

PAPER • OPEN ACCESS

Biology of *Eocanthecona furcellata* (Wolff) (Hemiptera: Pentatomidae) Predator Nettle Caterpillar *Setora nitens* Walker Origin from Riau

To cite this article: Rusli Rustam *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **347** 012009

View the [article online](#) for updates and enhancements.

Biology of *Eocanthecona furcellata* (Wolff) (Hemiptera: Pentatomidae) Predator Nettle Caterpillar *Setora nitens* Walker Origin from Riau

Rusli Rustam¹, Herman², Muhammad Abdul Gani³

¹Department of Agrotechnology Faculty of Agriculture, University of Riau

²Department of Biology Faculty of Mathematics and Natural Sciences, University of Riau

³Master Student of Agricultural Science, Postgraduate Program, University of Riau

Abstract. The growing prospect of crude palm oil (CPO) has led to rapid development of oil palm plantations in Riau. Oil palm cultivation is somehow inseparable from the attack of Nettle Caterpillar. In practice, the control measures taken are usually by using synthetic insecticides. In order to reduce the effects of synthetic insecticides, it requires alternatives in the technique of controlling this caterpillar pest such as the use of *Eocanthecona furcellata* predators. This research aims to obtain biochemical data on *Eocanthecona furcellata* from Riau as predator of Nettle Caterpillar pest on palm oil plants with alternative prey of *Oecophylla smaragdina* (Kroto) larvae. This research uses observation method where the growth and development of 100 larvae of *Eocanthecona furcellata* with prey of *Oecophylla smaragdina* (Kroto) broods were observed in the laboratory. The results showed that *Eocanthecona furcellata* fecundity is 134.88 eggs/female imago, hatch percentage of 82.93%. The life cycle of *Eocanthecona furcellata* passes through 5 instars with first nymphal instar period of 4.08 days, second-instar of 3.42 days, third-instar of 2.97 days, fourth-instar of 3.06 and fifth-instar of 5.25 days. The life cycle of female imago is longer than the life cycle of male imago, which is 37.41 days and 35.22 days. *Oecophylla smaragdina* (Kroto) larvae can be used for alternative prey in *Eocanthecona furcellata* predator multiplication.

1. Introduction

Palm oil is a commodity that significantly contributes to the Indonesian economy, particularly Riau Province. Riau is one of the largest palm oil producers in Indonesia. The growing prospect of crude palm oil (CPO) has led to the rapid development of oil palm plantations in Riau. According to Riau Central Bureau of Statistics (2016), that total surface area of oil palm plantation in Riau in 2015 is 2,424,545 ha with a production of 7,841,947 tons.

Oil palm cultivation is inseparable from pests attack. Nettle Caterpillar (*Setora nitens*) is classified as a major pest that attack oil palm crops [1] and the dominant caterpillars found in oil palm plantations in Riau [2]. The netter caterpillar attack palm oil plant by eating leaf blades which leaves the leaves damaged and the sticks left over. During its first life cycle, the netter caterpillar is able to eat up to 400 cm² of leaves (Wood, 1968 in Ref. [3]). The attack of netter caterpillars has an impact on production decrease of up to 70% in first attack and 93% in second attack in the same year [4].

The control efforts undertaken by smallholder plantations and large corporations generally use synthetic insecticide. In order to reduce the effects of synthetic insecticides, it requires a need for alternatives in the techniques of controlling caterpillar pests such as the use of natural enemies like *Eocanthecona furcellata* predator. *Eocanthecona furcellata* insects have the ability to prey on several



types of caterpillars; Lepidoptera, *Coleoptera* and *Heteroptera* orders [5]. In India, *E. furcellata* predator has been regarded as an important predator on several lepidopteran pests [6,7]. These predators can be used as important biological control agents in an integrated pest management program.

The use of natural enemies as biological agents with augmentation techniques requires large numbers of predatory insects. The multiplication of predatory insects through easy-to-obtain, easy-to-reproduce, and low-cost alternative prey may serve as an alternative solution for insect predators to be mass-produced [8]. The purpose of mass-production of natural enemies is to easily produce natural enemies in large quantities, in a quick time and at an affordable cost [9]. An alternative prey that can be used in mass production of *E. furcellata* predator is *Oecophylla smaragdina* (Kroto) larvae.

2. Materials and Methods

The research was conducted in a Pest Laboratory, Faculty of Agriculture, Universitas Riau, Bina Widya Campus, Jl. Bina Widya, Simpang Baru Sub-District, Tampan District, City of Pekanbaru, Riau Province. This research applied an observational method through observing the growth and development of 100 predators *Eocanthecona furcellata* larvae preying on *Oecophylla smaragdina* (Kroto) larvae in the laboratory. The observed data were tabulated using Excel 2007 program and were presented with tables and figures and were descriptively analysed. The observations objects comprised of egg stadia, nymph stadia and imago stadia.

3. Results and Discussions

The research results for fecundity and percentage of *E. furcellata* egg hatching with Kroto feed are presented in Table 1. Observations were made on 27 pairs of imago *E. furcellata* and 7 egg groups.

Table 1. Fecundity and percentage of eggs hatching

Observation	Average \pm SE
Fecundity (egg/head)	134.88 \pm 4.547
Hatch Percentage (%)	82.93 \pm 1.518

Table 1 shows that *E. furcellata* produced 134.88 eggs/head on average. The eggs are placed in groups and each group of eggs comprised of 19-73 eggs. This finding is in contrary to Susanto and Dongoran's [10] findings where the *E. furcellata* is able to produce 12-40 eggs using *Setothosea asigna* feed. This suggests that multiplying predators *E. furcellata* with kroto alternative feed is better than using *Setothosea asigna* feed. Insects are able to multiply in large numbers under a relatively short time. There are two factors that influence the ability of an insect species to breed, namely natality and fecundity. Natality (birth) is the ability of this type of insect to produce new off springs. Small size of insects generally have relatively large natality rate. While fecundity (fertility) is the ability of a female insect to produce eggs. The more the number of eggs produced, the higher its ability to breed.



Figure 1. *E. furcellata* Eggs are placed in groups. a: freshly laid eggs and b: about to hatch eggs.

E. furcellata eggs are round in shape, 1.01 mm long and 0.90 mm wide in size. The eggs are bright black in color and gradually turn their color to brownish red with surface of shiny silver in color (Figure 1). This is in line with Semillano and Corey's findings (2006) that over time, *E. furcellata* eggs turn to brownish red until hatching time comes. Table 1 also shows that the percentage of egg hatching of *E. furcellata* is quite high which is at 82.93%, leading to the high success rate for mass production. This suggests that *E. furcellata* predators can be bred in a laboratory with Kroto feed (Figures 2 and 3). The purpose of mass-breeding of natural enemies is to easily produce natural enemies in large quantities, in a quick time and at an affordable cost [9].



Figure 2. Multiplication of *E. furcellata* with kroto feed



Figure 3. *E. furcellata* is preying on kroto

Table 2 below presents the life cycle of *E. furcellata* with kroto feed in a laboratory at an average temperature of 29.5°C and humidity of 65%.

Table 2. Life cycle of *E. furcellata* on insectarium maintenance

Stadia	Average \pm SE (daily)
Eggs Incubation	10.14 \pm 0.173
Nymph	
1 st Instar	4.08 \pm 0.003
2 nd Instar	3.42 \pm 0.007
3 rd Instar	2.97 \pm 0.006
4 th Instar	3.06 \pm 0.004
5 th Instar	5.25 \pm 0.007
Pre-oviposition	13.18 \pm 0.328
Male Imago	35.22 \pm 0.306
Female Imago	37.41 \pm 0.55

Table 2 shows that the incubation period of *E. furcellata* eggs lasts for 10.14 days. It is slower than the research results of Tiwari et al. [17] where the incubation period of *E. furcellata* eggs lasted only 5.33 days and the research results of [7] where the incubation period of eggs lasted 6 days with the same alternative feed, that is *Corcyra cephalonica*. According to Ref. [10], eggs hatch period takes 8-10 days and Kumar et al [11] puts forth that the incubation period of *E. furcellata* eggs lasts for 8.81 days. This suggests that the incubation period of *E. furcellata* eggs varies, due to internal factors of *E. furcellata* and due to external factors affecting the egg incubation period.

The hatched nymphs (1st instar) usually live in group (Figure 4). This is in line with Hideharu [12] (2004) statement in which he considers that the newly hatched *E. furcellata* nymph at 1st instar is still in group and has not actively fed the caterpillar.



Figure 4. *E. furcellata* nymph at 1st instar live in group around the egg

The duration of 1st instar *E. furcellata* nymph is 4,08 days, 3.42 days on 2nd instar, 2.97 days on 3rd instar, 3.06 days on 4th instar and 5.25 days on 5th instar. Therefore, in order to reach adulthood, it requires 5 times to turn the skin into different colors. According to Hagen et al [13] Wardhana [14], Barsagade and Gathalkar [15], the *E. furcellata* nymph consists of 5 instars during its development. *E. furcellata* nymph period takes 18.78 days. In accordance with the research results of Lenin and Rajan [7] that the nymphal period lasts about 16 days. On the contrary, Escalona and Abad [16] and Tiwari et al. [17] suggest that *E. furcellata* insects take up to more than 24 days to turn their colors five times.

Table 2 also shows that the life cycle of female *E. furcellata* imago is longer than that of male imago. The life cycle of female imago lasts for 37,41 days while life cycle of male imago lasts for 35.22 days and preoviposition lasts about 13,18 days. According to research results of Pillai and Agnihatri [18], and [7], that the life cycle of female imago is longer than the life cycle of male imago of *E. furcellata*.

Table 3 shows that length of *E. furcellata* egg is 1.01 mm with the width of 0.90 mm. The 1st nymphal instar has 1.27 mm of length and 0.91 mm of width. The 2nd nymphal instar has 2.25 mm of length and 1.08 mm of width. The 3rd instar has 4.08 mm of length and 2.55 mm of width. The 4th nymphal instar has 7.42 mm of length and 4.58 mm of width. The 5th instar has 9.94 mm of length and 6.27 mm of width.

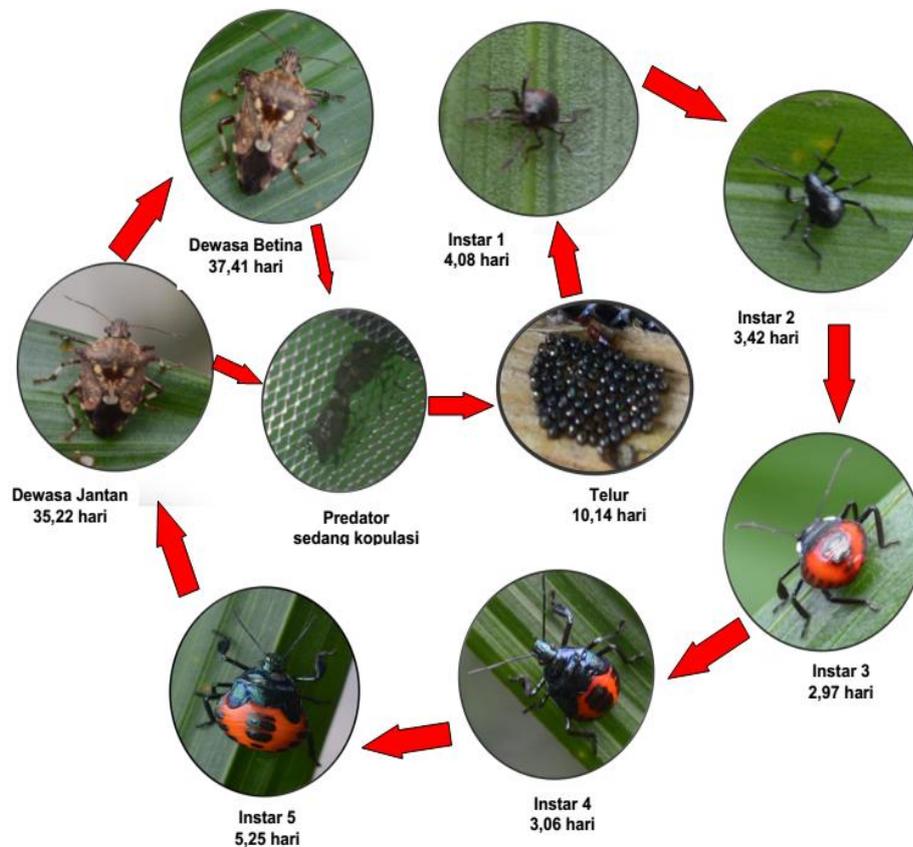


Figure 5. *E. furcellata* predator life cycle with kroto alternative feed in a laboratory

The size of each *E. furcellata* stadia with kroto alternative feed is presented in Table 3.

Table 3. Size of each *E. furcellata* stadia

Stadia	Average \pm SE (mm)	
	<i>Eocanthecona furcellata</i>	
	Length	Width
Egg	1.01 \pm 0.013	0.90 \pm 0.007
Nymph		
1 st Instar	1.27 \pm 0.014	0.91 \pm 0.009
2 nd Instar	2.25 \pm 0.020	1.08 \pm 0.012
3 rd Instar	4.08 \pm 0.062	2.55 \pm 0.039
4 th Instar	7.42 \pm 0.028	4.58 \pm 0.019
5 th Instar	9.94 \pm 0.101	6.27 \pm 0.043
Male Imago	10.99 \pm 0.065	5.81 \pm 0.054
Female Imago	14.79 \pm 0.048	7.98 \pm 0.033

The male imago has 10.99 mm of length with 5.81 mm of width and the female imago has 14.79 mm of length with 7.98 mm of width. This is the characteristics that differ between male and female imago where female imago is larger in size as compared to male imago. As Lee's et al. [19] put forth that the size of the female imago of predator *E. furcellata* is larger than that of the males.

4. Conclusions

The fecundity rate of *Eocanthecona furcellata* is 134.88 eggs/female imago, while percentage of egg hatching is 82.93% with egg incubation period lasting for 10.14 days. The life cycle of *Eocanthecona furcellata* with kroto as an alternative feed in the laboratory is as follows: 1st nymphal instar takes 4.08 days, 2nd instar takes 3.42 days, 3rd instar takes 2.97 days, 4th instar takes 3.06 and 5th instar takes 5,25 days. The life cycle of female imago is longer than the life cycle of male imago, which is 37.41 days and 35.22 days. Kroto (*Oecophylla smaragdina* ant larvae) can be used as an alternative feed to multiply predator *Eocanthecona furcellata* in the laboratory.

References

- [1] Buana L. 2003. Budidaya dan Kultur Teknis Kelapa Sawit. Pusat Penelitian Perkebunan Sumatra Utara. Medan.
- [2] Taftazani. 2006. Identifikasi ulat pemakan daun kelapa sawit (*Elaeis guineensis* Jacq) di PT. Eka Dura Indonesia Kecamatan Kunto Darussalam Kabupaten Rokan Hulu. Unpublished Thesis.Faculty of Agriculture. Universitas Riau, Pekanbaru.
- [3] Cendramadi. A.W. 2011. Pengamatan kelimpahan ulat api (Limaodidae) dan ulat kantong (Psychidae) serta predator pada perkebunan kelapa sawit di bawah naungan karet. Departemen proteksi tanaman. Fakultas Pertanian Institut Pertanian Bogor. (Unpublished).
- [4] Pahan I. 2008. Panduan Lengkap Kelapa Sawit Manajemen Agribisnis Dari Hulu Hingga Hilir. Penebar Swadaya. Jakarta.
- [5] Nyunt. 2008. Impact of planting dates on the population of cotton pests and natural enemies in Myanmar. M.sc.agr. Unpublished Thesis.Georg-August-University, Goettingen. German.
- [6] Claver MA and Jaiswal P. 2015. Distribution and abundance of two predatory stink bugs(Pentatomidae: Hemiptera) associated with rice field. Academic Journal of Entomology 6 (1): 33-36.
- [7] Lenin, EA dan Rajan, SJ. 2016. Biology of predatory bug *Eocanthecona furcellata* Wolff (Hemiptera: Pentatomidae) on *Corcyra cephalonica* Stainton. Journal of Entomology and Zoology Studies. 2016; 4(3): 338-340.
- [8] Sahid, A., W. D. Natawigena, Hersanti, Sudarjat, E. Santoso. 2016. Biologi dan perilaku kawin *Sycanus annulicornis* Dohrn (Hemiptera: Reduvidae) yang diberi pakan larva *Tenebrio molitor* L. (Coleoptera: Tenebrionidae). In Proceeding of Biology Education Conference.Universitas Sebelas Maret, Surakarta.
- [9] Sinaga, CFA. 2008. Kemampuan predator *Eocanthecona furcellata* mengendalikan ulat api sethosea asigna di pertanaman kelapa sawit. Unpublished Thesis.Department of Pests Science dan Plants Diseases. Faculty of Agriculture. Universitas Sumatera Utara. Medan.
- [10] Susanto. A dan Dongoran A,P. 2009. Kemampuan *Eocanthecona furcellata* (Wolff) dalam memangsa Ulat Api di Perkebunan kelapa Sawit; Strategi Perlindungan Tanaman menghadapi Perubahan Iklim Global dan Sistem Perdagangan Bebas. In National Seminar of Perlindungan Tanaman.
- [11] Kumar MN, Morrison S, Rajadurai AM, Babu V, Thiyagarajan Datta RK 2001. Studies on the biology and predatory behaviour of *Eocanthecona furcellata* (Wolff.) predating on *Spilarctica obliqua* (Walk.) in mulberry plantation. International Journal Indust Entomol. 2001; 2(2):173-180.
- [12] Hideharu. K. 2004. The Predator Properties of the Predatory Stinkbug *Eocanthecona furcellata* on the 3rd Instar of Common Cutworm Larvae *Spodoptera litura*. Proceeding of the Association for Plant protection of Shikoku.39-42. Accessed from <http://scienscelinks.jp/j-east/article/200507/000020050705A0250476.php>
- [13] Hagen, K. S., Bombosch S, McMutry JA. 1999. Biologi dan Dampak Predator. Dalam: Mangoendiharjo S, penerjemah; Huffaker CB, Messenger PS, editor. Jakarta: UI Press. Translation of: Theory and Practice of Biological Control.
- [14] Wardhana, S. 2004. Biologi predator *Andrallus spinidens* (F.) (Hemiptera: Pentatomidae) pada tiga jenis mangsa (Unpublished Thesis).Faculty of Agriculture. Institut Pertanian Bogor, Bogor.

- [15] Barsagade dan Gathalkar (2016). First predation record of *Canthecona furcellata* (Wolff.) (Hemiptera: Pentatomidae) on spinning stage silkworm *Antheraea mylitta* (Drury). Entomological Research. Departemen Zoologi, RTM Nagpur University, Nagpur, Maharashtra, India
- [16] Escalona. RR and Abad. RG. 1998. Observation on the test releases of *Eocanthecona furcellata* (Wolff.) (Heteroptera: Pentatomidae) against the slug caterpillars, *Parasa philopida* Holloway (Lepidoptera: Limacodidae). Philippine J. Crop Sci. 23-36.
- [17] Tiwari. S, Maurya. RP and Pandey. AK. 2017. Effect of different insect hosts on biology and predation efficiency of *Eocanthecona furcellata* Wolff (Hemiptera: Pentatomidae). International Quarterly Journal of Life Sciences. The Bioscan 12(1): 193-197
- [18] Pillai, K.A. and Agnihotri, M. (2013). Biology and predatory potential of *Eocanthecona furcellata* (Wolff.) on *Marucavitrata* Geyer. Madras Agricultur Journal. 100: 193-195.
- [19] Lee. H, Kim. J and Jung. S. 2015. A New record of Genus *Eocanthecona bergroth* (Hemiptera: Heteroptera: Pentatomidae: Asopinae) from the Korean Peninsula. Korean Journal of Applied Entomology. 54(3): 257-261 (2015)