

ESTIMATION OF POST MORTEM INTERVAL THROUGH FLY LIFE CYCLE ON WHISTAR RATS IN MEDAN

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Background : In deaths related to criminal cases, one of the most important things is determining post mortem interval. Estimation of PMI can be determined from changes that occur in dead bodies such as fall in body temperature, body bruising, post mortem rigidity and putrefaction. After the process of putrefaction, the estimation of PMI is rather difficult. In such case, estimation of PMI using the life cycle of a fly which begins laying eggs, developing into instar I, II, III, prepupa, pupa and becoming flies.

Method: Observational research using 20 healthy male whistar rats aged 3-4 months with a body weight of 150-250 grams divided into 4 quadrants, having been dislocated in the cervical bone and slashed in the abdomen with 1 cm long and left to decay. When there were larvae in the sample, 5 largest larvae were taken in each sample. The collection of larvae was carried out every day at the same hour. The larvae were terminated by soaking them in 70% alcohol solution for 4 hours and then measurements of the larvae was done in the Biology Laboratory of the Faculty of Mathematics and Natural Sciences, besides that the samples were also taken and reared at the FMIPA Laboratory and identification was done by the Biologists.

Result : The development of the life cycle in quadrants 1 and 2 is almost similar to that of coastal conditions, whereas the development of the life cycle of the flies is influenced by geography, the state of temperature, the rain and humidity. Likewise with quadrants 3 and 4 which have almost similarities because these two locations but are far from the coast and close to settlements. The type of fly encountered are *Chrysoma* Sp and *Lucilia* Sp, and there is no difference in the genus of fly larvae in dead whistar rats located near the coast and far from the coastal area where this study was conducted on the type of external fly species, The largest random sampling was done.

Conclusion : PMI estimation in the city of Medan is 12 days with the identification of the fly types encountered as follows, *Chrysoma* Sp dan *Lucilia* Sp.

Keywords : PMI, larvae length

Introduction

In deaths related to criminal cases, one of the most important things is determining post mortem interval. Estimation of PMI can be determined from changes that occur in dead bodies such as fall in body temperature, body bruising, post mortem rigidity and putrefaction.¹

One of them in determining the corpse examination that has been decaying is by looking at the organisms that breed on the corpse. One of the organisms that breed and is attracted to the corpse is a fly.

In our flies can also help estimate the location of death, whether the corpse has been moved from the scene based on several factors such as humidity, temperature, exposure to light, height in geography inside/outside the room and exposure to such bodies such as poisoning, burning corpses etc.

The life cycle of a fly that is eggs-larvae-prepupa-pupa-flies⁵. This period can be used in estimating PMI. Not all flies put eggs on the corpse but there are developments in flies by hatching the eggs in the parent body of the fly (ovovivipar).

The Life Cycle of The Fly and The Stage of Decay

Flies are ordo of dipterae which are ordo from insect classes with the largest population. Flies are found in almost all habitats spread throughout the world. The three families of flies that play a role in Forensic entomology are the family Calliphoridae, Sarcophagidae and Muscidae^{2,4}. All three belongs to the subordo of Cyclorrhapha⁵.

The stage of carcass decay and its relationship with the types of flies that come to it (Gennard-2007/ Byrd and Castner -2010) are divided into 5 stages :

- Stage 1 (Fresh Stage)
This stage is characterized by the abdomen the carcass begins to swell. The first flies that come at this stage are the family calliphoridae and sarcophagidae.
- Stage 2 (Bloated Stage)
This abdomen of the carcass is larger. Very many flies come because of the smell that the carcass emits. The highest of family Calliphoridae and Sarcophagidae flies is obtained at this stage.
- Stage 3 (Active Decay Stage)
The skin of the carcass is peeled and swollen blackish. At this stage many muscidae flies come to the carcass. At this stage the carcass while Calliphoridae and Sarcophagidae flies have left the carcass. At this stage the carcass is filled with Calliphoridae and Sarcophagidae fly larvae.
- Stage 4 (Post Decay Stage)
The carcass begins to dry out and only skin, cartilage, bones and hair are left. This stage is also characterized by a decrease in the population of flies.
- Stage 5 (Skeletonization)
Which only leaves and bones in the carcass. Flies are no longer found in the carcass.

Results

Table I : Measurements of Larvae Length Every Day and Photos of Larvae in Quadrant I (Medan Marelan)







HARI	PENGAMATAN	FOTO
H0	Rats were dislocated in the cervical bone and slashed in the abdomen with 1 cm long and place at 10.00 o'clock	
H1	Found larvae of instar I broken white 2 mm. (at 10.00 o'clock)	
H2	Found larvae of instar II blackish white dengan panjang 5,2 mm. (at 10.00 o'clock)	
H3	Found larvae of instar III brownish white with length 11 mm. (at 10.00 o'clock)	
H4	Still the same as H3	
H5	Still the same as H4	
H6	Found prepupa black with length 10 mm (at 10.00 o'clock)	
H7	Still the same as H6	
H8	Found brownish black pupa with length 7 mm. (at 10.00 o'clock)	
H9	Still the same as H8	
H10	Still the same as H9	
H11	Still the same as H10	
H12	Identification of the fly types encountered as followed: <i>Crysoma</i> Sp	

Table II : Measurements of Larvae Length Every Day and Photos of Larvae in Quadrant II (Medan Labuhan)






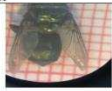
HARI	PENGAMATAN	FOTO
H0	Rats were dislocated in the cervical bone and slashed in the abdomen with 1 cm long and place at 11.00 o'clock	
H1	Found larvae of instar I broken white with length 4,5 mm (at 11.00 o'clock)	
H2	Found larvae of instar II white and black with length 9 mm (at 11.00 o'clock)	
H3	Found larvae of instar III brownish white with length 16 mm (at 11.00 o'clock)	
H4	Still the same as H3	
H5	Still the same as H4	
H6	Still the same as H5	
H7	Still the same as H6	
H8	Found brownish black prepupa with length 10 mm. (at 11.00 o'clock)	
H9	Found brownish black pupa with length 8 mm. (at 11.00 o'clock)	
H10	Still the same as H9	
H11	Still the same as H10	
H12	Still the same as H11	
H13	Identification of the fly types encountered as followed: <i>Lucilia</i> Sp	

Table III : Measurements of Larvae Length Every Day and Photos of Larvae in Quadrant III (Medan Baru)








HARI	PENGAMATAN	FOTO
H0	Rats were dislocated in the cervical bone and slashed in the abdomen with 1 cm long and place at 09.00 o'clock	
H0	Found laying of egg white oval shape with length 1,5 mm at 17.30 o'clock	
H1	Found larvae of instar I broken white with length 2 mm. (at 17.30 o'clock)	
H2	Found larvae of instar II broken white with length 4 mm (at 17.30 o'clock)	
H3	Masih sama dengan H2	
H4	Found larvae of instar III brownish white with length 13 mm (at 17.30 o'clock)	
H5	Still the same as H4	
H6	Still the same as H5	
H7	Found blackish brown prepupa with length 10 mm. (at 17.30 o'clock)	
H8	Found brownish black pupa with length 8 mm. (at 17.30 o'clock)	
H9	Still the same as H8	
H10	Still the same as H9	
H11	Identification of the fly types encountered as followed : a. <i>Crysoma</i> Megacephala b. <i>Lucilia</i> Sp	

Table IV : Measurements of Larvae Length Every Day and Photos of Larvae in Quadrant IV (Medan Amplas)








HARI	PENGAMATAN	FOTO
H0	Rats were dislocated in the cervical bone and slashed in the abdomen with 1 cm long and place at 12.00 o'clock	
H0	Found laying of egg white with length 0,7 mm at 19.00 o'clock	
H1	Found larvae of instar I broken white with length 2,1 mm. (at 19.00 o'clock).	
H2	Found larvae of instar II white and black with length 5,1 mm (at 19.00 o'clock).	
H3	Still the same as H2	
H4	Found larvae of instar III brownish white with length 16 mm (at 19.00 o'clock).	
H5	Still the same as H4	
H6	Found brownish black prepupa with length 9 mm (at 19.00 o'clock).	
H7	Still the same as H6	
H8	Found brownish black pupa with length 6,5 mm. (at 19.00 o'clock).	
H9	Still the same as H8	
H10	Still the same as H9	
H11	Still the same as H10	
H12	Identification of the fly types encountered as followed : <i>Crysoma</i> Megacephala	

Table V Identification of Flies in Medan City




No	Quadrant	Type a Fly	Photo
1	I (Medan Mareland)	Chrysoma Sp	
2	II (Medan Labuhan)	Lucilia Sp	
3	III (Medan Baru)	a. Chrysoma Megacephala b. Lucilia Sp	

Table VI The Development of The Fly Life Cycle

No	Development	Length	Fly Life Cycle	Time of Cycle
1	Laying egg / Quadrant	I	-	H0
		II	-	H0
		III	1,5mm	H0
		IV	0,7mm	H0
2	Larvae of Instar I / Quadrant	I	2mm	H1
		II	4,5mm	H1
		III	2mm	H1
		IV	2,1mm	H1
3	Larvae of Instar II / Quadrant	I	5,2mm	H2
		II	9mm	H2
		III	4mm	H2
		IV	5,1mm	H2
4	Larvae of Instar III / Quadrant	I	11mm	H3
		II	16mm	H3
		III	10mm	H4
		IV	16mm	H4
5	Prepupa / Quadrant	I	10mm	H6
		II	10mm	H8
		III	10mm	H7
		IV	9mm	H6
6	Pupa / Quadrant	I	7mm	H7
		II	8mm	H9
		III	8mm	H8
		IV	6,5mm	H8
7	Flies / Quadrant	I	-	H12
		II	-	H13
		III	-	H11
		IV	-	H12

Table VII Estimation Of Post Mortem Interval Through Fly Life Cycle in Medan City

Quadrant/Area	Type of Fly	Development of Flies	Length	Estimation Of PMI
I Medan Mareland, Part of Medan Belawan, Part of Medan Deli, Part of Medan Labuhan	Chrysoma Sp	Laying egg	-	-
		Larvae of Instar I	2,0 mm	1-2 day
		Larvae of Instar II	5,2 mm	2-3 day
		Larvae of Instar III	11,0mm	3-4 day
		Prepupa	10,0mm	6-8 day
		Pupa	7,0 mm	8-12 day
II Part of Medan Labuhan, Part of Medan Deli	Lucilia Sp	Laying egg	-	-
		Larvae of Instar I	4,5 mm	1-2 day
		Larvae of Instar II	9,0 mm	2-3 day
		Larvae of Instar III	16,0mm	3-8 day
		Prepupa	10,0mm	8-9 day
		Pupa	8,0 mm	9-11 day
III Medan Baru Medan Tuntungan, Medan Selayang, Medan Sunggal, Medan Helvetia, Medan Petisah, Part of Medan Johor, Part of Medan Polonia, Part of Medan Timur	1. Lucilia Sp 2. Chrysoma Megacephala	Laying egg	1,5 mm	1 day
		Larvae of Instar I	2,0 mm	1-2 day
		Larvae of Instar II	4,0 mm	2-4 day
		Larvae of Instar III	13,0mm	4-7 day
		Prepupa	10,0mm	7-8 day
		Pupa	8,0 mm	8-11 day
IV Medan Amplas, Medan Denai, Medan Area, Medan Tembung, Medan Perjuangan, Medan Maimun, Part of Medan Johor, Part of Medan Timur, Part of Medan Polonia	Chrysoma Megacephala	Laying egg	0,7 mm	>11 day 1 day
		Larvae of Instar I	2,1 mm	1-2 day
		Larvae of Instar II	5,1 mm	2-4 day
		Larvae of Instar III	16,0 mm	4-6 day
		Prepupa	9,0 mm	6-8 day
		Pupa	6,5 mm	8-12 day

Discussion

The samples in this study were 20 whistar rats aged 3-4 months weighing 150-250 grams which were divided into 4 quadrants are divided based on terrain city maps and are cut horizontally and vertically straight lines.

Estimation of PMI can be determined from life cycle of a fly which begins laying eggs, developing into instar I, II, III, prepupa, pupa and becoming flies.

Sometimes flies don't directly but sometimes hatch in the body of flies. On the development of the fly's life cycle we will also measure its length to see the size of each quadrant in the city of Medan and will asses the types of fly in the City of Medan.

- Quadrant I : Medan Mareland, sebagian Medan Belawan, Part of Medan Deli and Part of Medan Labuhan

In this area the types of fly found is Chrysoma Sp.

Estimation of PMI under 1 day can't be determined by the method in this area because any rats that have been left to rot 1 day are not found.

Estimation of PMI in whistar rats 1-2 days if found length of 1 mm of instar larvae 1.

Estimation of PMI in whistar rats 2-3 days if found length of 5,2 mm of instar larvae 2.

Estimation of PMI in whistar rats 3-6 days if found length of 11 mm of instar larvae 3.

Estimation of PMI in whistar rats 6-8 days if found length of 10mm of prepupa.

Estimation of PMI in whistar rats 8-12 days if found length of 7mm of pupa.

The life cycle of flies in this quadrant 1-12 days

- Quadrant II : Part of Medan Labuhan and Part of Medan Deli
In this area the types of fly found is *Lucilia* Sp.

Estimation of PMI under 1 day can't be determined by the method in this area because any rats that have been left to rot 1 day are not found.

Estimation of PMI in whistar rats 1-2 days if found length of 4,5mm of instar larvae 1.

Estimation of PMI in whistar rats 2-3 days if found length of 9mm of instar larvae 2.

Estimation of PMI in whistar rats 3-8 days if found length of 16mm of instar larvae 3.

Estimation of PMI in whistar rats 8-9 days if found length of 10mm of prepupa.

Estimation of PMI in whistar rats 9-13 days if found length of 8mm of pupa.

The life cycle of flies in this quadrant 1-13 days

- Quadrant III : Medan Marelan, Medan Tuntungan, Medan Selayang, Medan Sunggal, Medan Helvetia, Medan Petisah, Part of Medan Johor, Part of Medan Polonia and Part of Medan Timur.

In this area the types of fly found is *Lucilia* and *Chrysoma Megacephala*.

Estimation of PMI in Whistar Rats 1 days if found length of 1,5mm of egg.

Estimation of PMI in whistar rats 1-2 days if found length of 2mm of instar larvae 1.

Estimation of PMI in whistar rats 2-4 days if found length of 4mm of instar larvae 2.

Estimation of PMI in whistar rats 4-7 days if found length of 13mm of instar larvae 3.

Estimation of PMI in whistar rats 7-8 days if found length of 10mm of prepupa.

Estimation of PMI in whistar rats 8-11 days if found length of 8mm of pupa.

The life cycle of flies in this quadrant 1-11 days

- Quadrant IV : Medan Amplas, Medan Denai, Medan Area, Medan Tembung, Medan Perjuangan, Medan Maimun, Part of Medan Johor, Part of Medan Polonia and Part of Medan Timur.

In this area the types of fly found is *Chrysoma Megacephala*.

Estimation of PMI in Whistar Rats 1 days if found length of 0,7mm of egg.

Estimation of PMI in whistar rats 1-2 days if found length of 2,1mm of instar larvae 1.

Estimation of PMI in whistar rats 2-4 days if found length of 5,1mm of instar larvae 2.

Estimation of PMI in whistar rats 4-6 days if found length of 16mm of instar larvae 3.

Estimation of PMI in whistar rats 6-8 days if found length of 9mm of prepupa.

Estimation of PMI in whistar rats 8-12 days if found length of 6,5mm of pupa.

The life cycle of flies in this quadrant 1-12 days

In this case the development of the life cycle of the fly in quadrants 1 and 2 is almost similar due to the conditions of the location close to the coast, where the development of the fly life cycle is influenced by geography, natural conditions such as temperature, humidity and rainfall. So also in quadrants 3 and 4 which have almost similarities because these two locations are far from the coast and close to the settlement in accordance with previous studies (Hanan Anwar Rusidi).

In this study the types of flies encountered *Chrysoma* Sp and *Lucilia* Sp, that there was no difference in the genus of fly larvae in dead whistar rats near the coast and far from the coast where this study perched on the species of external flies. Random sampling with the largest.

In this study no measurements of temperature, humidity and high rainfall were carried out and looked at the types of fly life cycles based on flies species perched. So that the next research would be carried out specifically in terms of the factors in the cycle

Conclusin

PMI estimation in the city of Medan is 12 days with the identification of the fly types encountered as follows, *Chrysoma* Sp dan *Lucilia* Sp.

Suggestion

Reseach on Forensic Entomology in Indonesia is very little while this knowledge is very useful in the development of Forensic Medicine.

The role of Forensic Entomology is very important in terms of determining PMI, so that in the future it is expected that the development and reseach of this field will be ider so that the results can be utilized to thr maximum extent possible.

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