

LIFE TABLE AND LIFE CYCLE *GRAPHIUM EVEMON* (LEPIDOPTERA: PAPILIONIDAE) ON SOURSOP (*ANNONA MURICATA*.)

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Abstract

Butterflies choose one or several particular plant species which are very closely as a place of food and life, as well as *G. evemon*. Soursop plant (*Annona muricata*) is one of the natural food for the *G. evemon* caterpillars. This plant is widely spread both along the highway and in the office complex. Until now there is no research on the life cycle and life table of the *G. evemon* in the soursop plant. However the need of this information is important to preserve the existence of a butterfly as one of pollinating insects to determine the biotic potential of the *G. evemon*. The purposes of this study are to determine the life cycle and morphometric of *G. evemon*. This study uses rearing method and the subject of the study are 30 eggs *G. evemon*. The length of time and morphology of each pre-adult stages of the *G. evemon* was recorded. The calculations in the table are based on the life stage of the development and mortality of each stage of the development of *G. evemon*. The results showed that the average time of the *G. evemon* life cycle on soursop plant was 28 – 50 days. The morphology of each stage has a specific characteristic.

Keywords: *G. evemon*, *Annona muricata*, Life Cycle, morphology and morphometric

1. Introduction

Indonesia is one of megabiodiversity country on plant and animal. One of instance is Butterfly. Butterfly important things supporting various diversity in Indonesia, one of function is pollinating flowers (Bima, 2007). In general, host plant of these butterfly are in wide range. The existing of host plant role are as shelter, food and protection as well (Whitten et al, 1999). Due to its important to role to sustain ecological system need a conserve site to keep maintain its life in the future.

Butterfly is a famous animal because of its beauty. The magnificence of its color and wings which made it become a tourism object. It live is support by existing of host plant as food source on larvae as well as on imago.

Deforestation and land use are example things that disturb butterfly diversity for instace *Graphium agamemnon* known as *Swallowtail Butterfly* because it has a large wings instead of others.

An investigation on alternave plant is needed. One of the good practice is Soursop leaf (*Annona muricata*), it succeeded achieve to imago on *G. Agamemnon*.

Time and place

This research was conducted in March 2016 until July 2016 at the Laboratory of Environmental Research Universitas Pendidikan Indonesia Bandung.

Materials used in this study were *G. evemon*, leaves of soursop, Alcohol 70%, honey bee 10 %, and distilled water. The tools used were jars, cages imago, termohigrometer, insect net, digital cameras, calipers, styerofoam, streo microscopes, calculators, board extenders and specimen boxes.

2. Theoritical Background

3. Method

Pre-study phase

Survey method was conducted by observed butterfly on sousop plant near campus between 09.00 am up to 13:00 pm, these observations include the selection of media laying eggs butterfly *Graphium evemon* around or on the plant soursop (*Annona muricata* L)

Study Phase

Sampling

Egg retrieval was conducted on the fourth day after the pre-study. Preparation of eggs begins with capturing adult male and female butterfly *G. evemon* that were laying eggs around the plant soursop (*A. muricata*). Imago females captured using

insectnet. Imago females were caught and then entered into a mason jar 29 cm diameter coated paper towel and unbiased young leaves along the stem of the plant soursop. Of the 30 eggs obtained, only 30 eggs were sampled in this study. Then leaves that are egg *G. evemon* preserved in jars of 8.5 cm diameter by means of leaf stalks are plugged eggs on a damp sponge. Eggs awaited and observed until hatch into larvae. After hatch into larvae, the larvae were taken 30 and each larva was transferred into a jar diameter of 8.5 cm.

Graphiumevemon

Larvae kept in a jar was topped covered gauze. Each of the jars were filled only one larvae and labeled. As has become a pupa imago, the imago imago transferred into cages measuring 50x50x75 cm.

Morphology Each Stadia in Lifecycle *Graphiumevemon*

Observations were made every day at 9:00 to 13:00 pm. The method used is the method of rearing. Do observations from egg, larva, pupa to imago. At the moment an egg stadia, parameters measured and observed that the color of the egg, egg shape, and size of the diameter of the eggs. After the eggs hatch into larvae, the parameters measured and observed that the color of the larvae, larval body length, diameter of the thorax, caput diameter, and the number of instar stages. The feeding is done every morning and stopped when the larvae enter the stage pupasi. In the pupal stage, the parameters observed were discoloration pupa. The time required for each phase observed from egg to imago phase ie from laying eggs to hatch, change of skin in the larva, the larva changes into a pupa, pupa becomes imago, the imago until death. During the course of each stage *G. evemon*, is recording physical factors include the indoor air humidity and temperature using termohigrometer. When *G. evemon* been out of the pupa, also recorded the date and counting sex ratio (number of males and females). After that, it was noted long life span of each butterfly. Butterfly lethal taken for morphometric measurements. In the thorax butterfly, injected with 70%

alcohol, this is done so that the butterfly is not moldy. Then, the samples are stored temporarily in the bag papilot.

Morphometrics Mounting

Samples removed from the paper papilot, then stabbed in the thorax using a pin parallel to the axis of the body. When they are aligned, then the sample was inserted into a gap spanning the board and set the left and right wing positions, and also the position of the antenna, and covered with waxed paper with a plus pin so that the paper is not shifted. Samples *G. evemon* that has spanned / extenders for mounting on board is dried using artificial oven with a temperature of 45C for ± 2 weeks. The dried samples removed from the board extenders and moved on Styrofoam (Peggy, 2014). Then do the morphometric measurements by measuring the body length, length of the antenna, the length of the front wing, front wing width, wing span, length and width of the rear wing rear wing. Data have been obtained are then analyzed descriptively in narrative form and displayed in the form of tables and figures.

The number of individuals who have survived from egg to imago phase was calculated and recorded.

Data Analysis

The method of analysis in this research was quantitative descriptive. In the descriptive statistical analysis techniques used calculating measures of dispersion (standard deviation) as well as the data presented in the form of: (1) Table. By this analysis will be known tendency of research findings, whether in the category of low, medium or high; (2) Visual like charts (Muhson, 2009).

2. Results and Discussion

In this study, feeding only natural given at instar larval instar of 1 to 5. The average time it takes the life cycle *Graphium evemon* on host plants *Annona muricata* were presented in Table 1.

Tabel 1. Life Cycle of *Graphium agamemnon* Feed on *Annona muricata* leaf

Stadia	Soursop (<i>Annona muricata</i>)			
	N	Kisaran waktu (hari)	Length (mm)	Width (mm)
Egg (d=3mm)	30	1-2	-	-
Instar 1	20	1 – 4	2.5 – 4	1
Instar 2	15	1 – 5	6 – 9	2 – 3
Instar 3	13	1 – 3	8 – 19	3 – 6
Instar 4	12	2 – 5	15 – 21	5 – 7
Instar 5	11	6 – 8	22 – 27	7 – 9
Prepupa	9	1	33 – 43	8 – 10
Pupa	9	14 – 17	31	8
imago	5	1-3	-	-

Description: (*) values in the table are the minimum and maximum values. (X) average. (SD) Standard Deviation.


The average time of the life cycle *Graphium evemon* was 28-50 days. Phase shortest is prepupa with an average time of 1.00 ± 0.00 days (Table 1). The longest is the larval phase with a total average of 11-2 days. In the phase of eggs, hatching time of 30 samples of eggs is 2 days.. The time of each stage varies *Graphium evemon* in the life cycle. The longest occurred in larval stage, this is because the larval stage through several molting (moulting). Factors affecting the life cycle period of which is the


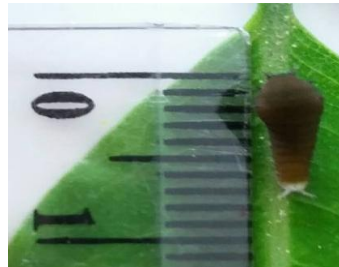

amount of feed consumed and the effects of the hormone responsible for the process of metamorphosis. There feed on the leaves of nutrients needed or used in the process of metabolism and regulating the flow of energy. According Suhara (2009) production of secondary compounds on host plants affect the growth and development of the larval body. Nutritional deficiencies can interfere with metabolic processes that will inhibit the growth and development of the larval body. In addition to nutrition, the hormone regulating the process of metamorphosis was influential on the development of each life stage *Graphiumevemon*. The main hormone that plays a role in the process of metamorphosis is a juvenile hormone and hormone edyson (Hadi et al., 2009). The data obtained in the observations long life cycle time will be used as a reference for the calculation of life tables.



Morphology and Morphometric *G. Evemon* feed on Sousop leaves



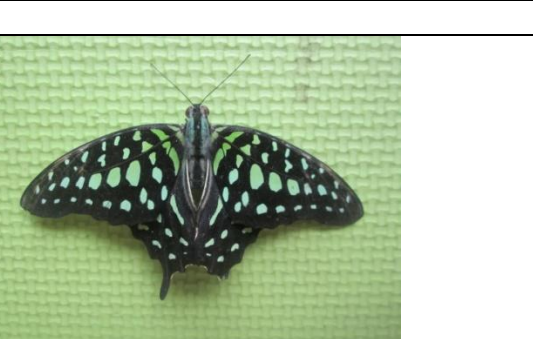
In this second study, morphology and morphometric that feeding on sousop leaves that describe all stadia from egg until Imago were presented in Table 2 and Table 3.

Table 2. Morphology and Morphometric *Graphiumevemon* egg

Morphology	Characteristic	Morphometric	Average \pm SD (cm)
			
Shape	Round	Diameter	0,12 \pm 0,00
Color	Greenish white		

Stadia of Larvae	characteristics of Morphometric		
	Length		Diameter of thorax
	Average (cm)	±SD	Average±SD (cm)
Instar 1 Larvae	0,35 ± 0,11		0,09 ± 0,06
Sign			
<p>Caput dark brown to black.</p> <ul style="list-style-type: none"> - The body of the dorsal part black to brown, while the ventral white. - Part of the last segment of the abdomen is white. - A pair of brownish-yellow lateral spines found on each each segment of the thorax, while a pair of anal spines (the final segment abdomen) are white. 			
instar 2 Larvae	0,65 ± 0,13		0,22 ± 0,04
Sign			
<p>-Caput yellowish brown.</p> <ul style="list-style-type: none"> - Segment thorax larger than the other body segments. - Pair of lateral spines on pterothorax shrinkage (Reduction in proportion to body size). - Regional sub-spirakular on abdominal segments brownish white. 			
instar 3 Larvae	1,09 ± 0,15		0,33 ± 0,03
KarakteristikMorfologi			
<p>Caput brown orange.</p> <ul style="list-style-type: none"> - Pair of lateral spines are black, while the final spina abdomen colored white. 			
instar 4 Larvae	1,71 ± 0,26		0,45 ± 0,04

KarakteristikMorfologi			
<p>-Body pale brown dorsal section, while the ventral colored white.</p> <p>- Part of the last segment of the abdomen is brown.</p>			
instar 5 Larvae	3,05 ± 0,54	0,59 ± 0,06	0,35 ± 0,00
Morphology			
<p>- Caput yellow orange (the beginning of molting) then changed be green.</p> <p>- The body of the dorsal orange yellow or brown faded (The beginning of molting) then changed to light green to dark green, whereas the ventral part is white.</p> <p>- Part of the last segment of the abdomen is green.</p> <p>- Lateral spines Part 1 (prothorax) is declining.</p> <p>- Lateral spines Part 2 (mesothorax) reduced (lost).</p> <p>-Spina lateral section 3 (metathorax) contained circle like a ring small yellow.</p> <p>- A pair of lateral spines 3rd metallic blue color.</p> <p>- Part of the last abdominal segment follows the same color as the other segments.</p> <p>- Spina at the end of the abdomen is white greenish, then there a straight line is black outer edge of the spine.</p>			

<p>Prepupae</p> <p>There are white lines ranging from the thorax to abdomen and skin shrivel.</p>			
<p>Pupae</p> <ul style="list-style-type: none"> - Green but in some parts there is a colored linelight yellow. - There is a horn at the mesothorax slender and pointy. - Has a pair of horns cephal short and blunt. - Do not have legs prolage to stick on the leaves. - When the butterfly is ready to hatch, then: - Part black thorax greenish blue spots appearsomewhattransparent. - The end of a transparent abdomen. 			
<p>Imago</p>			
<p>Morphometric</p> <p>- Long body</p>	<p>Male (♂) (4 Individu) Average ± SD (cm) 2,2 ± 0,00</p>	<p>Female (♀) (4 Individu) average ± SD (cm) 2,2 ± 0,00</p>	
<p>The length of the antenna</p>	<p>1,3 ± 0,00</p>	<p>1,3 ± 0,00</p>	

The length of the front wing	$3,7 \pm 0,12$	$3,74 \pm 0,13$
The width of the front wing	$3,25 \pm 0,15$	$3,26 \pm 0,17$
The length of the rear wing	$7,4 \pm 0,24$	$7,48 \pm 0,27$
wing span	$2,46 \pm 0,06$	$2,4 \pm 0,09$
The width of the rear wing	$2,24 \pm 0,14$	$2,26 \pm 0,14$
KarakteristikMorfologi		
<ul style="list-style-type: none"> - - The head (caput) shaped capsule. - The type of oral appliance haustelata. - Long filament-shaped antenna with an enlarged end like a club. - Rear wing wavy edge, basic color black front and rear wings, on the outer edge of the wings are small spots of blue-green. - In the middle of the wing there is a large spots turquoise. - At the base of the rear wing are large white spots. - There is an additional red spots on the ventral part of the rear wing. - The composition of the tile of similar scales. - The head, thorax, and abdomen black (dorsal) but white on the ventral sightings. 		

3. Conclusion and Remark

The results of the data in Table 2 and Table3 indicate that occur during the process of growth and development of stadia *G. evemon*. It can be seen from the shape and size of the body is growing every stadia. The observation is in line with Dyar (1890) who noted that an increase in the diameter of the capsule head 1.2-1.4 times between the larval stage (instar1-5) of some Lepidoptera species. This study concludes that the average period of the life cycle *A.muricata* of the host plant of *G. evemonon* soursop leaves was 28 -50 days.

References

- Begon, Michael BSc, PhD & Mortimer, Martin BSc, PhD. (1986). *Population Ecology, A Unified Study of Animals and Plants*. Blackwell Scientific Publications, Oxford London Edinburgh :Hoston Palo Alto Melbourne.
- Bima. (2007). Penagkarankupu-kupu di KepulauanSeribu. [Online]. Tersedia :<http://www.pulauseribu.net> [diaksespadatanggal 17 Juni 2015]
- Campbell, A. Neil & Reece, B. Jane. (2010). *Biology Eighth edition*. Pearson Education, Inc., New York.
- Dyar H. G. (1890). The number of moults of lepidopterous larvae. *Psyche* 5: 420-422
- Hadi, H. Mochamad., Tarwotjo, Udi.,&Rahadian, Rully. (2009). *BiologiInsektaEntomologi, EdisiPertama*. Yogyakarta: GrahaIlmu.
- Mason, W., &Wolfinger, N. (2001). Cohort Analysis. *Los Angeles, CA: California Center for opulation Research*, University of California.
- Muhson, Ali. (2009). PengembanganMetodologidanSistematikaPenelitian. [Online]. Tersedia :[http://staff.uny.ac.id/sites/default/files/lain-lain/ali-muhson-spd-mpd/Ali%20Muhson%20\(2009\)%20PENGEMBANGAN%20METODOLOGI%20DAN%20SISTEMATIKA%20PENELITIAN.pdf](http://staff.uny.ac.id/sites/default/files/lain-lain/ali-muhson-spd-mpd/Ali%20Muhson%20(2009)%20PENGEMBANGAN%20METODOLOGI%20DAN%20SISTEMATIKA%20PENELITIAN.pdf) [diaksespadatanggal 08 Juli 2015]
- Peggie, Djunijanti. (2014). *MengenalKupu-Kupu*. Jakarta Timur :PanduAksara Publishing, PT. IndolearningPanduCendekia.
- Suhara. (2009). Ordo Lepidoptera, Ngengat Dan Kupu-kupu. Bandung : UPI Publisher.
- Whitten, R.E., S. Soeriaatmadja. Dan Affiff. (1999). *EkologiJawadan Bali*. Jakarta :Kanisius.
- Chin, W. Y. 2014. Plant fact sheet ; *Aristolochia tagala*. Nature Watch Magazine. [Online] Tersedia : www.habitatnews.nus.edu. (Diakses pada 2 Agustus 2014
- Dahelmi, S. Salmah, I. Abbas, N. Fitriana, S.N. Nakamura. 2008. *Duration Of Immature Stages of Eleven Swallowtail Butterflies (Lepidoptera: Papilionidae) In West Sumatra, Indonesia*.FarEastern Entomologis.
- Hoskins, A. (2012). *Learn about Butterflies, the complete guide to the world of butterflies and moths : Strategies for survival*. [Online] Tersedia di :www.learnaboutbutterflies.com (Diakses pada 05 September 2015)
- Peggie, D. (2011). *Precious And Protetcted Indonesian Butterflies*, Pandu Aksara Publishing, Jakarta. Indonesia

- Triplehorn, C. A. and Johnson, N. F. (2005). Borror and DeLong's Introduction to the Study of Insects *Biodivers Conserv.* Tomson Belmon.
- Soekardi, H. 2000. Realtionship between diversity of Butterfly and Thet host plants. National of Biology. Bandung. Indonesia.
- Yushio dan Ishii. (1996). *Rearing Larvae of The Great Mormon Butterfly, Papilio memnon L. (Lepidoptera : Papilionidae) on Artificial Diet.* *Jpn. J, Ent.*, 64.
- Morton, A.C. (1979) *Rearing Butterflies On Artificial Diets.* journal of research on the Lepidoptera 18(4)