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ACCUMULATION OF ITP-Hi AND GROWTH PERFORMANCE OF *HERMETIA ILLUCENS* PREPUPAE REARED IN TWO DIFFERENT MEDIA

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Abstract

This study aimed to observe the comparison of productivity of ITP-Hi in the fifth instar stage of the Hermetia illucens (BSF) prepupa reared in two different organic media: dry media with a composition of 200 grams of rice bran, 50 grams of coconut pulp and 50 grams of fish meal; the wet medium consisted of a mixture of 100 grams manure of cow farm and mixed with wet garbage fruits (300 grams). The media was placed in a cylindrical container with a dimension of 15 cm high and 8.5 cm of diameter. A total of 100 larvae aged 5 days old were placed in each media. The parameters of this study were growth performance and accumulation of ITP-Hi which consists of body weight, body length, body thickness, body width. The results showed that there was no significant difference (P>0.05) on body weight of H. illucens width of the two media. In addition, the growth performance of these insect larvae had a significant difference (P<0.05) higher from papaya fruit media compared to dry media. We concluded that papaya fruit is a good growth medium for BSF compared to media using coconut pulp and rice bran.

Key words: *antigens, Hermetia illucens, growth performace, rearing media*

INTRODUCTION

The purpose of this study was to determine the effect of different media on concentration of crude extract of antigen at larvae stage especially to its immungen thoraxial of prepuae of *Hermetia illucens* (ITP-Hi), beside that the effect of the media treatment on growth performace of *H. illucens* prepuae was also evaluated. Insects have immunogen antigens as reported by Rumokoy et al. (2017a) and Toar et al. (2019) underpinning the use of treatment material in this study. There are other hints that: insect salivary glands can be used for the immune system of mammalian organisms as related to the report of Breijo et al. (2018).

The antigens of several insect species as in Diptera order have been tested to stimulate the synthesis of IgG antibodies, which are natural substances that are used as alternatives in dealing with various pathogenic diseases, especially in newborn individuals (Toar et al., 2017). A study of Choi et al. (2012) used the extract of *Hermetia illucens* larvae as anti Gram-negative bacteria. A study conducted by Park et al. (2015) showed a novel peptide from *H. illucens* as an antibacterial. The positive effect of *H. illucens* larvae meal on broiler immunity has been reported Lee et al. (2018).

The high mortality rate in goats is caused by various factors as connected to the work of Ershaduzzaman et al. (2007), for example: genetic factors (Nguluma et al., 2013), environmental factors and the arrangement of the agricultural system (Phocas et al., 2016), where in a well-managed agricultural system zone will be able to provide opportunities for livestock (Oliveira et al., 2016). In addition, management of disease prevention and control is also a very determining factor in goat health (Goolsby et al., 2017). According to Fukuda et al. (2019), an unclean environment can be a source of pathogenic microbes that can be transmitted to livestock by transmitters such as flies.

The progress of several studies using the immunomodulatory antigen Diptera fly gives hope to improve the immune system in mammals as related to reported of Toar et al. (2019). Utilization of insects as a source of antigens can stimulate the production and circulation of antibodies in goat kids (Toar et al., 2017). Immunogens from the thoraxial extracts of Diptera (Muscidae) have been tested as immunogens as reported (Rumokoy et al.,

2020; Rumokoy et al., 2017b) have a potential benefit to overcome immunity and mortality problems in livestock such as local breed goats.

MATERIALS AND METHODS

Insects: *Hermetia illucens* were bred from the larva stage (maggot) in two different rearing media. The eggs come from adult flies that carry out an ovipositor in a special box.
Rearing: This study used a dimensioned rearing box (30 x 30 x 30 cm) to place the media containers. Larvae 5 days old were placed in two types of media in containers with dimensions of 15 cm in diameter and 8.5 cm in height. There are two different media, namely dry media (A) and wet media (B) where each container contains 100 larvae:
Media A as dry media was consisted by a mixture of 200 g of rice bran, 50 g of coconut dregs in the fermentation process and 50 g of fish meal and then were sprayed sufficiently with a clean water.
Media B as wet media, was used organic materials mixture: 100 g of cow manure and 300 g of wet mixture of garbage fruits like unconsumed of ripe papaya and waste ripe banana fruits.
The observation of the accumulation of ITP-Hi and growth performance was observed at the 4^{th} instar. The prepupas were transferred to a transparent tube placed in a rearing box equipped with porous paper and moistened to maintain moisture. Before using all prepupae were washed with a clean water then placed in a box equipped with a filter then moved to a box equipped with a tissue for drying before measuring the growth performance. To measure the body weight: ten larvae were weighed in each weighing, and then continued with an extraction stage and freezing.
Immunogen crude extract preparation:
The *H. illucens* collection was carried out from each media unit and placed in a net bag, then moved in a 1 liter measuring glass then placed in a refrigerator at -4ºC for 10 minutes. The next stage was thoracic dissection using a three-dimensional photonic microscope.
Isolation of thoracic cavity by using a spatula and tweezers on a Petri dish by separating the exo-skeleton. The substance obtained was added with a 10% phosphate buffered saline (PBS) solution of 0.2 ml with a pH of 7.4 then crushed, filtered, centrifuged and separation substances. Then centrifuged at 5000 rpm for 3 minutes, followed by sediment accumulation and then a dilution and filtration using a 0.22 µm micro-filter to sterilize ITP-Hi against microbe-pathogenic substance and other materials. The level value of ITP-Hi substances obtained in this step of work were detected under a %Brix value by using portable spectrometry instrument.
The data was analyzed by using t-test of paired two samples for means.

RESULTS AND DISCUSSIONS.

The results as presented in the following Figures 1-5.

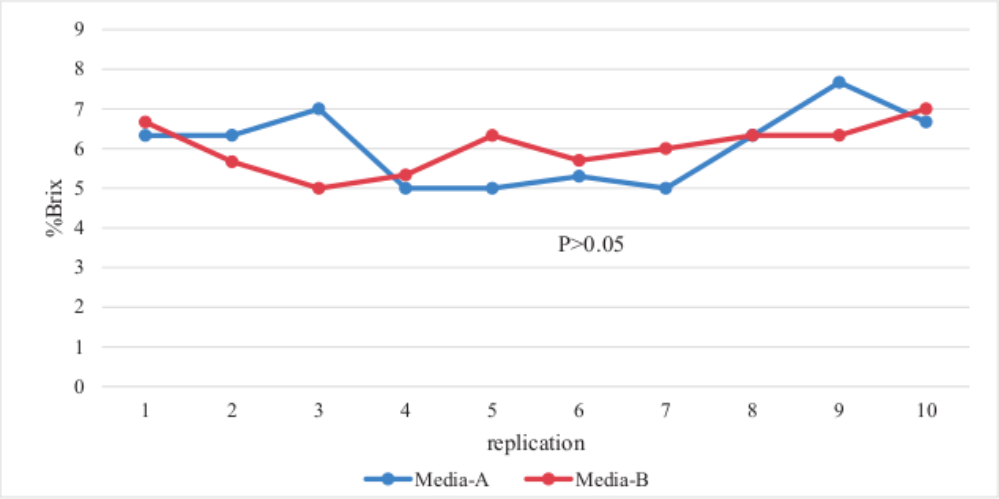

Figure 1. The ITP-Hi of *H. illucens* propotional level

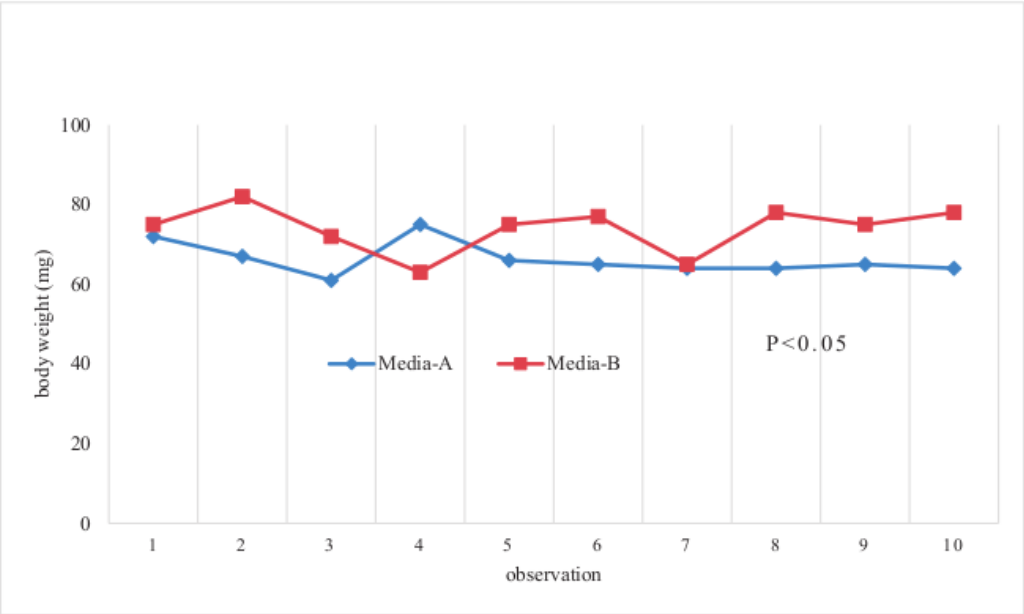

Figure 2. The weight of *H. illucens* in media-A and media-B

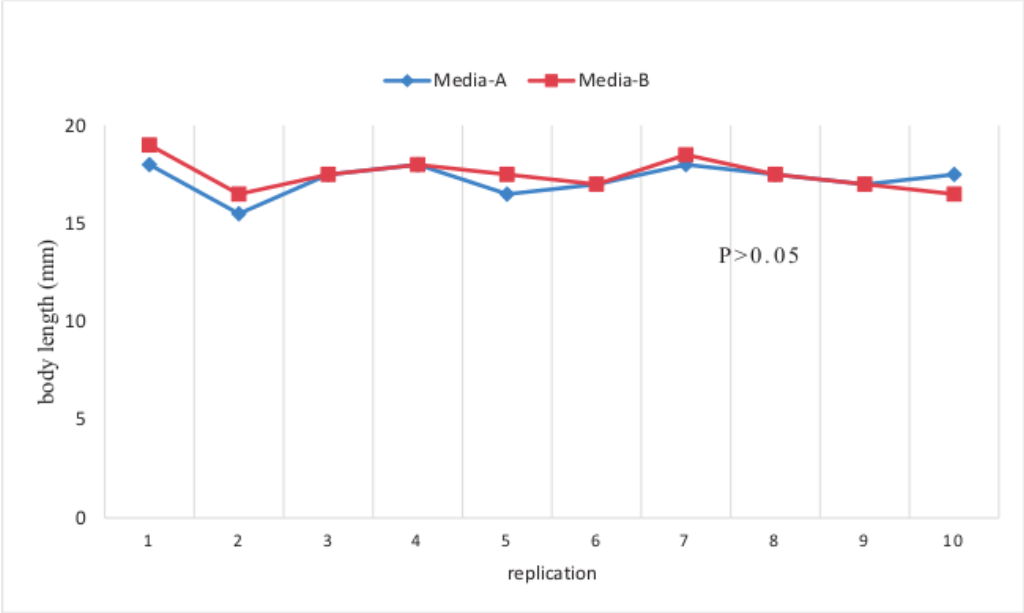

Figure 3. The body length of *H. illucens* in media-A and media-B

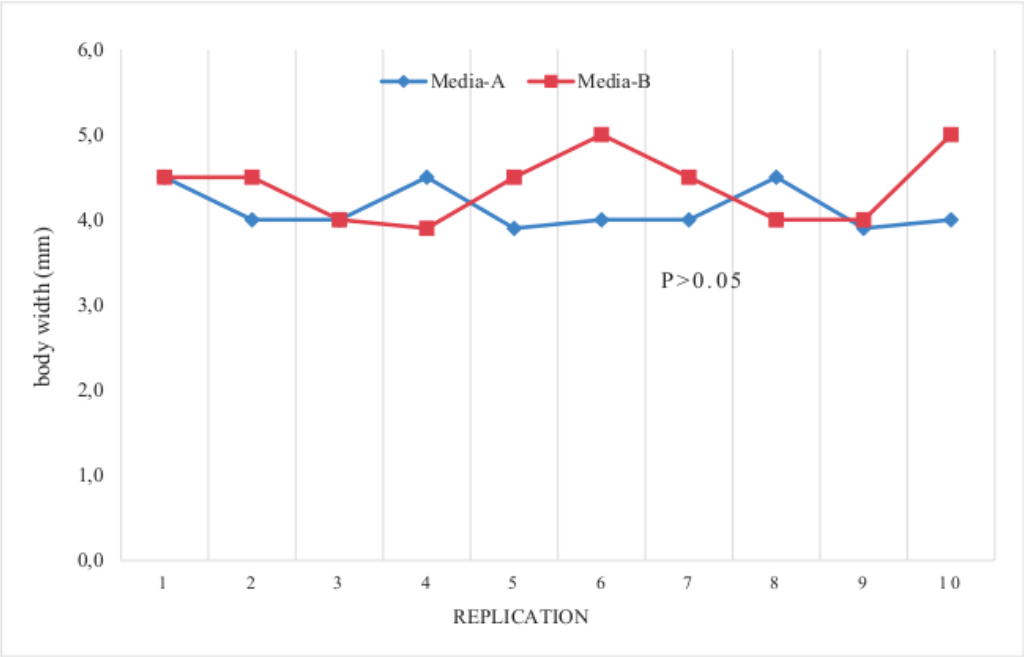

Figure 4. The body width of *H. illucens* in media-A and media-B

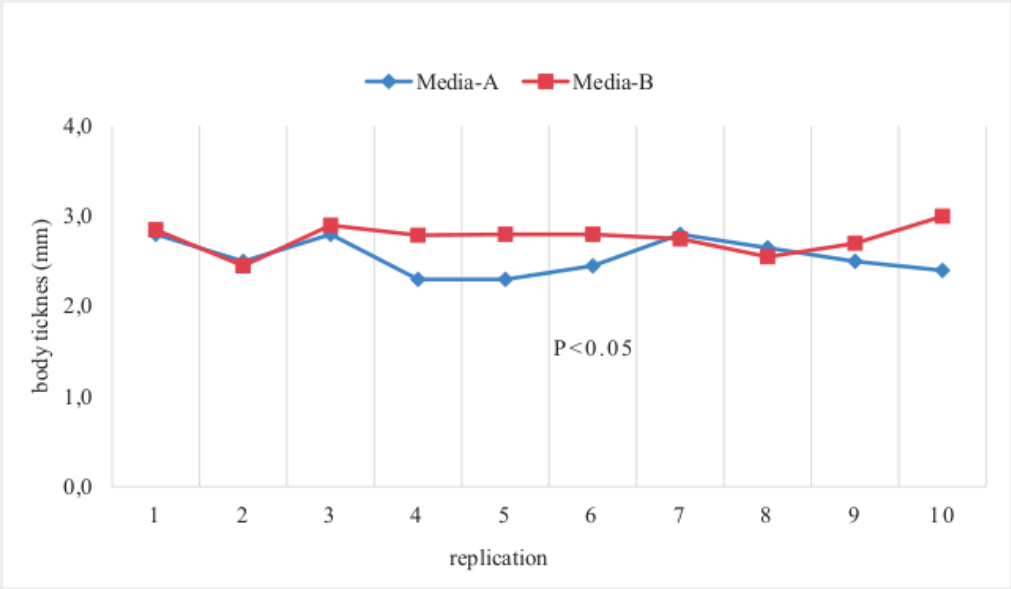

Figure 5. The body tickness of *H. illucens* in media-A and media-B

The treatment in media-A caused a non-significant effect on proportional level of ITP-Hi compared to the control media-B (P>0.05) as shown in Figure 1. The lowest level (%Brix) was found in prepupae both reared in media-A and media B which was at 3.9% Brix while the highest value was found in media-B. This non-significant difference could be caused by the ability of the larvae of *H. illucens* to profite the organic matter to converted to body protein mass of larva connected to a scientific report of Kawasaki et al. (2020) and Klammsteiner et al. (2021). We considered this substance to be an immunogen for ruminant immunity as linked to the previous researcher reports (Lee et al., 2018; Rumokoy et al., 2017b) and also to

overcome the health problems of goat livestock in uncontrolled spread of pathogenic agent environment as described by Aldridge et al. (2018). The non-significant effect of media treatment showed in growth performances were in body length and body width. These results may due to genetic factor of this species: the situation of two types of media were negligible to body development especially to its body length and body width of larvae. Various organic material were suitable to *H. illucens* (Manangkot et al., 2014), when an attractant found in the media then they refused to use it (Toar et al., 2013). The larvae of *Hermetia* had a same adaptation to the experiment media as related to Khamis et al. (2020). The body weight of experiment larva in media-B was significant higher ($P<0.05$) then in media-A.

CONCLUSIONS

The difference of rearing media could be adapted by the larvae of *Hermetia illucens* as long as the conditions of media could be tolerated by the individuals for their ITP-Hi level (in %Brix) their body width and body length development. In this case the larvae were more able to profite media-B than media-A to improve their body weight and body tickness.

REFERENCES

Aldridge, M.E., Fearon, J.E., Haynes, B.P., Miller, H.M., Sanford, K.Y., Scott, R.R., ... & Memili, E. (2018). Solutions for Grand Challenges In Goat And Sheep Production. *Biotropia*, 26(1), 55-64.

Ershaduzzaman, M., Rahman, M.M., Roy, B.K., & Chowdhury, S.A. (2007). Studies on the diseases and mortality pattern of goats under farm conditions and some factors affecting mortality and survival rates in Black Bengal kids. *Bangladesh Journal of Veterinary Medicine*, 71-76.

Fukuda, A., Usui, M., Okamura, M., Dong-Liang, H., & Tamura, Y. (2019). Role of flies in the maintenance of antimicrobial resistance in farm environments. Microbial Drug Resistance, 25(1), 127-132.

Choi, W.H., Yun, J.H., Chu, J.P., & Chu, K.B. (2012). Antibacterial effect of extracts of *Hermetia illucens* (Diptera: *Stratiomyidae*) larvae against Gram-negative bacteria. *Entomological research*, 42(5), 219-226.

Goolsby, M.K., Leite-Browning, M.L., & Browning Jr., R. (2017). Evaluation of parasite resistance to commonly used commercial anthelmintics in meat goats on humid subtropical pasture. *Small Ruminant Research*, 146, 37-40.

Kawasaki, K., Kawasaki, T., Hirayasu, H., Matsumoto, Y., & Fujitani, Y. (2020). Evaluation of fertilizer value of residues obtained after processing household organic waste with black soldier fly larvae (*Hermetia illucens*). *Sustainability*, 12(12), 4920. Retrieved May 10, 2021 from https://www.mdpi.com/2071-1050/12/12/4920.

Khamis, F.M., Ombura, F.L., Akutse, K.S., Subramanian, S., Mohamed, S.A., Fiaboe, K.K., ... & Tanga, C.M. (2020). Insights in the global genetics and gut microbiome of black soldier fly, *Hermetia illucens*: implications for animal feed safety control. *Frontiers in microbiology*, 11, 1538. Retrieved May 10, 2021 from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7381391/

Klammsteiner, T., Walter, A., Bogataj, T., Heussler, C. D., Stres, B., Steiner, F.M., ... & Insam, H. (2021). Impact of Processed Food (Canteen and Oil Wastes) on the Development of Black Soldier Fly *(Hermetia illucens)* Larvae and Their Gut Microbiome Functions. *Frontiers in Microbiology*, 12, 20. Retrieved May 20, 2021 from https://www.frontiersin.org/articles/10.3389/fmicb.2021.619112/full.

Manangkot, H.J., Rondonuwu, S.J., Pinontoan, O.R., Najoan, M., & Rumokoy, L.J. (2014). Black soldier fly larvae manure degradation as fish meal replacer in native chicken ration. *Lucrari stiintifice-Seria Zootehnie*, 62, 139-142.

Lee, J.A., Kim, Y.M., Park, Y.K., Yang, Y.C., Jung, B.G., & Lee, B.J. (2018). Black soldier fly *(Hermetia illucens)* larvae enhance immune activities and increases survivability of broiler chicks against experimental infection of *Salmonella gallinarum*. *Journal of Veterinary Medical Science*, 17-0236. Retrieved 10 May 12, 2021, from https://www.jstage.jst.go.jp/article/jvms/advpub/0/advpub_17-0236/_article/-char/ja/

Nguluma, A., Leite-Browning, M.L., & Browning Jr., R. (2013). Comparison of Boer-Cross and foundation breeds for meat goat doe fitness in the humid subtropics. *Livest. Res. Rural Dev.*, 25, 1-11.

Oliveira, G., & Hecht, S. (2016). Sacred groves, sacrifice zones and soy production: globalization, intensification and neo-nature in South America. Retrieved April 7, 2021 from www.tandfonline.com/doi/abs/10.1080/03066150.2016.1146705.

Park, S.I., Kim, J.W., & Yoe, S.M. (2015). Purification and characterization of a novel antibacterial peptide from black soldier fly (*Hermetia illucens*) larvae. *Developmental & Comparative Immunology*, 2(1), 98-106.

Phocas, F., Belloc, C., Bidanel, J., Delaby, L., Dourmad, J.Y., Dumont, B., ... & Brochard, M. (2016). Towards the agroecological management of ruminants, pigs and poultry through the development of sustainable breeding programmes: I-selection goals and criteria. *Animal*, 10(11), 1749-1759.

Rumokoy, L.J.M., Adiani, A., Kaunang, C., Toar, W.L., & Kiroh, H. (2017a). The effect of combination of colostrum Immunoglobulin-G with crude salive gland extract of *Stomoxys calcitrans* (Diptera: Muscidae)

on IgG serum level of young horses. *Scientific Papers. Series D. Animal Science*, 60, 271-277.

Rumokoy, L., Adiani, S., Assa, GJ. V., Toar, W.L., & Aban, J.L. (2017b). Entomology contribution in animal immunity: Determination of the crude thoraxial glandular protein extract of *Stomoxys calcitrans* as an antibody production enhancer in young horses. *Journal of Entomological and Acarological Research*, 49(3). Retrieved April 12, 2021, from https://pagepressjournals.org/index.php/jear/article/view/7074.

Rumokoy, L., Kiroh, H., Untu, I. M., Assa, G., Turangan, S., & Toar, W. L. (2020). Antigen-G of Larva Serum of *Musca domestica* as an Immunoglobulin Production Promoter in Goats under an Organic Maintenance. *Animal Production*, 22(1), 31-36.

Toar, W.L., Warouw, J., [illegible]ng, M., Najoan, M., & Rumokoy, L. (2013). The Landing periodicity of Stomoxys calcitrans in rations, supplemented with citronella and papain on broiler health. *Scientific Papers-Animal Science*, 59(8), 322-325.

Toar, W.L., Kaunang, C., Untu, I.M., Rumokoy, L., & Kiroh, H. (2017). The empowerment of crude extract antigen-G of insect on goats immunity enhancement an entomology contribution in animal husbandry. *Scientific Papers. Series D. Animal Science,* 60. Retrieved April 10, 2021, from http://animalsciencejournal.usamv.ro/pdf/2017/Art47.pdf.

Toar, W.L., Rumokoy, L., Untu, I.M., & Assa, G. (2019). Insect Crude Thoraxial Antigen-G Extracted from *Apis mellifera* to Enhance Serum Immunoglobulin of Goats: An Entomology Contribution in Animal Science. *Animal Production*, 20(2), 133-138.

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