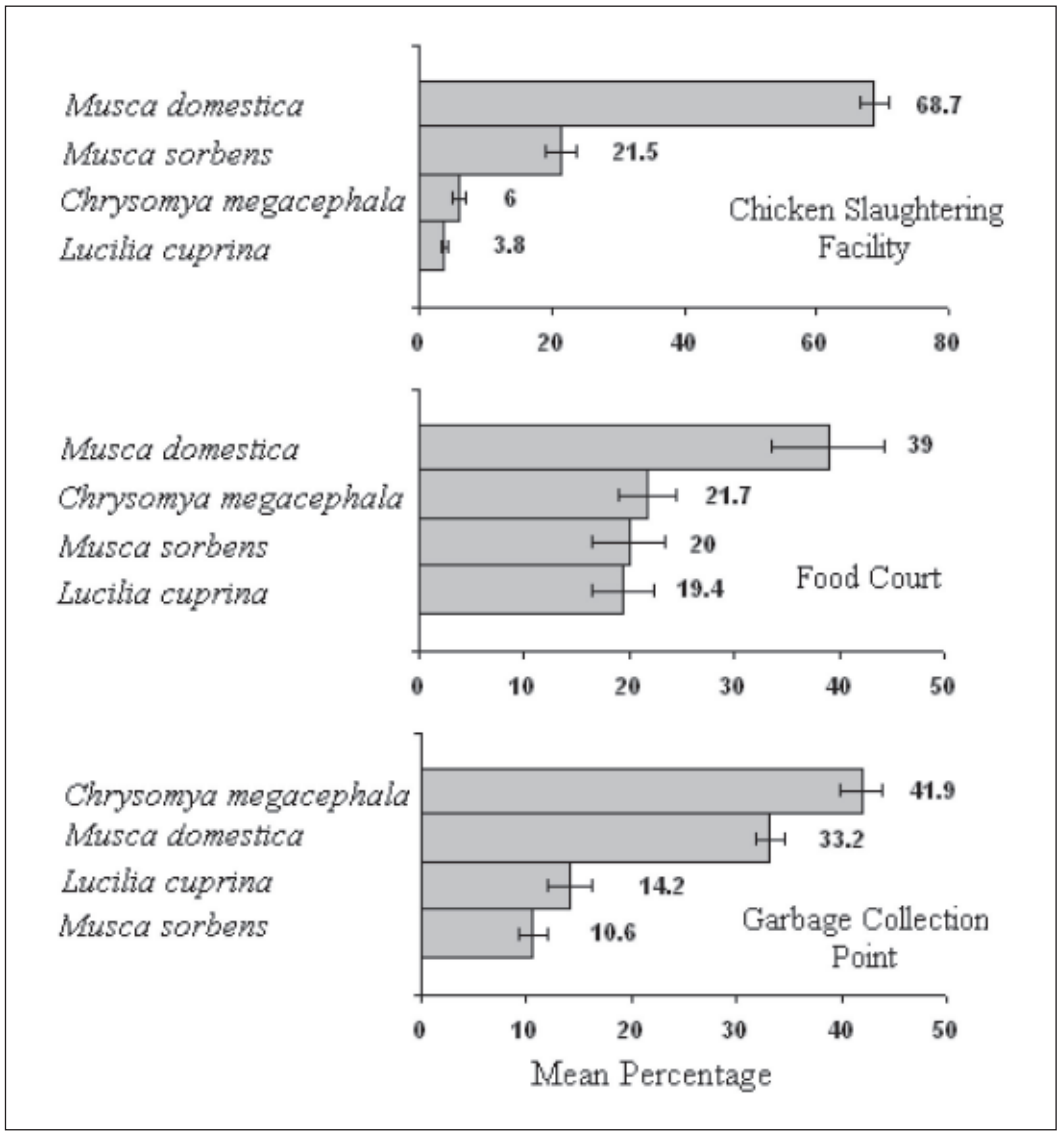

Figure 3. Mean percentage of fly catches per trap (n = 9) according to location at the Pulau Pinang site in the November 2003 survey.

point (10.1 ± 1.7%). It is interesting to note here that in April 2004 (Figure 5) the catches of *C. megacephala* was surprisingly low at all three trap locations unlike in November 2003 (Figure 3) where at the garbage collection point this species was the most abundant (41.9 ± 2.0%). At the food court of the Pulau Pinang site in November 2003, *C. megacephala* came second with a percentage of 21.7 ± 2.8% and at the chicken slaughtering facility, it was ranked third at 6.0 ± 1.0%. *Sarcophaga* sp. was recorded lowest at all three trap locations of the Pulau Pinang site in April 2004 (Figure 5) but this species was not present in November 2003.

No catches of *M. sorbens* was recorded in Kedah, however *Megaselia* sp., a species that was not present at the Pulau Pinang site in either November 2003 or in April 2004, was present at the Kedah site. The meat stall location in the Kedah survey recorded the highest mean percentage of *M. domestica* (77.4 ± 1.4%). The fish stall had the highest percentage of *C. megacephala* (25.5 ± 7.1%),

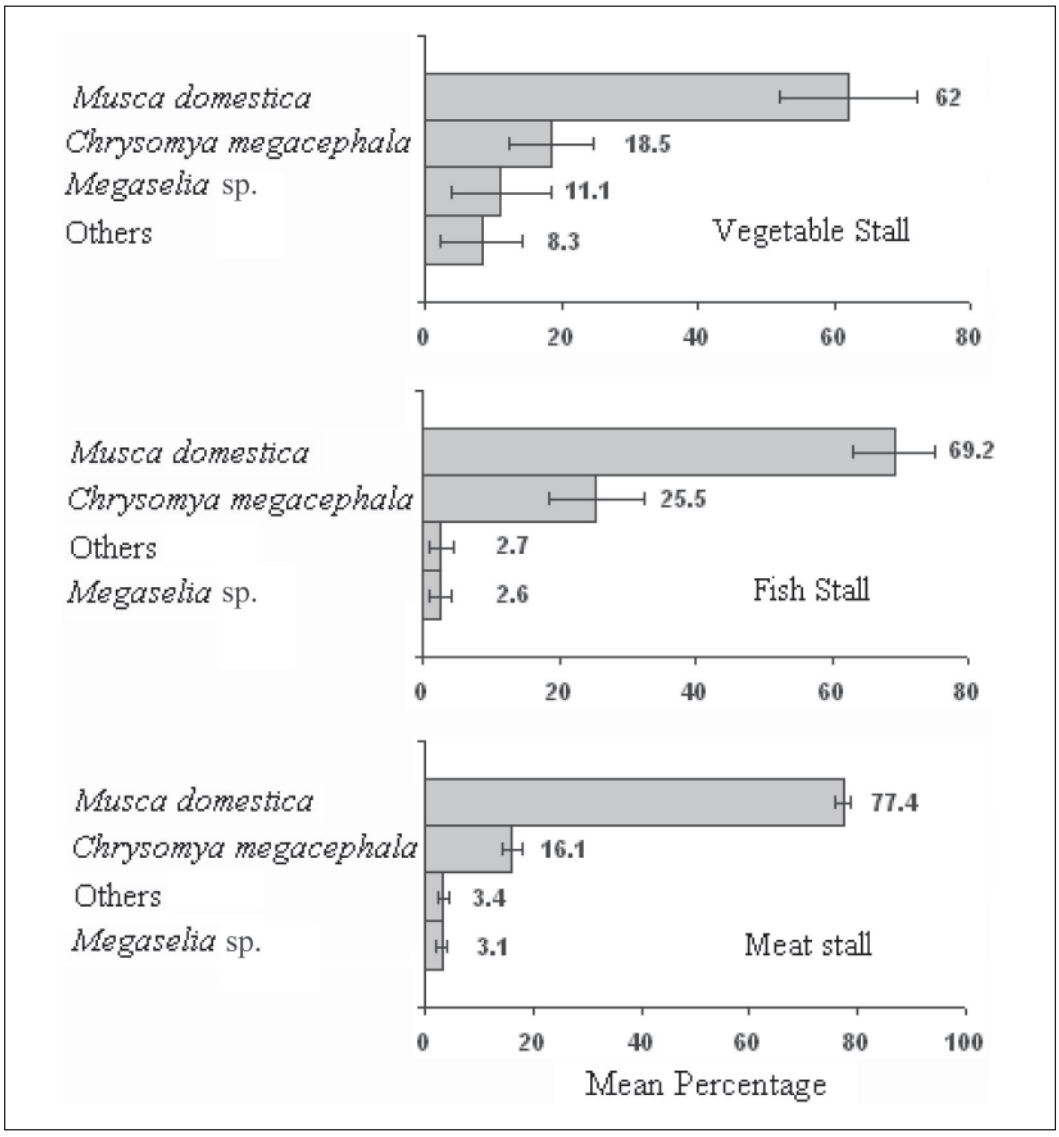

Figure 4. Mean percentage of fly catches per trap (n = 9) according to location at the Kedah site in the November 2003 survey.

followed closely by the vegetable stall where *C. megacephala* percentage was at 18.5 ± 6.3% (Figure 4).

DISCUSSION

Surveys were conducted in Kedah and Pulau Pinang in November 2003 and April 2004 to determine the species composition of fly populations there. The surveys were conducted a week before chemical fly bait evaluations were conducted. The Kedah site chosen for the survey was a small sundry shop in Sungai Kechil Ulu (rural area), which also sells vegetables, meat and fish. The vegetables, meat and fish are sold in stalls in front of the sundry shop.

The Pulau Pinang study site has a food-court, a small chicken slaughtering facility and a garbage collection point all located adjacent to each other. The chicken slaughtering facility is small establishment located between the garbage collection point

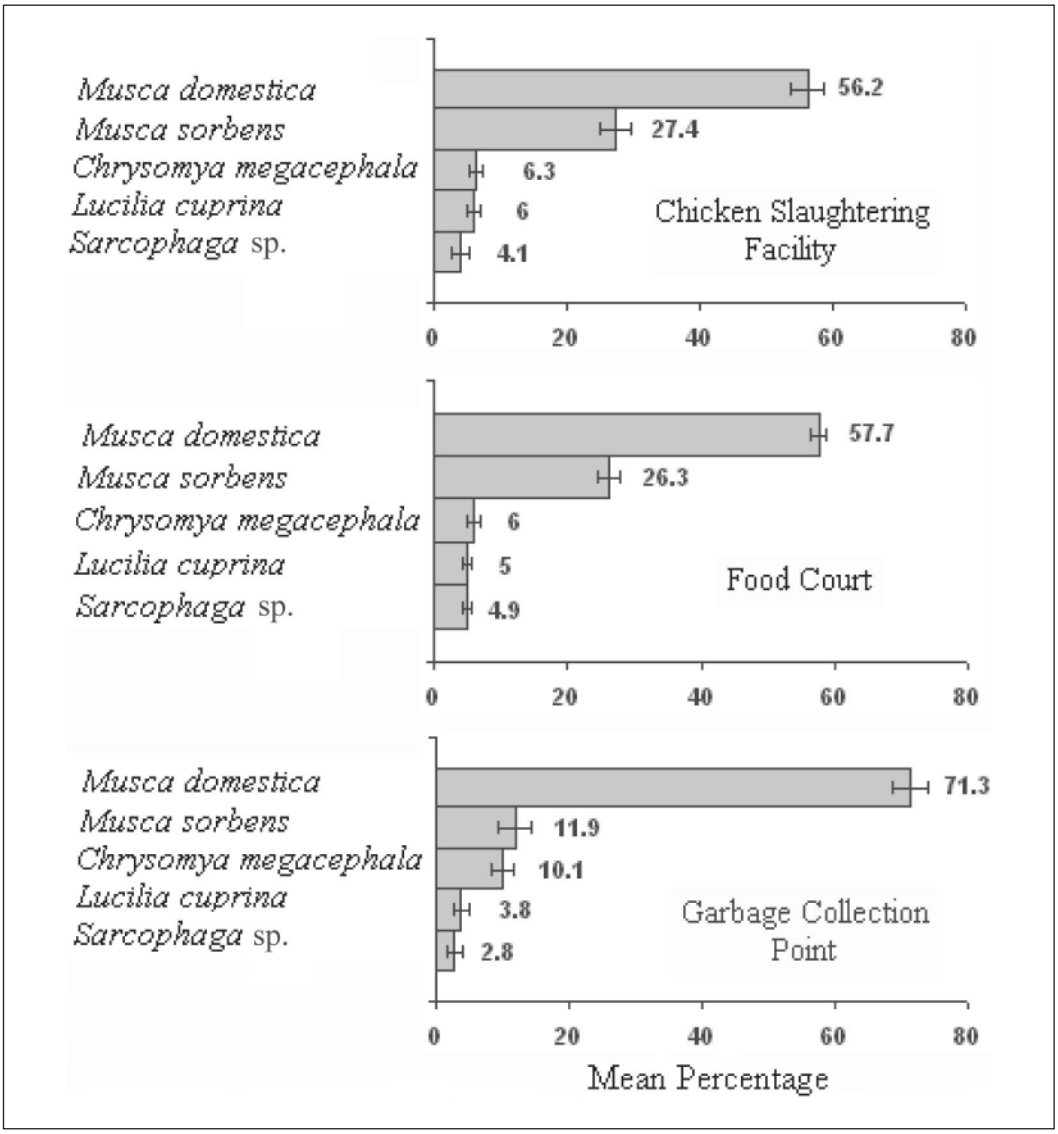

Figure 5. Mean percentage of fly catches per trap (n = 9) according to location at the Pulau Pinang site in the April 2004 survey.

and the food court. Chicken slaughtering at this facility is conducted between 10 am to 12 noon, after which the facility is cleaned by workers by hosing down the equipments and slaughtering area, including the floors and walls. The clean up however is not always thorough and flecks of chicken blood and flesh can still be seen on the floors and walls. The garbage collection point consists of three large garbage bins located within a white tiled concrete enclosure.

The garbage deposited at the collection point usually consists of chicken carcasses, chicken viscera and refuse from the food court operators. The garbage is usually not wrapped in plastic bags and is simply dumped into the bins. Even when the garbage was placed in plastic bags, it was usually not tied-up and the garbage would eventually spill out into the bins. The municipal council workers collect the garbage around 10 am, but are usually

inconsistent. The garbage is sometimes left there for several days and this normally causes large fly populations to congregate on the putrid garbage. The workers also hose down the floor and walls of the enclosure but are again inconsistent in doing so. Therefore, due to the inconsistency of the garbage collection and enclosure clean up, the garbage collection point is usually rife with flies and other insects including ants and wasps.

The species composition survey showed that the housefly, *Musca domestica* was the predominant species and was ranked first in overall prevalence in all three studies. The housefly is commonly found wherever man has established himself. Therefore, it can be found in abundance at fisheries, slaughterhouses, garbage disposal sites, vegetable farms, market places and poultry farms (Sulaiman *et al.*, 1988). The high numbers of *M. domestica* recorded in the current study is similar to previous studies of flies associated with waste in other countries (Imai, 1985; Essa & El Sibae, 1993). However, Goulson *et al.* (1999) reported low proportions of *M. domestica* in flies emerging from garbage in landfills.

In the survey conducted at the Pulau Pinang site in November 2003, the dominant species was *M. domestica* except at the garbage collection point, where *C. megacephala* was dominant. The discrepancy in the dominant species that was observed at the garbage collection point is probably due to the fact that this location was more attractive to *C. megacephala* because of the discarded chicken carcasses and chicken viscera in the garbage bins. As noted in the results, the catches of *C. megacephala* at the Pulau Pinang site in April 2004 were low compared to November 2003. This could be due to the changes in meteorological conditions such as temperature & rainfall. Meteorological conditions effects rates of population increase and this in turn influences the number of flies available for trapping (Wall *et al.*, 1992 & 1993; Wardhaugh *et al.*, 1994).This could probably be explained by the decrease in chicken carcasses and viscera in the garbage bins throughout the month (April 2004) because the municipal council workers were consistent in collecting and cleaning the bins and walls during this month compared to other months.

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