Substrate combination of *Lemna minor* and muds affects biomass and population of *Tubifex* sp.

Mahendra*1*, D Damara2, M Nufus2 and V R Putri1

1Aquaculture Study Program, Faculty of Fisheries and Marine Science, Teuku Umar University, West Aceh, Indonesia
2Fisheries Study Program, Faculty of Fisheries and Marine Science, Teuku Umar University, West Aceh, Indonesia

*E-mail: mahendra@utu.ac.id

Abstract. This study was aimed to determine the effect of the use of a substrate of *Lemna minor* and mud on the biomass and silkworms population. This experimental study was designed completely random using five treatments and three replications. The treatments given were P1 = a growing medium with 500 g of *L. minor*, P2 = a growing medium with 375 g of *L. minor*, P3 = a growing medium with 250 g of *L. minor*, P4 = a growing medium with 125 g *L. minor*, and P5 = a growing medium 0 g of *L. minor*. The parameters observed included the amount of biomass, population and water quality parameters, including temperature, pH, and DO. Data were analyzed statistically using ANOVA and tested further with the Least Significant Difference test (LSD). Results from a 50-day study showed that differences in formulations had a significant effect (P < 0.05) on biomass and population. The best treatment found in P1 produced 8.60 g biomass within population.

Keywords: biomass, *Lemna minor*, Mud, population, *Tubifex* sp.

1. Introduction

The hatchery business requires natural food, one of the natural food commonly given to fish larvae is silkworm. Silkworms are a natural food for fish larvae that are easily digested with nutrient content of water is 11.21%, crude protein 64.47%, crude fat 17.63%, ash 7.84%, and BETN 10.06% (Wijayanti 2010). Cultivation of silkworms have not been existed, especially in Aceh province. So far the availability of silkworms still depends on the catch from nature, whereas in nature the presence of silkworms is uncertain because it is influenced by seasonal factors and environmental conditions (Muria et al 2011). Silkworms need to be kept in constant supply, so cultivation needed to be done by adding nutrients as food. *L. minor* is a small aquatic plant that has a high protein content reaching 10-43%, 7-14% fiber, 35% carbohydrates, 3-7% fat, and a high vitamin and mineral content (Leng et al 1995). According to the research of Ilyas et al (2014) showed that 25% of *Lemna perpusilla* can replace pellets with 32.75% protein retention.
The high nutrient content of *L. minor* is expected to be used as an alternative material in the use of *L. minor* substrate and mud to increase growth in aquaculture with a recirculation system. The use of mud according to Kesuma (2016) increased silkworm population and biomass with a formulation of 50% oil palm kernel cake and 50% paddy mud with a population of 111,008 ind/m² and biomass 750.72 gr/m². This study was aimed to determine the effect of the use of a substrate of *Lemna minor* and mud on the biomass and silkworms population.

2. Materials and methods

2.1. Research location
This research was conducted from April 6 to May 25 2019. The research location was in Peunaga Cut Ujong Village, Meurebo District, West Aceh Regency.

2.2. Research design
This experimental research was conducted with a completely randomized design (CRD) consisting of *L. minor* media (substrate) formulations and mud with 5 treatments with 3 replications in each treatment. The respective treatments used in this study included:

- P1 = growth media with 500 g (*L. minor*)
- P2 = growth media with 375 g (*L. minor*)
- P3 = growth media with 250 g (*L. minor*)
- P4 = growth media with 125 g (*L. minor*)
- P5 = growth media with 0 g (*L. minor*)

The treatment dosage was obtained after conducting a preliminary test with the use of *L. minor* media suitable for silkworm cultivation which was a maximum of 500 g, and the use of 2,000 g mud to obtain the height of the cultivation medium of 4 cm (Safrina et al 2015).

2.3. Test variables
Silkworms were maintained for 50 days. The measurements of water quality observed in this study were temperature, pH, and DO. The variables measured in this study were population and biomass.

2.4. Data analysis
The data obtained were analyzed using Analysis of Variance (ANOVA). When the result showed a significant difference it analyzed furthermore with the least significant difference Test (LSD).

3. Results

3.1. Absolute biomass of silkworms
The absolute biomass growth results of silkworms maintained for 50 days can be seen in figure 1.

The highest absolute biomass value was found in treatment P1 (8.60 g). While the lowest biomass was found in P5. Results from a 50-day study showed that differences in formulations had a significant effect (P<0.05) on biomass.

3.2. The population of silkworms
Population results obtained after the maintenance of silkworms for 50 days of observation showed the highest population was in the treatment of P1, with total individual of 6,250 followed by P2 with 5,323 individuals, P3 (4,629 individuals), then P4 (4,096 individuals). The lowest population was found at P5 3,914 individuals. Population results are presented in figure 2.
3.3. Water quality

The water quality parameters observed in this study including temperature, pH, and DO. The measurements results of water quality parameters during this experiment are presented in table 1.

| No | Parameter          | Values | Threshold Reference |
|----|--------------------|--------|---------------------|
| 1  | Temperature (°C)   | 25-28  | 25-28 (Putri et al 2018) |
| 2  | pH                 | 7.5-8.1| 7.4-8.14 (Cahyono et al 2015) |
| 3  | DO (ppm)           | 3.3-4  | 3.5-4.5 (Lou et al 2013) |

4. Discussion

The use of *L. minor* substrate and mud with a recirculation system on silkworm rearing media produced a significant effect on the growth rate of biomass and silkworm populations. This is thought to be an environmental condition in culture medium that can still be tolerated by silkworms.
The highest biomass in the P1 treatment was suspected because the culture media had higher nutrient content, thus it could promote silkworms grow to be relatively high. According to Syam et al (2011), the high organic matter addition in the media will increase the number of bacteria and organic particles resulting from decomposition by bacteria. Furthermore, it could increasing the amount food in the media that can affect the absolute biomass growth of silkworms. This is also in accordance with the statement of Febrianti (2004).

Silkworms can grow in a variety of media that contain adequate nutrients such as nitrogen (N), phosphate (P), potassium (K), and other microelements (Chumadi et al 2004). Febrianti (2004) stated that silkworms feeding on bacteria and organic particles resulted from the decomposition of organic matter by bacteria.

Apart from the substrate composition, the high productivity of silkworms is also influenced by water. Based on the results of water quality measurements of the culture media, obtained temperatures were 25°C-28°C, pH values 7.5-8.1, DO 3.3-4 ppm. This value range is still at the optimum range for silkworm growth.

References
Cahyono E W, Hutabarat J and Herawati V E 2015 Pengaruh pemberian fermentasi kotoran burung puyuh yang berbeda dalam media kultur terhadap kandungan nutrisi dan produksi biomassa cacing sutra (Tubifex sp) JAM. Tech. 4 127-135
Chumadi S, Ilyas Y, Sahlan R, Utami A, Priyadi P T and R Arifudin 2004 Pedoman teknis budidaya pakan alami ikan dan udang (Jakarta: Pusat Penelitian dan Pengembangan Perikanan) p 84
Febrianti D 2004 Pengaruh pemupukan harian dengan kotoran ayam terhadap pertumbuhan populasi dan biomassa cacing sutera Limnodrillus [Undergraduate Thesis] (Bogor: IPB University)
Ilyas A P, Nurhalma K, Harris E and Widiyanto T 2014 Pemanfaatan Lemma perpusilla sebagai pakan kombinasi untuk ikan nila (Oreochromis niloticus) pada sistem resirkulasi J. Limnotek. 21 193-201
Kesuma W I 2016 Pemanfaatan bungkil inti sawit sebagai media pertumbuhan cacing sutra (Tubifex sp.) (Undergraduate Thesis) (Bandar Lampung: Lampung University)
Leng R A, Stambolie J H and Bell R 1995 Duckweed a potential high-protein feed resource for domestic animals and fish (New England: Livestock Research for Rural Development)
Lou J, Cao Y, Sun P and Zheng P 2013 The effects of operational conditions on the respiration rate of Tubificidae PloS One 8 1-9
Muria E S, Masithah E D and Mubarak S 2011 Pengaruh Penggunaan Media dengan Rasio C:N Yang Berbeda Terhadap Pertumbuhan Tubifex (Undergraduate Thesis) (Surabaya: Airlangga University)
Putri B, Hudaiddah S and Kesuma W I 2018 Pemanfaatan bungkil inti sawit sebagai media pertumbuhan cacing sutra (Tubifex sp.) e-JRTB. 6 730-738
Safrina, Putri B and Wijayanti H 2015 Pertumbuhan cacing sutra (Tubifex sp.) yang dipelihara pada media kulit pisang kepok (Musa paradisiaca) dan lumpur sawah Jurnal Swasembada Pangan 2 520-525
Syam F S, Novia G M and Kusumastuti S N 2011 Efektivitas Pemupukan dengan Kotoran Ayam dalam Upaya Peningkatan Pertumbuhan Populasi dan Biomassa Cacing Sutra Limnodrilus Sp. Melalui Pemupukan Harian dan Hasil Fermentasi [Undergraduate Thesis] (Bogor: IPB University)
Wijayanti K 2010 Pengaruh pemberian pakan alamai yang berbeda terhadap sintasan dan pertumbuhan benih ikan palmas (Polypterus senegalus senegalus Cuvier, 1829) [Undergraduate Thesis] (Depok: University of Indonesia)