

First Medicolegal Forensic Entomology Case of Central Amazon: A Suicide by Hanging with Incomplete Suspension

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Abstract. This report describes the first medicolegal forensic entomology case of Central Amazon. A suicide by hanging took place in a “terra firme” primary forest on an upland plateau. The postmortem interval estimation was calculated on the basis of the biology of the blow fly *Hemilucilia segmentaria* (Fabricius) and also on the ecological succession pattern of the silphid beetle *Oxelytrum cayennense* (Sturm). This is the first case where the ecological information of a beetle was used as a forensic indicator in Brazil. Preliminary studies in the urban area of the city of Manaus, state of Amazonas, and in similar habitats of primary forest in the Reserva Florestal Adolpho Ducke, close to where the case occurred, were instrumental in helping the postmortem interval estimation.

Keywords: Central Amazonia; Forensic Entomology; Postmortem interval.

Primeiro Caso de Entomologia Médico-legal da Amazônia Central: Um Suicídio por Enforcamento com Suspensão Incompleta

Resumo. Este relato descreve o primeiro caso de entomologia forense médico-legal na Amazônia Central. Um suicídio por enforcamento ocorrido em um platô de “terra firme” em floresta primária. A estimativa de intervalo pós-morte foi calculada com base na biologia da mosca varejeira *Hemilucilia segmentaria* (Fabricius) e também pelo padrão de sucessão ecológica do besouro silfideo *Oxelytrum cayennense* (Sturm). Este é o primeiro caso onde as informações ecológicas de um besouro foram usadas como indicador forense no Brasil. Estudos preliminares realizados em área urbana na cidade de Manaus e em hábitat semelhante em floresta primária, na Reserva Florestal Adolpho Ducke, próximo do local onde o caso ocorreu, foram fundamentais para ajudar para a estimativa do intervalo pós-morte.

Palavras-chave: Amazônia Central; Entomologia Forense; Intervalo Pós-morte.

Warning: This Article has Pictures of Corpse

On July 23rd, 2012, the body of a 38 year old male Brazilian Indian, in the decay stage, was found in incomplete suspension (partially hanged) by the neck, in a “terra firme” area of dense rainforest 2°54'37.2”S 59°59'38.1”W, (Figure 1) near the AM-010 highway. The deceased was last seen alive in July 15th, 2012. The neck was tied up by a liana that was naturally hanging from one of the trees. The skeletonized head was tilted opposed to the knot (Figure 2). Forensic examination found no evidence of struggle or defensive wounds on the body, and death was attributed to suicide by hanging.

This is the first case report in Central Amazon with the postmortem interval (PMI) furnished by entomological data. This medicine legal forensic entomology case is very significant because there is little scientific information available in the literature that allows for the application of PMI. One of the only known studies was done by SHALABY *et al.* (2000) in Hawaii (USA), but it was based on pig carcasses totally suspended by the neck.

MATERIAL AND METHODS IN THE FIELD AND IN THE LABORATORY

On July 24th, 2012, The INPA forensic entomologists were able to process the place where the corpse was found. Five soil samples

were collected in the decomposition island and its surroundings. The entomological evidence was analyzed in the **Laboratório de Entomologia Sistemática, Urbana e Forense** (LESUF-INPA): 300 third instar (L3) larvae of Diptera, 287 belonging to the family Calliphoridae and 13 to the family Sarcophagidae. From the former, 179 were killed in hot water (*in locus* and counted in the laboratory) and fixed in 80% ethanol, and the remaining 108 were placed in rearing cages for adult emergence. From the latter, 9 were killed and 4 were reared. The larvae were fed with rotten beef, and vermiculite was used as a substrate for pupation. These cages were maintained at a temperature of 27.5°C (±1°C of variation, close to the average local temperature according to the “Instituto Nacional de Meteorologia - IMMET) and relative humidity of 75% in a TECNAL BOD.

In addition, 7 adults and 10 larvae (8 probably L2 and L3) of *Oxelytrum cayennense* (Sturm) (Silphidae, Coleoptera) (Figure 3) were also collected and the larvae killed in hot water. The emerging adult flies were identified with the key of MELLO (2003). The adult Silphidae were identified with the key of ALMEIDA & MISE

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(2009). All insects were deposited as vouchers in the Invertebrate Collection of INPA.



Figure 1. Satellite view of the site with plotted coordinates (Google Maps-12/08/2004, 4 1.4Km altitude).



Figure 2. Corpse in the site.



Figure 3. Adult of *Oxelytrum cayennense* collected on July 24th, 2012.



Figure 4. Adult of *Hemilucilia segmentaria* collected as a third instar larva on July 24th, 2012 and reared at LESUF-INPA.

RESULTS AND DISCUSSION

Of the 108 reared third instar larvae, only 20 emerged and were identified as *Hemilucilia segmentaria* (Fabricius) (Figure 4). The biology of this species was described by THYSSEN (2005) in the laboratory and by BARROS-DE-SOUZA *et al.* (2012) under natural conditions in Central Amazon. The temporal distribution of this species, and other blow flies of forensic importance, was studied by URURAHY-RODRIGUES *et al.* (2013). The biology of *O. cayennense* was not described yet, but its possible ecological succession pattern was described by URURAHY-RODRIGUES *et al.* (2010). These studies developed in Central Amazon were used for PMI estimation. The accumulated degree days (ADD) and the period of insect activity (PIA) were calculated for *H. segmentaria* (AMENDT *et al.* 2007), and the PIA for *O. cayennense* was estimated based on the ecological succession pattern of its larvae.

Twenty *H. segmentaria* specimens emerged as adults and the first was considered the oldest (sampled). They were collected on July 24th, 2012, the pupation occurred on July 26th, 2012, and the adults emerged on August 1st, 2012, eight days after sample collection (Table 1). According to BARROS-DE-SOUZA *et al.* (2012) the developmental time from egg to adult for this species can be almost 11 days (10.7 if considering a temperature of $28.03 \pm 1.60^{\circ}\text{C}$, the closest possible temperature to the case in question for Central Amazon). This suggests a PIA of three days beginning on July 21st, 2012 (Table 1).

In addition, a 60.45 ADD (degree days for July 21st-22nd, 2012, were calculated based on data from IMMET, mean environmental temperature of 27.5°C and minimal threshold temperature of 10°C ; and for the 23rd-24th a constant of 32°C was used based on maggot mass aggregated in the soil) suggests the same period: 3 days before the collection of soil samples. However, the ecological succession pattern of *O. cayennense* suggests that death occurred on July 18th-19th, 2012, at least five to six days before collection. According to URURAHY-RODRIGUES *et al.* (2010), in a study using pig models, this has to be the minimum time after death since there were active L1 silphid larvae on the carcass on July 24th, 2012 (Table 1).

The presence of L2-L3 (probably) larvae (Table 1), and not only L1, of *O. cayennense* suggests that the colonization by silphids could have occurred before July 18th-19th, 2012. It is in accordance with the information yielded by the investigation that the deceased was last seen alive on July 15th, 2012 (Maximum PMI). The difference between the maximum and minimum PMI could be due to the time lapse from the moment in which the beetles reach the corpse and lay eggs to the development of L3 (probably) larvae. It is possible that the L3 larva of *H. segmentaria* in the soil sample was not the oldest insect present on the site. This fact may be explained by: a) pupae were not present in the

soil samples; b) the absence of pupae of *H. segmentaria* may be related to the incomplete suspension of the corpse, since the larvae can fall down from the body and, due to competition or lack of resources in the new microenvironment ('drip zone'), have their survival and pupation processes negatively affected (SHALABY *et al.* 2000); c) the fly's larvae could have been preyed on by adults of *O. cayennense*, as observed in this case (Figure 5) and also by URURAHY-RODRIGUES *et al.* (2010) on experiments with pig carcasses in similar habitat.

Table 1. Period of Insect Activity estimative (PIA). Columns from left to right: Date, *Hemilucilia segmentaria* development rearing in LESUF, (PIA), *Oxelytrum cayennense* date of material sampled, (PIA). Cells marked with # indicate the date when the insect was sampled, and those marked with * indicate the estimated dates for the insect colonization of the corpse. L1: First instar larvae; L3: Third instar larvae.

Date	<i>Hemilucilia segmentaria</i>	PIA	<i>Oxelytrum cayennense</i>	PIA
15/07/2012				
16/07/2012				
17/07/2012				
18/07/2012*				6*
19/07/2012*				5*
20/07/2012				4
21/07/2012*		11*		3
22/07/2012		10		2
23/07/2012		9		1
24/07/2012#	L3#	8	L1-L3#	
25/07/2012		7		
26/07/2012	Pupae	6		
27/07/2012		5		
28/07/2012		4		
29/07/2012		3		
30/07/2012		2		
31/07/2012		1		
01/08/2012	Adult			
02/08/2012				

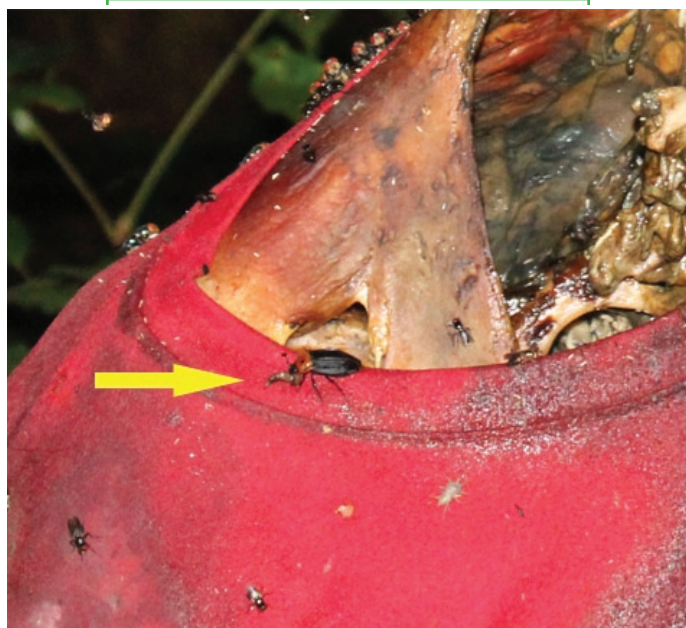


Figure 5. Arrow indicating an adult of *Oxelytrum cayennense* preying on a Diptera larva on the corpse.

Finally, after all the considerations discussed above, there is a possibility that the victim was dead in the day after his disappearance.

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