Biodiversity of butterfly in the waxy corn flowers

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Abstract. A study about the biodiversity of butterfly in the waxy cornflowers very important to know more about their role and behavior in nature. The purpose of the research is to identify the butterfly family and their visiting frequency to waxy cornflowers as alternative food. The research was conducted at Samangki village, Maros District, South Sulawesi from April to July 2018. Among the Pulut or waxy corn (Zea ceritina Kulesh) family Gramineae that growth in farmers field, the butterfly family and their visiting frequency were recorded. The results were showed the butterfly family visited the waxy cornfield from Nymphalidae (Danaus chrysippus L. and Melanitis sp.), Papilionidae (Papilio demolition L. and Graphium agamemnon L.) and Pieridae (Delias hyparete But. and Catopsylla pomona Fab.). Catopsylla pomona (Pieridae) was a higher frequency (5.6 times) visited waxy cornflowers than another species during observation. The result of the study recommended waxy cornflowers can use as one of the alternative management tools for maintaining the butterflies population. Need more effort increasing the role of stakeholder/local government to manage and educate local people in butterfly conservation. Supporting this activity, it need to apply depth ecological knowledge such as high-resolution distributional data and annual censusing.

1. Introduction
Butterfly as the pollinator insect playing an important role in the agricultural ecosystem. Commonly pollinators visiting flowers to find out nectar, pollen and another product from the plant. The alternative foods mainly coming from horticultural and weeds flowers which grow around the field [5, 10] and from secretion released by aphids [2]. Insects order including Hymenopteran, Lepidopteran, Dipteran and some of Coleopteran is the main part of the food web and consumer of some alternative foods. Flowers as the main source of food was selected by insect visitor based on nectar content, flower morphology or type of flowers and way to access them. The complex array of insect species interactions, or the biotic environment, maybe the most defining characteristic of tropical environments. In particular, it is meaning the close relationship between butterflies, their host plants and the environment [5, 7, 10].

Tropical forest as a source of life on earth and preparing useful material for humans and organisms surrounding it. More research into economic alternatives to habitat or forest exploitation will almost certainly aid the cause of tropical butterfly conservation and should be explored as well. Butterflies provide ecosystem services in tropical ecosystems by, for example, providing pollination services [4], an indicator of environmental health [12, 15]. Beside pollination services and indicators of quality life, their beauty colorful wings providing life-fulfilling aesthetic services. The aesthetic services can also
translate into a direct economic value chain. The sustainable use of butterfly farming, for example, can provide an additional source of increasing income for local communities looking to combat logging threats [1].

In fact, any chance of effectively conserving butterfly populations globally, the first step is to understand their ecologies including behaviour, the pattern of spread in nature and environmental condition. This is important notes butterfly studies because butterflies are probably the best known taxonomically and ecologically. Indeed, the study of butterfly biology has a long history and contributed greatly to understanding generally of ecology, evolution, biogeography, conservation and biomolecular [8,18].

Waxy corn or Pulut (Zea ceritina Kulesh) family Gramineae is the one of important local corn were grown in South Sulawesi including the field around Bantimurung-Bulusaraung National Park. Since a long time ago, people around this area used new land from the forest for all of the agricultural activities. Waxy corn is a traditional staple food has a high rate of amylase and kept durable. On the other hand, the waxy cornfield to be an interesting habitat for many natural enemies and butterfly species because available abundant pollen from their flowers. It was exploited as the main source of energy and nutrition by insect pollinators especially honey bees and butterflies. For example, food requirement for honey bee (Apis sp.) and bumble bee (Bombus terrestris) provided by Medicago sativa and cornflowers in farmers field [3]. Commonly farmers around Bantimurung-Bulusaraung National Park grow waxy corn after harvesting rice in the same field. The purpose of research is to identify the butterfly family and their visit frequency on the waxy cornflowers. This information is very useful providing alternative foods for butterfly conservation efforts.

2. Methodology
Survey of butterfly family was conducted in the waxy cornfield at Samangki village, Maros District, South Sulawesi from April to July 2018. The research area including in Bantimurung-Bulusaraung National Park which spreads from Maros to Pangkep Districts (4.9000° S, 119.7500° E). The elevation of farmers’ field is about 250 m above sea level with an average precipitation of 1.500-1.900 mm per year. Maximum and minimum air temperature ranging from 22 - 30°C, relative humidity ranging 65 - 88% and soil pH of 5.47 [9]. Bantimurung-Bulusaraung National Park is the greatest natural habitat for many butterfly species including protected butterflies. The presence of butterflies was supported by flowering vegetation and weeds around the karst habitat [16, 17].

The research was started when the farmer’s waxy corn plant at 45 days after transplanting until harvest. It used one of farmer field with assumed the environment such as natural habitat for butterfly. Before treatment, they agree with all of the research treatment into their crops especially not applied herbicide, insecticide, fertilizers and other chemical material. Visual observation of butterfly was conducted every Saturday morning (07.00 – 09.00 hours). The survey was conducted in three sampling points inside the waxy cornfield (2 m x 5 m). The field observation replicated four times with an interval of 7 days. Butterfly that used waxy cornflower as the food source from three sampling points were identified and recorded on-site using magnifying glass. Butterfly identification process including their taxonomy used literature [11, 12, 15, 19, 20] and another relevant scientific sources from internet.

3. Result and Discussion
Based on the observation in the waxy cornfield, a butterfly visitor divided into three families Pieridae, Nymphalidae, and Papilionidae. Commonly local people around Bantimurung-Bulusaraung National Park prefer waxy corn that sweet corn. They are famous traditional staple food of this areas. The impact of waxy cornfield as source of pollen resulting visit frequency butterfly was showed the higher activity by Catopsylla pomona, Danaus chrysippus, Papilio demoleon and Graphium agamennon is 5.6 times; 0.5 times; 0.5 times and 0.5 times in two hours observed, respectively. Another butterfly such as Delias hyparete and Melanitis sp. is a similar result of 0.3 times in two hours (Table 1).
Table 1. Family, Species, and Average of Butterfly Visit Frequency at Waxy Corn Flowers

| Family     | Species                      | Average of visit frequency (times) |
|------------|------------------------------|-----------------------------------|
| Pieridae   | Delias hyparete But.         | 0.3                               |
|            | Catopsylla pomona Fab.       | 5.6                               |
| Nymphalidae| Danaus chrysippus L.         | 0.5                               |
|            | Melanitis sp.                | 0.3                               |
| Papilionidae| Papilio demolion L.        | 0.5                               |
|            | Graphium agamemnon L.       | 0.5                               |

According to family and butterfly visit frequency into waxy cornflowers depend on nectar availability from the plant. Flowering weed from Lantana camara growth surrounding waxy cornfield and their function as a source of limited alternative foods. Butterfly chooses the flower based on nectar content or fragrance out of the flower. Butterfly prefer colorful flowers indicated the food that they need [2, 7, 14, 21]. Commonly butterfly prefers red than the white flower [13]. Butterfly learning from their experience visiting flower because color indicating the presence of nectar. In Battus philenor (Papilionidae), they attract yellow, blue and purple flowers [6]. Base on field observation, cornflowers have a pale color without nectar, also contain many pollens without fragrance. As we know, commonly more their pollen spread by the wind than pollinator services. It assumed to be one factor avoid visited by butterfly.

Based on visual observation, C. pomona started entrance into the field about 45 days after transplanting. The number of an individual is higher (17 individuals) still in the field until harvest. In contrast to another butterfly such as D. hyparete, D. chrysippus, Melanitis sp., P. demolion, and G. agamemnon has decreased together with the increasing of plant age. In the third visual observation, were did not find these butterflies in the field.

The decreasing of butterfly visit waxy cornflowers because the farmer was used synthetic insecticides to control armyworm (Spodoptera sp.) in the vegetative phase of vegetables before planting waxy corn. It killing and limiting the number of beneficial insects control insect pest. Besides chemical material in the field, another important factor caused by decreasing the number and diversity of butterflies is wild hunting from people around Bantimurung-Bulusaraung National Park. Uncontrolled collecting contributing many butterfly species in endangered status and lose their habitat because of agricultural activities. Local people used the butterfly as a source of an interesting ornament (pinning dried original butterfly) a unique souvenir from Bantimurung, keyrings, and others. This activity contributed as an important point to explain why the family recorded very limited (Sri, unpublished).

Bantimurung-Bulusaraung National Park has a dry and wet season. The best example explains how butterflies’ survival in the dry condition is butterflies living in Australia. It is one of the best-studied about natural conservation with respect to responding to adverse conditions in the tropical dry season. For example, female adults of some Eurema species have a reproductive diapause phase coinciding with poor larval host plant conditions and are triggered to reproduce by changes in rainfall and/or photoperiod. Another butterfly example such as Hypolimnas bolina exhibits a regularly timed adult reproductive diapause also likely caused by photoperiod changes. Another common dry season strategy is a distribution shift similar to a migratory strategy, in which butterflies retreat to moist refugia and riparian habitats [4]. Although Indonesia and Australia similar in dry conditions but management of butterflies very different. Illegal logging, butterfly wild hunting, and change of environment in Bantimurung-Bulusaraung National Park force their migration to another location. The remain of the butterfly still living in a human environment (such as around waxy cornfield) and survival with limiting food sources. Harvesting of butterflies (especially case in Bantimurung areas for protecting butterfly) in these circumstances can be devastating, but beyond those large Papilionidae and possibly the spectacular morphology, harvesting has very significant effect on most butterfly populations and diversity, particularly when compared to more imminent threats such as habitat loss.
Ultimately, effective butterfly conservation will require the utilization of multiple approaches mainly teaching local people about the role of butterfly in the environment. It may be very difficult to replicate the success seen in large scale temperate butterfly conservation efforts in the tropical areas without similar depths of ecological knowledge (e.g. high-resolution distributional data and annual censusing). While understanding the exact utility of butterflies as indicators (and of what) would be of interest, it is now time to consider butterflies as more than just indicators but targets of conservation in their own right. I conclude by urging further studies on all aspects of butterfly bioecology, avoid habitat loss and conserve butterflies in their habitat. It very important things support conservation effort such as the role of stakeholder/local government regulation, manage and educate of local people. If they are done, then in the future it will be possible to review butterfly ecology and conservation used farmers crops more completely and definitively.

4. Conclusion

C. pomona was a higher number of frequency visiting waxy cornflower (5.6 times). D. chrysippus, P. demolion, and G. agamemnon have a similar frequency (0.5 times). Waxy cornflowers as alternative conservation effort (pollen source) for butterfly living around Bantimurung-Bulusaraung National Park. This study demonstrated that waxy cornflowers could be used as one of the alternative management tools for maintaining the butterflies population.

References

[1] Ehrlich P R, and Ehrlich A H 1992 The value of biodiversity. Ambio, 21: 219–226.
[2] Jervis M A, Kidd N A C, Fitton M G, Huddleston T and Dawah H A 1993 Flower Visiting by Hymenopteran Parasitoids. Journal Natural History, 27: 67-105.
[3] Karise R, Mand M, Ivask M, Koskor E and Bender A 2006 The effect of pollen amount and its caloric value in hybrid Lucerne (Medicago x varia) on its attractiveness to bumble bees (Bombus terrestris). Agronomy Research, 4: 211-216.
[4] Kremen C, Williams N M, Aizen M A, Gemmill-Harren B, LeBuhn G, Minckley R, Packer L, Potts S G, Roulston T, Steffan-Dewenter I, Vazquez D P, Winfree R, Adams L, Crone E E, Greenleaf S S, Keitt T H, Klein A M, Regetz J, Ricketts, T H 2007 Pollination and other ecosystem services produced by mobile organisms: a conceptual framework for the effects of land-use change. Ecology Letters, 10: 299–314.
[5] Landis D A, Wratten S D, and Gurr G M, 2000. Habitat management to conserve natural enemies of arthropod pests in agriculture. Annual Review Entomology, 45: 175-201.
[6] Lewis A C and Lipani A G, 1996 Learning and Flower Use in Butterflies: Hypotheses from Honey Bees. In: “Insect-Plant Interactions Vol. II” (Bernays EA, ed.) pp. 95-110. CRC Press. Boca Raton, Ann Arbor, Boston.
[7] Lundgren J G 2009. Progress in Biological Control: Relationship of Natural Enemies and Non Prey Foods. Springer Science and Business Media B.V. 434p.
[8] Mallet J 1986. Hybrid zones of Heliconius butterflies in Panama and the stability and movement of warning colour clines. Heredity, 56: 191–202.
[9] Maryatul Q, Heru S, Sriyanti P, Azis M, Mursidin dan Fajri 2010 Identifikasi Keragaman Jenis Kupu-kupu di Bantimurung. Departemen Kehutanan Dirjen Perlindungan Hutan dan Konservasi Alam Balai Taman Nasional Bantimurung-Bulusaraung Kabupaten Maros.
[10] Nentwig W 1998 Weedy Plant Species and Their Beneficial Arthropods: Potential for Manipulation in Field Crops. In: “Enhancing Biological Control: Habitat Management to Promote Natural Enemies of Agricultural Pests” (Pickett CH and Bugg RL., eds.). pp. 49-67. University of California Press, USA.
[11] Peggie D, and Amir M 2006 Panduan Praktis Kupu-kupu di Kebun Raya Bogor. Bidang Zoologi, Puslit Biologi LIPI dan Nagao Natural Environment Foundation Japan.126 hal.
[12] Peggie D 2011 Precious and Protected Indonesian Butterflies. Centre of Biology LIPI and Nagao Natural Environment Foundation Japan. 72 p.
[13] Salmah S, Abbas I dan Dahelmi 2002 Kupu-kupu Papilionidae di Taman Nasional Kerinci Seblat. Departemen Kehutanan dan Yayasan Kehati. 88 hal.
[14] Schoohoven L M, Jermy T, and van Loon, J J A 1998 Insect-Plant Biology: From Physiology to Evolution. Chapman and Hall, London.
[15] Scoble M J 1992 The Lepidoptera: Form, Function, and Diversity. Oxford University Press. 404p.
[16] Sri NAN, Annie P S, Nurariaty A, Amran A and Ifayanti R 2014a Two artificial diets formulations for *Troides helena* Linn. larvae (Lepidoptera: Papilionidae) in Bantimurung-Bulusaraung National Park, South Sulawesi. *International Journal of Scientific and Technology Research*, 3 (7): 170-173.
[17] Sri NAN, Nurariaty A and Annie P S 2014b. The potential of flowering weeds as refugia for predatory insects at Bantimurung-Bulusaraung National Park, South Sulawesi. *International Journal of Tropical Crops Science*, 1 (2): 25-29.
[18] Thomas J A 2005 Monitoring change in the abundance and distribution of insects using butterflies and other indicator groups. Philosophical Transactions of the Royal Society B, *Biological Sciences*, 360: 339–357.
[19] UNEP-WCMC 2012 Review of Butterflies From Asia and Oceania Subject to Long-Standing Positive Opinions. UNEP-WCMC, Cambridge. 103p.
[20] Vane-Wright R I and de Jong R 2003 The Butterflies of Sulawesi: Annotated Checklist for a Critical Island Fauna. Zoologische Verhandelingen. Leiden, 265: 79-80.
[21] Weiss M R 1997 Innate color preferences and flexible color learning in the Pipevine Swallowtail. *Anim. Behav.*, 53(5):1043-1052.