Differences in Development Time of Green Fly Larvae (Calliphoridae) on Mice (Mus musculus) Carcasses Between Medan City and Berastagi City

Said Muzani, Agustinus Sitepu, Adriansyah Lubis, Ismurrizal, Doaris Ingrid Marbun

zali.doctor46@gmail.com

Forensic and Medicolegal Study Program, Faculty of Medicine, University of North Sumatra, Dr. Mansyur Street No. 5 Medan 20155, Indonesia

Abstract

The green fly family Calliphoridae is the most important taxon in forensic entomology. These flies immediately colonize corpses immediately after death. studying insect populations including larval development is useful for estimating post-mortem times. However, the development of insects, including flies, is greatly influenced by environmental factors, one of which is geographical location. This research aims to compare the length of development of the life cycle of green fly larvae and the time difference between geographical types, namely Medan City and Berastagi City, as well as the time difference between the two. Using descriptive observational research with a prospective research design. Variables are measured at the same time as the research takes place. Research using primary data to determine the duration of the larval life cycle in each of 3 (three) samples of mice (Mus musculus) aged 2-3 months and weighing 20-25 grams at the Medan and Berastagi locations. A dislocation was carried out on the mice's necks and a 5 cm incision was made on the mice's stomachs and the changes in the samples were seen by examining each phase of the life cycle of the development of green fly larvae from egg to pupa and identifying the flies in the samples. There is a comparison of the development of green fly larvae of the Calliphoridae family in the Medan area and the Berastagi area. The development of Calliphoridae fly larvae in Medan from egg to imago phase is 208 hours (8.6 days) while in Berastagi it is 272 hours (11.3 days). The difference between the development of calliphoridae fly larvae between Medan City and Berastagi City is 64 hours (2.5 days).

Keywords: Calliphoridae; Fly larvae; Mus musculus

1. Introduction

The time of death can be determined by identifying the changes that occur, such as identifying flies found on a corpse. Flies are the first living creatures to land on a corpse, sometimes within minutes of death. Flies are also the most important species in forensics. Apart from that, flies are also found in large numbers so it is more likely that flies can be used to predict the time of death. The time between flies laying eggs until they form a developmental stage can be used to estimate the time of death. Factors that influence the development of fly larvae are factors that can also indirectly determine the length of time of death, such as the presence or absence of free air, environmental temperature, body temperature and the location of the carcass indoors or outdoors. Another determining factor is the geographic location of an area which can influence the size of the larvae and the type of fly larvae. Identification of changes in fly shape can also be used to determine the dose of drugs contained in the body of a corpse. Not only using larvae, determining the age of adult flies can also be used to determine the time of death.

2. Method

This research is research using descriptive analytics with a prospective research design. Variables are measured at the same time as the research takes place. Research using primary data to determine the development of fly larvae on mouse carcasses in the Medan and Berastagi areas. This research was conducted in the city of Medan and Berastagi City. The population in this study were mice that were killed. The samples in this study were freshly dead mice placed in Medan City and Berastagi City. The research will be carried out starting in December 2023-finish. This research consists of two variables, namely independent and dependent variables. The independent variable in this study is the difference in time to death, while the dependent variable in this study is the development time of fly larvae.

3. Results

Based on observations of the development of green fly larvaeCalliphoridae in Medan City, it can be seen that the entire life cycle of larvae until they become adults takes approximately 208 hours (8.6 days). Where the egg hatch phase becomes the first instar larva 8 hours, the first instar to the second instar takes 16 hours, the second instar larva to the third instar takes 24 hours, the third instar larva goes to the prepupa phase for 24 hours, the third instar goes to the prepupa phase for 16 hours and the pupa phase to imago is 120 hours. Research by Salimi et al (2018) on another type of calliphoridae fly of the genus Chrysomya: (calliphoridae) found a similar duration, namely around 8.5 days from egg emergence to adult flies. Based on observations of the development of Calliphoridae green fly larvae in Berastagi City, it can be seen that the entire life cycle of Calliphoridae flies from egg emergence to imago at locations in Berastagi City takes approximately 272 hours (11.3 days). Where the egg hatch phase becomes the first instar larva 8 hours, the first instar to the second instar takes 16 hours, the second instar larva to the third instar takes 24 hours, the third instar larva goes to the prepupa phase for 72 hours, the third instar goes to the prepupa phase for 24 hours and the pupa phase to imago is 128 hours. The results of this research are in line with Simatupang (2020) who found that in Wistar rat carcasses in the highlands of Toba district it took 11-13 days for Calliphoridae flies to complete their life cycle. Several factors influence the duration of a fly's life cycle, one of which is air temperature. Air temperature and air humidity both have an important role for the blowflies fauna, including green flies. Temperature affects insect development, growth, and behavior. Insects are poikilothermic animals, that is, animals that cannot regulate their body temperature and internal temperature and vary along with the temperature of the surrounding environment. As a result, the development of insects such as flies will be faster when the average temperature is around 28-32 °C, and develop much more slowly in cool conditions (Palumbo, 2011). Calliphoridae is a type of fly that is very commonly found in various types of locations and altitudes. These flies at temperatures require 7 -14 days to complete their life cycle depending on environmental conditions. During observations it was also found that there were similar growth patterns between green fly larvae in Medan and Berastagi. However, this pattern is seen only from the egg stage to the second instar, which both require 48 hours or 2 (two) days. However, when larval development enters the third instar larval phase, there is a difference in the duration of the larval development phase, namely that larvae in Medan City complete their third instar larval phase more quickly than those in the Berastagi City location. The third instar larvae in Medan City only lasted 24 hours while the third instar larvae in Berastagi City lasted 72 hours. This also occurs in the Pupa phase where exclosure (exfoliation) of the pupa becomes the imago phase (adult fly) in Medan City faster than in Berastagi City. Pupae in Medan City only need 120 hours to mature while in Berastagi City it takes 128 hours longer. This is of course closely related to the differences in the geographical conditions of the two regions. Medan City is an area with lowland topography which has a maximum-minimum temperature range32° / 24° C. where this temperature is the ideal and optimum temperature for the development of Calliphoridae type flies,Meanwhile the regionBerastagi City 18° / 25° where low temperatures affect the rate of development of flies. This difference is an important factor in the development of larvae into adult flies. Based on research by Ichsan et al.(2016) at high temperatures, the duration of development of pre-adult flies will be faster, compared to temperatures lower than the optimum temperature, this is related to the metabolic rate and activity of the larvae being low so that their development is slow. The optimum temperature for survival and rate of development of pre-adults or development from eggs to adults of flies is 28oC. The pattern of the relationship between the influence of temperature on the development period (longevity) of pre-adults is formed. exponential equation pattern (Trianto et al, 2020).The density of the larval population is also considered to influence the development of green fly larvae in Medan and Berastagi. The green fly larvae in Medan appear to be more numerous than the population of fly larvae in Berastagi, this makesGreen fly larvae in Medan must compete more with green fly larvae in Berastagi in terms of food availability. This causes flies to have to compensate by completing their life cycle more quickly (Salimi et al, 2018).Based on the results of observations of larval development in the Medan City and Berastagi City areas in this study, it was found that there was a difference between the development time of Calliphoridae larvae from egg to adult phase in Medan City.and Berastagi City is about 64 hours or about two and a half days.

4. Conclusion

There is a comparison of the development of Calliphoridae fly larvae in the Medan and Berastagi areas. The development of Calliphoridae fly larvae in Medan City from egg to imago phase is 208 hours (8.6 days) while in Berastagi City it is 272 hours (11.3 days). The difference between the development of Calliphoridae fly larvae between Medan City and Berastagi City is 64 hours (2.5 days).

.

Anknowledgements

Thank you to the USU FMIPA laboratory staff and the Head of the USU FK USU Forensic and Medicolegal Medicine Study Program.

References

BPS. crime rate in Indonesia 2022,https://www.google.com/search?client=firefox- b-d&q=data+crime+city+medan+2022

Idris, AM 2013 Practical Guidelines for Forensic Medicine. Jakarta: Sagung Seto.

Ihsan, IM, Hidayati, R., Hadi, UK 2016. The Effect of Air Temperature on Fecundity And Preadult Development of House Flies (Musca Domestica). Technology Journal Environment,17(2): 100.

Isfandiari, AB, Suharto, G., Kirana LB, SK 2009. Differences in the genus of dead Wistar rat fly larvae in the high and lowlands of Semarang. Thesis. Semarang: Faculty of Medicine, Diponegoro University.

Ismail, I. 2018. Various types and activities of decomposer flies (Diptera: Cyclorrhapha) on white rat carcasses as a forensic indicator. Thesis. Bogor: IPB.

Kumar, R., Shiv, K. 2019. Determining Time of Death Using Forensic Entomology. International Medico-Legal Reporter, 2(3): 7.

Laksmita, AS, Watiniasih, NL, Junitha, IK 2013. Prediction of Length of Death Based on the Presence of Insects of the Genus Lucilia (Calliphoridae) on Mouse (Mus Musculus) Carcasses in Mangrove Forest Locations. Journal of Biology, 16(1): 1. Maley, K., Komasara, L. 2003. VET 120 Introduction to Lab Animal Science. Val Macer.

Mansjoer, A. 2005.Capita Selecta Medicine. Jakarta: Media Aesculapius. M´arquez-Grant, N., Roberts, J. 2012. Forensic Ecology Handbook. UnitedKingdom: Wiley-Blackwell.

Metcalf, JL 2019. Estimating the Postmortem Interval Using Microbes: Knowledge Gaps and A Path to Technology Adoption. Forensic Science International: Genetics, 38: 211.

Muhammad Fernando Manik, MF 2018. Determining the Estimated Time of Death from the Development of the Fly Life Cycle in Wistar Rats in the Medan City Area. Medan Thesis: USU Faculty of Medicine.

Mullen, GR, Durden, LA 2019. Medical and Veterinary Entomology. UK: Academic Press

Pai, C.,Jien, M., Li, L., Cheng, Y., Yang, C. 2007. Application of Forensic Entomology to Postmortem Interval Determination of a Burned Human Corpse: A Homicide Case Report from Southern Taiwan. Formos Med Assoc, 106(9): 792.

Primahatmaja, B., Sardjono, TW, Lestari, N. 2014. Changes in Growth Speed of Chrysomya sp Fly Larvae. on Rat Carcasses Containing Various Levels of Morphine. FKUB Health Magazine, 1(4): 190.

Rusidi, HA, Yulianti, K. 2019. Description of the Genus and Length of Fly Larvae on Wistar Rat Carcasses with Different Geographical Locations in Bali. Udayana Medical Journal, 8(9): 1.

Santi, DN 2001. Fly Control Management. Medan: Faculty of Medicine, University of North Sumatra.

Sharma, A., Bala, M., Singh, N. 2018. Five Case Studies Associated with Forensically Important Entomofauna Recovered from Human Corpses from Punjab, India. J Forensic Sci & Criminal Investigations, 7(5): 001.

Sigit, SH, Hadi, UK 2006. Indonesian Settlement Pests Introduction to Biology & Control. Bogor: Bogor Agricultural Institute.

Sirois, M.. 2005. Laboratory Animal Medicine: Principles and Procedures. United States of America: Mosby Inc.

Sucipto, CD 2011. Tropical Disease Vectors. Yogyakarta: Goysen Publishing.

Suckow, MA, Steven, HW, Craig, LF 2006. The Laboratory Rat. USA: Academic Pr.

Suharsono, Nuryadin, E. 2019. The Effect of Temperature on the Life Cycle of Fruit Flies (Drosophila melanogaster. Bioexperiments, 5(2):114.

Supriyono, Soviana, S., Hadi, UK 2019. Patterns of Arrival of Insects on BodiesAnimals as Indicators in Forensic Activities. Veterinary Journal, 20(3): 418.

Switha, ET, Anwar, C., Dalilah, Ghiffari, A. 2019. The influence of different carcass

placement locations on the growth of fly larvae in rats (Rattus norvegicus). Syifa' MEDIKA, 10(1): 46.

United Nations Office on Drugs and Crime. 2019. Global Study on Homicide: Executive Summary, Vienna: UNODC.

Wanga, M., Chu, J., Wang, Y., Li, F., Liao, M., Shi, H., Zhang, Y., Hu, G., Wang,J. 2019. Forensic Entomology Application in China: Four Case Reports. Journal of Forensic and Legal Medicine, 63: 40.

World Encyclopedia, p2k.stekom.ac.id, 2022https://p2k.stekom.ac.id/ensiklopedia/Mencit

Wardani, DPK, Mulyanto, A. 2019. Identification of Fly Larvae in PostMortem Interval on Rat (Rattus Novergicus) Carcasses Given CiuOplosan at the Science Techno Park, Muhammadiyah University, Purwokerto. Herb-Medicine Journal, 2(1):15.

Wistar Institute, 2020. Our History Philadelphia: The Wistar Institute. Available inhttp://www.wistar.org,Accessed 28 May 2020.

Yermia S. Mokosuli, YS 2001. Health Entomology of Mites and Ticks as Vectors. Bioactivity and Molecular Biology Laboratory, FMIPA UNI