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BRIEF COMMUNICATION

SPECIES COMPOSITION OF CARRION BLOW FLIES IN NORTHERN THAILAND: ALTITUDE APPRAISAL

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SUMMARY

Distribution and occurrence of blow flies of forensic importance was performed during 2007 and 2008 in Chiang Mai and Lampang Provinces, northern Thailand. Surveys were conducted in forested areas for 30 minutes using a sweep net to collect flies attracted to a bait. A total of 2,115 blow flies belonging to six genera and 14 species were collected; *Chrysomya megacephala* (Fabricius) (44.7%), *C. pinguis* (Walker) (15.1%), *C. chani* Kurahashi (9.3%), *C. thanomthini* Kurahashi & Tumrasvini (0.3%); *Achoetandrus rufifacies* (Macquart) (10.5%), *A. villeneuvi* (Patton) (2.2%); *Lucilia papuensis* Macquart (2.2%), *L. porphyrina* (Walker) (12.4%), *L. sinensis* Aubertin (0.7%); *Hemipyrellia ligurriens* (Wiedemann) (1.3%), *H. pulchra* (Wiedemann) (0.1%); *Hypopygiopsis infumata* (Bigot) (0.6%), *Hy. tumrasvini* Kurahashi (0.2%) and *Ceylonomyia nigripes* Aubertin (0.4%). Among them, *C. megacephala* was the predominant species collected, particularly in the summer. The species likely to prevail in highland areas are *C. pinguis*, *C. thanomthini*, *Hy. tumrasvini*, *L. papuensis* and *L. porphyrina*.

KEYWORDS: Blow flies; Carrion flies; Forensic entomology; Altitude; Thailand.

Blow flies (Diptera: Calliphoridae) represent a key group of insects used as entomological evidence in forensic investigations throughout the world including, but not limited to, North America^{1,5,6}, Europe² and Asia^{10,13}. A review of forensic entomology cases occurring in northern Thailand between 2000 and 2006 was conducted¹³. For 30 cases, 30 cadavers from various places of death (e.g., forested, suburban and urban areas) were investigated, with forested areas being the most common places of death. However, currently, little is known about the environmental factors regulating the distribution of blow flies, particularly those of forensic importance, such as altitude. Up until now, studies of carrion-frequenting blow flies have been limited in Thailand^{3,11}.

This study was conducted to elucidate species composition of blow flies in northern Thailand and determine whether blow fly species distribution could be related to altitude activity. This information will provide a database on blow flies from a specific location in northern Thailand, particularly in shaded forested areas, where deaths occur most commonly. Such information could prove vital when determining whether remains have been moved between regions.

The study periods were July 2007 for the rainy season, December 2007 for the winter and March 2008 for the summer. Adult fly collections

were performed in the forested areas of Chiang Mai and Lampang provinces in northern Thailand. Such areas comprised of mixed deciduous forest. Five sites were selected for each period. Four sites were selected from Chiang Mai, i.e., Huey Tueng Tao reservoir (Mueang district); Siridhon observatory at Doi Suthep-Pui Mt. (Mueang district); Headquarters at Doi Suthep-Pui Mt. (Mueang district); and Doi Nang Kaew (Doi Saket district). One site was selected from a mountainous area in Lampang province (Doi Khun Tan, Mae Ta district). Table 1 and Figures 1 and 2 display the collection sites for assessing the distribution of carrion blow flies.

Adult flies attracted to baited meat were caught with a sweep net at different times of the day between 10.00 a.m. and 3.00 p.m., based on the flight activity and feeding time of flies in this group (HK, personal observation). The one-day tainted beef (500 g placed on a plastic plate) was used as bait, which was placed on the ground. The altitudes were coordinated using a handheld e-Trex® Garmin GPS. The collection period was performed in 30 min. The captured flies were transferred to a transparent jar containing ethyl acetate. The dead flies were then transferred to a transparent tube for identification in the laboratory of the Department of Parasitology, Faculty of Medicine, Chiang Mai University. All flies collected were pinned individually, and subsequently identified

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Table 1
Collection sites of carrion blow flies in northern Thailand during 2007 and 2008

Altitude (asl)	Site	Location (District, Province)	Latitude (North)	Longitude (East)
300-450 m	A	Huey Tueng Tao (Mueang, Chiang Mai)	18° 51' 52"	98° 56' 16"
	B	Samoeng-Hang Dong Rd. (Hang Dong, Chiang Mai)	18° 45' 14"	98° 52' 54"
451-600 m	C	Doi Khun Tarn (Mae Ta, Lampang)	18° 23' 31"	99° 12' 55"
751-900 m	D	Sirindhorn observatory (Mueang, Chiang Mai)	18° 47' 19"	98° 55' 17"
	E	Headquaters Suthep-Pui (Mueang, Chiang Mai)	18° 48' 40"	98° 55' 00"
901-1,050 m	F	Doi Nang Kaew (Doi Saket, Chiang Mai)	19° 03' 46"	99° 22' 37"

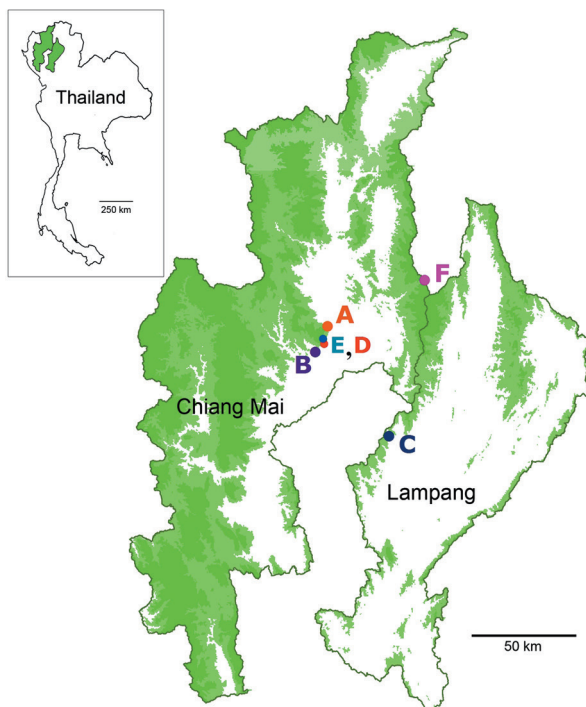


Fig. 1 - Carrion blow fly collection sites in northern Thailand. A (Huey Tueng Tao, Mueang, Chiang Mai); B (Samoeng-Hang Dong Rd., Hang Dong, Chiang Mai) at 300-450 m; C (Doi Khun Tarn, Mae Ta, Lampang) at 451-600 m; D (Sirindhorn observatory, Mueang, Chiang Mai); E (Headquaters Suthep-Pui, Mueang, Chiang Mai) at 751-900 m; F (Doi Nang Kaew, Doi Saket, Chiang Mai) at 901-1,050 m.



Fig. 2 - General topography of the blow fly collections in Northern Thailand. Upper display of site C in Fig. 1 (Doi Khun Tarn, Mae Ta, Lampang) at 451-600 m; with lower display of site F in Fig. 1 (Doi Nang Kaew, Doi Saket, Chiang Mai) at 901-1,050 m.

from external morphology using the key of KURAHASHI *et al.*⁷ and the aid of a binocular microscope.

A total of 2,115 carrion blow flies belonging to 14 species of six genera were collected in this study. They were *Chrysomya chani* Kurahashi, *C. megacephala* (Fabricius), *C. pinguis* (Walker), *C. thanomthini* Kurahashi & Tumrasvin; *Ceylonomyia nigripes* Aubertin; *Achoetandrus ruffacis* (Macquart), *A. villeneuvi* (Patton); *Hemipyrellia ligurriens* (Wiedemann), *H. pulchra* (Wiedemann); *Hypopygiopsis infumata* (Bigot), *Hy. tumrasvini* Kurahashi; *Lucilia papuensis* Macquart, *L. porphyrina* (Walker) and *L. sinensis* Aubertin. Among them, *C. megacephala* was the predominant species collected, particularly in the summer (Table 2) which is similar to results found

in previous investigations such as those in Chiang Mai^{12,14}, Phitsanulok in the north³, and Ubon Ratchathani in the northeastern region of Thailand⁴. Approximately 945 of this fly species were attracted to the bait after its placement. Their frequency of occurrence was consistent throughout the season with its populations peaking during the summer, as previously reported in Thailand¹².

Data from this study indicate an altitude of distribution for each blow fly species in mixed deciduous forests (*e.g.*, Huey Tueng Tao reservoir, Doi Suthep-Pui Mt., Doi Nang Kaew and Doi Khun Tan). On the basis of restricted distribution at various altitudes, some species, such as *C. pinguis*, *C. thanomthini*, *Hy. tumrasvini*, *L. papuensis*, and *L. porphyrina* are likely to prevail in highland areas. This observation correlates with

Table 2
Species composition of blow flies collected in northern Thailand during 2007 and 2008

Species	Altitude (metre above sea level)				Total
	300-450	451-600	751-900	901-1,050	
<i>Achoetandrus rufifacies</i>	191	8	3	1	203
	10	5	0	1	16
	3	1	0	0	4
<i>A. villeneuvi</i>	8	4	3	3	18
	0	8	2	2	12
	0	10	0	6	16
<i>Chrysomya chani</i>	2	24	3	3	32
	0	66	4	11	81
	0	79	3	1	83
<i>C. pinguis</i>	0	5	37	192	234
	0	19	2	10	31
	0	23	4	28	55
<i>C. megacephala</i>	342	43	87	161	633
	57	25	28	15	125
	40	100	16	31	187
<i>C. thanomthini</i>	0	0	0	5	5
	0	0	0	0	0
	0	0	0	1	1
<i>Ceylonomyia nigripes</i>	0	0	0	0	0
	0	5	0	0	5
	0	4	0	0	4
<i>Hemipyrellia ligurriens</i>	2	0	0	0	2
	11	0	0	0	11
	14	0	0	0	14
<i>H. pulchra</i>	0	0	0	0	0
	0	0	0	1	1
	0	0	0	0	0
<i>Hypopygiopsis infumata</i>	1	7	1	0	9
	0	1	0	0	1
	1	1	0	0	2
<i>Hy. tumrasvini</i>	0	0	0	0	0
	0	0	0	4	4
	0	0	0	0	0
<i>Lucilia papuensis</i>	0	0	11	14	25
	8	3	0	7	18
	0	2	0	1	3
<i>L. porphyrina</i>	0	5	24	71	100
	0	0	0	27	27
	2	84	13	37	136
<i>L. sinensis</i>	0	0	0	1	1
	0	0	0	0	0
	0	15	1	0	16

Numbers in the yellow line represent summer collection (March 2008), those in the blue line represent rainy season collection (July 2007) and those in the orange line represent winter season collection (December 2007).

data from previous investigations conducted in southeast Asian countries, e.g., Thailand, Malaysia, Singapore, Cambodia, Laos, Vietnam, and the Philippines^{3,7-9}. Interestingly, *C. megacephala* is widespread as it was commonly collected from lowland to highland areas. A previous study revealed that *C. megacephala* appears to spread up to the highest peak of Inthanon mountain in Chiang Mai province (2,667 meters above sea level) (KL Sukontason, unpublished data), suggesting strong adaptation to a man-made environment at various altitudes from lowland to highland fauna (Fig. 3).

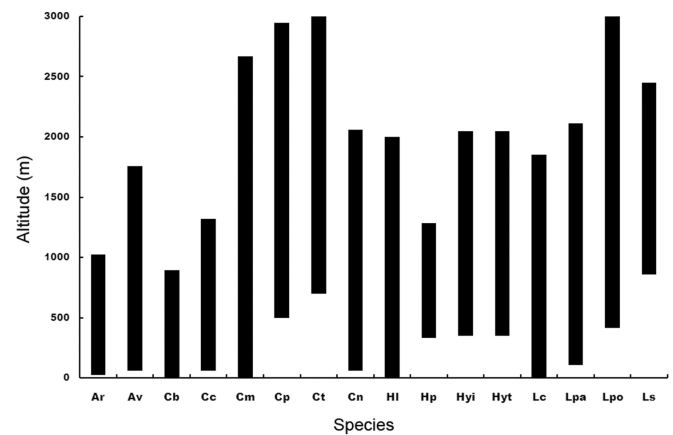


Fig. 3 - Altitudinal distribution of carrion blow flies. Data gathered from Thailand [this study, recent survey in 2013 and TUMRASVIN *et al.*¹⁴], Malaysia and Singapore⁷, Cambodia, Laos and Vietnam⁸ and the Philippines⁹. Abbreviations: Ar, *Achoetandrus rufifacies*; Av, *A. villeneuvi*; Cb, *Chrysomya bezziana*; Cc, *Chrysomya chani*; Cm, *Chrysomya megacephala*; Cp, *Chrysomya pinguis*; Ct, *Chrysomya thanomthini*; Cn, *Ceylonomyia nigripes*; Hl, *Hemipyrellia ligurriens*; Hp, *Hemipyrellia pulchra*; Hyi, *Hypopygiopsis infumata*; Hyt, *Hypopygiopsis tumrasvini*; Lc, *Lucilia cuprina*; Lpa, *Lucilia papuensis*; Lpo, *Lucilia porphyrina*; Ls, *Lucilia sinensis*.

On the other hand, no specimen of *Lucilia cuprina* (Wiedemann), which is another forensically important blow fly, was captured in this study. A possible explanation for this may be the tendency of this species to prevail more in lowland and residential areas, which were not included in this study. *L. cuprina* was collected in and around human habitations, such as restaurants, garbage piles, school cafeterias and paddy fields in the urbanized areas of Ubon Ratchathani⁴, as similarly observed in Phitsanulok province³. However, a study conducted by TUMRASVIN *et al.*¹⁴ in 1978 managed to collect this species at high altitudes up to 1,400 meter, but in very low numbers. It should be noted that the altitudinal distribution of fly fauna varies, based on seasonal changes, even in northern Thailand¹⁴.

In conclusion, the data obtained from this study provides species composition of forensically important blow flies as related to altitude. Based on the fact that several synanthropic species are present at a wide range of altitudes, their application for explaining the re-location of corpses is limited, especially when the immature specimens of these flies are found to be associated. However, in the case of some feral species having unique foci of altitude, such data are crucial for detecting movement of corpses post-mortem, particularly when moved from a high altitude in forested areas to lowland residential areas.

RESUMO

Composição das espécies de moscas-varejeiras do lixo no norte da Tailândia: avaliação da altitude

Distribuição e ocorrência de moscas-varejeiras de importância forense foi realizada durante 2007 e 2008 nas províncias de Chiang Mai e Lampang, norte da Tailândia. Os levantamentos foram feitos em áreas de florestas, durante 30 minutos usando rede de varredura para coletar as moscas atraídas por iscas. Um total de 2115 moscas-varejeiras pertencentes a seis gêneros e 14 espécies foram coletados; *Chrysomya megacephala* (Fabricius) (44,7%), *C. pinguis* (Walker) (15,1%), *C. chani* Kurahashi (9,3%), *C. thanomthini* Kurahashi & Tumrasvin (0,3%); *Achoetandrus rufifacies* (Macquart) (10,5%), *A. villeneuvei* (Patton) (2,2%); *Lucilia papuensis* Macquart (2,2%), *L. porphyrina* (Walker) (12,4%), *L. sinensis* Aubertin (0,7%); *Hemipyrellia ligurriensis* (Wiedemann) (1,3%), *H. pulchra* (Wiedemann) (0,1%); *Hypopygiopsis infumata* (Bigot) (0,6%), *Hy. tumrasvini* Kurahashi (0,2%) e *Ceylonomyia nigripes* Aubertin (0,4%). Dentre elas a *C. megacephala* foi a espécie predominante coletada particularmente no verão. As espécies capazes de predominar nas áreas altas são: *C. pinguis*, *C. thanomthini*, *Hy. tumrasvini*, *L. papuensis* e *L. porphyrina*.

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