Journal of Asian Scientific Research

journal homepage: http://aessweb.com/journal-detail.php?id=5003

# OVIPOSITION AND LONGEVITY OF *COCCINELLA* SP. (COLEOPTERA: COCCINELLIDAE) ON ARTIFICIAL DIETS

**Agus N**

*Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University, Indonesia*

**Abdullah T**

*Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University, Indonesia*

**Aminah S.N**

*Department of Plant Pests and Diseases, Faculty of Agriculture, Hasanuddin University, Indonesia*

## ABSTRACT

*Coccinella* sp. *is a polyphagous predator which is potential to be developed into a biological control agent for aphids. The research was aimed to determine the oviposition and longevity of the adults predators when given artificial diets and various kinds of drinks. The experiment was performed by placing a pair of insect adults into a Petri dish, covered with a piece of filter paper, containing five mg of food made of ground honey bee larvae (Apis cerana) and then given a drink that is stored or absorbed on a sponge or a cotton swab as a treatment. There were nine treatments and each repeated three times. The results showed that significant differences among the treatments were present, both in the number of groups of eggs and the number of individual eggs produced by an adult predator. The highest number of eggs (323.7 eggs) and the number of egg groups (69.3) laid by an adult was found when the adult was presented with the artificial food and drink of sugar solution in the sponge. When the predator was supplied with the artificial food and water in a sponge, the lowest number of individual eggs and groups of eggs were laid, 65.00 eggs and 19.7 egg groups, respectively. Longevity of the female predator was the longest when given a drink of sugar solution compared to the other treatments. For mass-rearing of predator Coccinella* sp. *on artificial diet, drinks solution made of honey or sugar solution prepared in the sponge should be added.*

**Keywords:** Oviposition, Longevity, Predator *Coccinella* sp., Srtificial diet.

## INTRODUCTION

*Coccinella* spp. is a potential biocontrol agent in suppressing aphid populations in the field. The predator's natural population, however, is usually so low in the field due to indiscriminate use of insecticides that it fails to provide satisfactory control of the pest Agus (2007; 2008);(Agus *et al.*,

2007). Rearing coccinellids on natural food, i.e living aphids, is difficult and uneconomical (Ohkada and Matsuka, 1973). This requires a lot of resources such as space, time, and labor for aphid mass rearing in order to secure continuous and reliable supply of aphids. Those obstacles can be overcome by rearing the predator on an artificial diet (Agus, 2007). Artificial diets for insects generally must contain the following components: proteins but sometimes free amino acids, lipids, carbohydrates, vitamins and minerals (Cohen, 2005). Nutrient intake of adult insects influences their longevity and fecundity. (Ohkada and Matsuka, 1973) reported that artificial diets made from larvae of drone honey bee provides sufficient nutrients for rearing *Harmonia axyridis* Pallas. Nutrition of drone honey bee is better than milks and eggs (Lamerkabel, 2005). The same diet has been proven suitable for rearing *Coccinella* sp. but insects feed on diet made of ground larvae of *A. cerana* drones lay more eggs than those feed on diet made of *A. mellrateiffera* (Agus *et al.*, 2010).

Although many entomophagous arthropods accept sugar sources as food, these foods are typically insufficient as a sole source of nutrition for all life processes. *Chrysoperta plorabunda* larvae fed sugar is survive substantially longer than those fed water alone (Limburg and Rosenheim, 2001). Adult coccinellids need water supplement, usually prepared in a water-saturated sponge, in addition to the artificial diet in order to survive (Agus *et al.*, 2010). Numerous laboratory studies support the notion that non prey foods (artificial diets) improve fecundity over prey/hosts alone, and sometimes can even support reproduction in the absence of prey altogether. Therefore, the objective of the study was to determine the effects of the artificial diets and water supplement contents (honey or sugar solution) given in sponge or in cotton on the longevity and fecundity of *Coccinella* sp.in the laboratory.

## MATERIALS AND METHODS

The study was conducted in the Laboratory of Plant Pest Clinic and Biological Control, Department of Plant Pests and Diseases, Hasanuddin University, Makassar Indonesia. Coccinellid larvae were collected from soybean fields and then brought back to our lab. The larvae were transferred into plastic containers containing artificial diet made of pulverized drone larvae of *A. cerana*. Adults emerging from the containers were used in the test.

A pair of adult coccinellids were placed into a Petri dish containing 5 mg of artificial diet made of larvae of *A. cerana*, placed on a piece of filter paper. In each dish, a supplemental solution was given either in sponge or cotton swab . This experiment consisted of nine treatments: artificial diet only (control) (M0), artificial diet + water in sponge (M1), artificial diet + water in cotton (M2), artificial diet + 10% honey solution in sponge (M3), artificial diet + 10% honey solution in cotton (M4), artificial diet + 10% sugar solution in sponge (M5), artificial diet + 10% sugar solution in cotton (M6), 10% honey solution in sponge (M7), and 10% honey solution in cotton (M8). Every treatment had three replications of one Petri dish each.

A pair of adult *Coccinella* sp. were placed in each of the Petri dish. The adult insects were transferred into a new Petri dish with the same treatment every 24 h until no more eggs were deposited. The number of eggs and groups of eggs were determined by counting the eggs deposited in each Petri dish. Adult longevity was determined by counting the number of days since the adults emerged until they died.

### Data Analysis

The treatments were arranged in a completely randomized design. The count data were subjected to ANOVA and when significant differences were detected, the average counts of the treatments were separated using the least significant difference with 5% probability.

## RESULTS AND DISCUSSION

### Oviposistion

The number of egg groups laid by an adult female predator for the treatments M2, M3, M4, M5, and M6 were not significantly different each other but significantly higher than those for the other treatments. While the number of eggs deposited by an adult insect for the treatments M1, M2, M4, M5, and M6 were not significantly different each other but significantly more than those for the other treatments (Table 1).

The highest number of egg groups and individual eggs were deposited by an adult insect fed with the artificial food and 10% sugar solution in sponge. This diet combination seemed to provide more complete nutrients needed by the insect. Sugar is a good source of energy for the insect to perform all of its activities (Irawan, 2007). Besides that, sugar is also important in the formation of cuticle (Cohen, 2005). Lundgren (2009) reported that entomophagous arthropods consume sugar as an important part of their diets. However, the insects do not respond equally to all types of sugar. For example, *Eristalis tenax* strongly responded to sucrose and glucose but it is less attracted to fructose, maltose, galactose, rhamnose, rafinose, and stachyose (Wacht *et al.*, 2000). Reproduction capability of a predatory insect varies, depending on the prey or diet (Evans, 2004).

### Longevity

The diet treatments non significantly affected the adult longevity (Table 2). Adult predators fed with artificial diet only and honey solution had longevities of 14 and 29 - 30 days, respectively. The longest adult longevity was found in M5 (71.3 days) but it was not significantly different from other treatments with honey or sugar solution. Adult longevity of all treatments with honey or sugar solution had longer compared to the treatments with water (M2 and M3). The results suggested that carbohydrate (sugar and honey) as source of energy was important for the survival of the adult predators. The type of solution container (sponge or cotton), however, did not significantly influence the adult longevity. This phenomenon is different from the results of research by Ashraf *et al.* (2010) that that longevity of *Coccinella septempunctata* is longer if fed aphids and water than honey solution.

## CONCLUSION

The highest number of individual eggs and egg groups (323.7 and 69.3, respectively) were deposited by *Coccinella* sp. fed with artificial food and 10% sugar solution prepared in a sponge. While the insects fed with artificial food with water in sponge layed the lowest number of individual eggs and egg groups, which were 65.0 and 19.7, respectively. The highest longevity was shown by adult female fed with the artificial food and sugar solution.

## ACKNOWLEGMENT

The research is a part of National Strategy Grant Program reseived by DGHE (2011) and therefore my thank is expressed to this oppotunity. Like that to Nia Arifah and friends which is help me to observe in the field.

## REFERENCES

Agus, N., 2007. Behaviour and Predatism Periods of Coccinella sp. (Coleoptera : Coccinellidae) Larva and Adult's at Aphis glycines Matsumura (Homoptera : Aphididae)" Proc. of the 5th International Symposium on Biocontrol and Biotechnology, Thailand.

Agus, N., 2008. Aspek Biologi predator Coccinella sp. (Col. : Coccinellidae) pada kutu daun kedelai dan metode perbanyakannya pada makanan buatan" Laporan Penelitian, Fak. Pertanian UNHAS.

Agus, N., D.I. Daud and Hariman, 2010. Pengaruh jenis lebah sebagai bahan makanan buatan terhadap aspek peneluran coccinella sp. Jurnal Fitomedika, 7(2): 138-141.

Agus, N., A.S. Saranga, Budiaman and S. Thamrin, 2007. Metode Pembiakan Predator Coccinella sp. (Coleoptera : Coccinellidae) pada Makanan Buatan (Artificial diet) sebagai Agens Pengendali Hayati Hama Kutu Daun" Laporan Penelitian HB XV, DIKTI.

Ashraf, M., M. Ishtiaq, M. Asif, M. Adrees and M.N. Ayub, 2010. A study on laboratory rearing of lady bird beetle (coccinella septempunctata) to observe its fecundity and longevity on natural and artificial diets. International Journal of Biology, 2(1): 165-173.

Cohen, A.C., 2005. Insect diets: Science and technology. Boca Raton London New York Washington, D.C: CRC PRESS.

Evans, E.W., 2004. Egg production in response to combined alternative foods by the predator coccinella transversalis. Entomologia Experimentalia at Applicata, 34(2): 141-147.

Irawan, M.A., 2007. Karbohidrat, 1(3): http://www.pssplab.com/journal/ 03.pdf.

Lamerkabel, 2005. Lebah madu hasil hutan dan ternak harapan. Available from http://www.freewebs.com

Limburg, D.D. and J.A. Rosenheim, 2001. Extrafloral nectar consumption and its influence on survival and development of an omnivorous predator larval Chrysoperla plorabunda (Neu roptera: Chrysopidae). Environmental Entomology, 30: 595-604.

Lundgren, J.G., 2009. Relationships of natural enemies and non-prey foods" published b springer science + business media B.V.

Ohkada, I. and M. Matsuka, 1973. Artificial rearing of hormonia oxyridis on pulverized drone honeybee brood. Environ. Entomol, 2(2): 301–302.

Wacht, S., K. Lunau and K. Hansen, 2000. Chemosensory control of pollen ingestion in the hoverly eristalis tenax by labellar taste hairs. Journal of Comparative Physiology A, 186: 193-203.

**Table 1.** Average numbers of egg groups and number of eggs deposited by a single adult female of *Coccinella* sp.

| Treatments | Number egg groups | Number of eggs |
|---|---|---|
| Food only (M0) | | |
| Food + water in sponge (M1) | 0.0a | 0.0a |
| Food + water in cotton swab (M2) | 19.7b | 65.0b |
| Food + 10% honey in sponge (M3) | 27.7b | 115.7b |
| Food + 10% honey in cotton swab (M4) | 45.0b | 198.7c |
| Food + 10% sugar in sponge (M5) | 35.3b | 168.7c |
| Food + 10% sugar in cotton swab (M6) | 69.3b | 323.7c |
| 10% honey in sponge (M7) | 45.3b | 189.7b |
| 10% honey in cotton swab(M8) | 0.0a | 0.0a |
| | 0.0a | 0.0a |

**Table 2.** Average longevity of adult *Coccinella* sp. fed with different diets

| Treatments | Longevity (days) |
|---|---|
| Food only (M0) | 14.0 |
| Food + water in sponge (M1) | 51.0 |
| Food + water in cotton (M2) | 54.3 |
| Food + 10% honey in sponge (M3) | 66.3 |
| Food + 10% honey in cotton (M4) | 66.3 |
| Food + 10% sugar in sponge (M5) | 71.3 |
| Food + 10% sugar in cotton (M6) | 66.0 |
| 10% honey in sponge (M7) | 29.0 |
| 10% honey in cotton (M8) | 30.0 |