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Conservation of *Troides helena* Linnaeus (Lepidoptera: Papilionidae) in Forest Park of Mount Tumpa, Manado, North Sulawesi

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Abstract: *Troides helena* is a butterfly species that are protected in Indonesia. *T. helena* scarcity caused by reduced host plant (*Aristolochia tagala*) in nature and habitat destruction. The research objectives were to establish a conservation area of *T. helena* in Forest Park of Mount Tumpa, Manado, North Sulawesi, to study visit frequencies of *T. helena* in conservation site with scans and focal sampling, and assess the biophysical environment of conservation area. Determining the location of conservation based on a location where there are host plants of *T. helena* (*A. tagala*). *A. tagala* conserved by way of augmentation in ex-situ, and also the planting of nectar-producing plants (*Hibiscus rosasinensis*, *Ixsora paludosa*, and *Callistephus chineasis*). These treatments may increase visit frequencies of *T. helena* from 1-2 into 2-7 individual individuals, and increase the activity of *T. helena* like to fly in the longer study site, rest, play, preparation copulation, lay eggs, and even found *T. helena* coming out of the cocoon. Plants produce nectar which is often visited by *T. helena* was *Spatodea campanulata* (Important Value Index = 27.9%). *Alstonia scolaris* is the dominant tree in Forest Park of Mount Tumpa, Manado, North Sulawesi.

Keywords: Conservation, *Troides helena*, Augmentation, *Aristolochis tagala*, *Spatodea campanulata*.

I. Introduction

Butterflies play an important role in maintaining biodiversity because of its function as pollinators [1]. In the context of the conservation of ecosystems, butterflies are also very popular used as bio-indicators of the change in quality of the environment because they are very sensitive to changes in habitat or habitat damage levels [2,3].

The existence of the butterfly may become extinct or endangered in case of loss of habitat, fragmentation, isolation, and changes in temperature [4]. In Indonesia, to protect butterflies from extinction, some species of butterflies are protected through regulation and legislation, namely Regulation no. 7 of 1999 and Law No. 5 of 1990, which establishes the protection of several species including 12 of the 15 of the genus *Troides* that exist in Indonesia. Under CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), protects 20 species of the genus *Troides* in the world included in appendices I and II [5]. But in reality, the existence of *Troides* threatened because their hunting and feeding on larvae reduced. The public is less aware that *Tagala aristolochia* is a source of food for butterfly larvae.

T. helena known as Helena Monarch Butterfly with wings covered with scales of black and yellow that is known as the Black and Gold Butterfly [5] or Common Yellow Birdwing [5]. *T. helena* described (1758) as *Papilio Helena* Linn. [5]. *T. helena* existence in North Sulawesi can be encountered in several places, one of which is Forest Park of Mount Tumpa, Manado, North Sulawesi. Based on the Decree of the Minister of Forestry of the Republic of Indonesia Number SK.434/Menhut-II/2013 dated July 17, 2013, Protected Forest Areas of Mount Tumpa into conservation areas, especially into the area of Park Forest of Mount Tumpa. This forest area has many problems similar to those occurring around the world are utilizing the forest by the public for commercial logging, fires, agricultural and development projects, so that the flora and fauna, is undergoing the process of the threat of scarcity and destruction especially unique wildlife Sulawesi [6] including *T. helena*. To support the existence of *T. helena* in Northern Sulawesi, the need to make conservation of butterflies.

II. Materials and methods

2.1. Time and Place of Research

This research was conducted at the Forest Park of Mount Tumpa, Manado, North Sulawesi in November 2014 until July 2015.

2.2. Research Procedure

The study begins by determining the conservation status *T.helena* in North Sulawesi through literature and field observations [7]. Conservation has been implemented by way of augmentation. Determination of the conservation area was carried out by using territorial theory of *T. helena* to find a host plant. Host plant species conservation carried out by the method of augmentation ex situ and the addition of host plants produce nectar. Observations of the visit frequencies of *T. helena* on the location of the research was conducted using scan sampling with intervals of two minutes and focal sampling. Observations biophysical include temperature and humidity, and for vegetation analysis using squares method to calculate the index of the importance of each species. Data analysis was performed descriptively.

III. Results and discussion

T. helena in North Sulawesi can be found in several places, one of which is the Park Forest of Mount Tumpa, Manado, North Sulawesi [8]. By following the territorial fly of *T. helena* could be found in the host plant (*Aristolochia tagala*) at the study site is located at position $1^0$33'58.4" N and $124^0$56'20.18" E with a height of 388 m above sea level, because females of *T. helena* visiting *A. tagala* for sucking nectar and lay eggs [9], then the area found a host plant is designated as a conservation area of *T. helena*. *A. tagala* which has been found at the site of research can be seen in Figure 3.1.

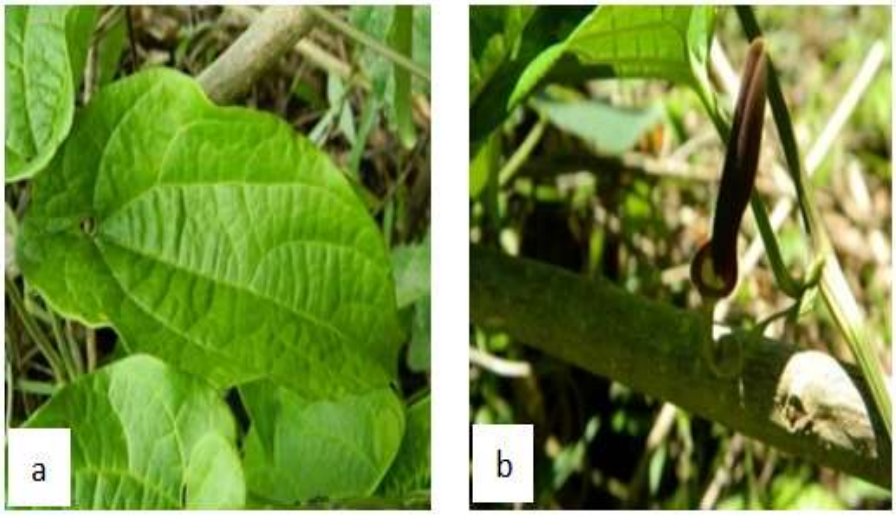

Figure 3.1. *Aristolochia tagala* vegetative (a) and generative (b).

Besides conservation *A. tagala* was carried out in place of discovery, also made augmentation, and the planting of nectar-producing plants (*Hibiscus rosasinensis*, *Ixrora peludosaand* and *Callistephus chinensis*) in the conservation site. Host plants were added to the study site can be seen in Figure 3.2.

Figure 3.2. The Host Plant were Added in the Location of Conservation. a. *A. tagala*, b. *Ixsora paludosa*, c. *Callistephus chineasis*

After was determined conservation site, an increase in the number of individuals of *T. helena* from 1-2 into 2-7 individuals. *T. helena* activities in the conservation area increases as rest, fly, sucking nectar, courtship, mating, and found a butterfly emerging from a cocoon. Activities butterfly on a conservation area can be seen in Figure 3.3.

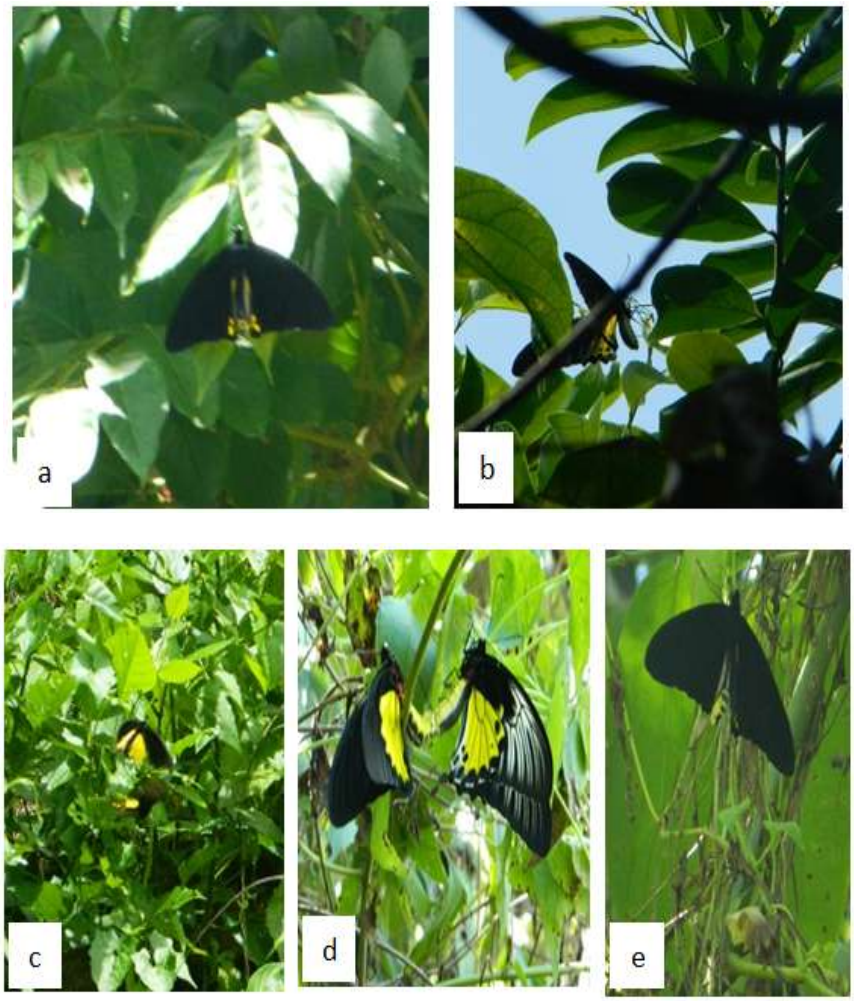

Figure 3.3. Butterfly Activities at the Sites of Research. a. Rest, b. Egg-Laying, c. Sucking, d. Copulation, e. Butterfly Out of the Cocoon.

T. helena lay eggs in *A. tagala* and/or leaves near host plants. Fecundity of *T. helena* ie 8 eggs in the egg sac. According to [10], the eggs produced per day with a range of 4-8 eggs. Figure 3.4 was a *T. helena* eggs are laid on the leaves near the host plant.

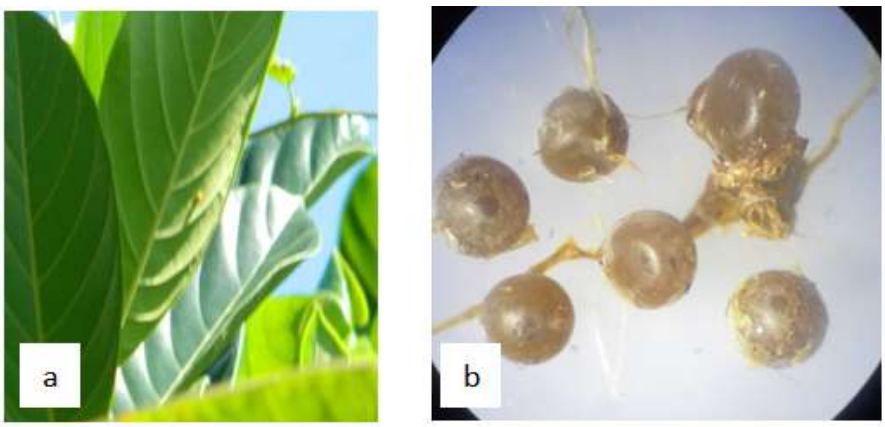

Figure 3.4. *T. helena* Eggs Laid on Leaves (a), Egg Result Fecundity (b).

Based on Figure 3.5, *T. helena* including animals that possess the ability to fly high. The ability to fly can be used for shelter, to feed, breed and play. The frequency of *T. helena* fly occurs throughout the day starting from 6:00 am -17: 00 pm. The highest frequency of flying is done in the morning from 8:00 to 10:00 o'clock when the sun was bright. High-flying done to raise body temperature and dry the wings, According to [11] that butterflies flew in the morning 8:00 to 10:00 am in the sun to dry their wings. Information from Figure 4.12 was the frequency of visits of *T. helena* on flower sucking nectar made from 7:00 am until 4:00 pm, frequency of visits increased from 7 am until 9.00 am, then decreases at 9:00 am and again increased at 12:00 to 3:00 pm. Nectar is required by the butterfly as a food that can be converted into energy that is used to conduct flight activities. According to [11], butterflies usually visit flowers at 08:00-10:00 am, when the sun is shining enough. The frequency of visits to suck nectar also occurred in the afternoon at around 1:00 to 3:00 pm. Plants most frequently visited *T. helena* to suck nectar were *Spatodea campanulata* and *Alstonia scolaris*. *S. campanulata* and *A. scolaris* visited by *T. helena* can be seen in Figure 3.6.

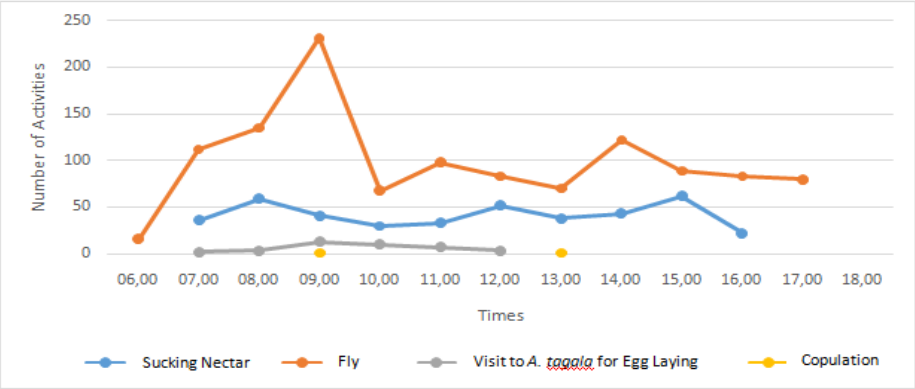

Figure 3.5. Visit Frequencies and Times and Activities of *T. helena*.

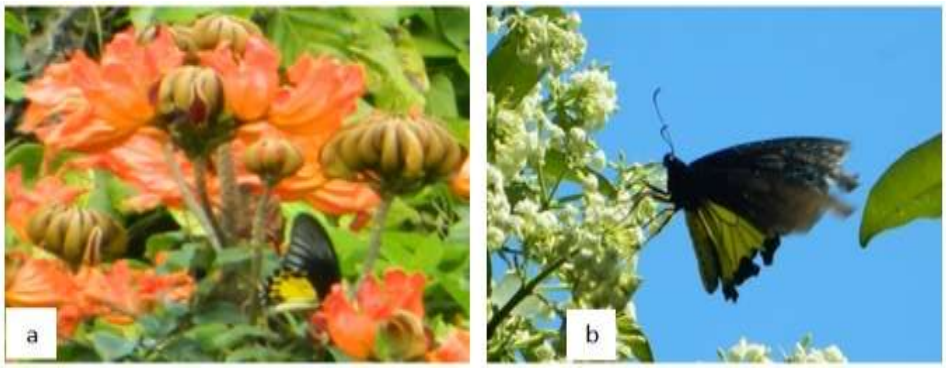

Figure 3.6. Plants that Visited by *T. helena* to Suck Nectar. a. *Spatodea campanulata*. b. *Alstonia Scolaris*.

The frequency of visits to copulation occurs during the period of 09:00 am and 1:00 pm. The time needed in copulation 30 to 2:42 minutes, and a mating position interdependent or face. According to [12] stated that the butterflies began to copulate in the morning. *T. helena* copulation position can be seen in Figure 3.7.

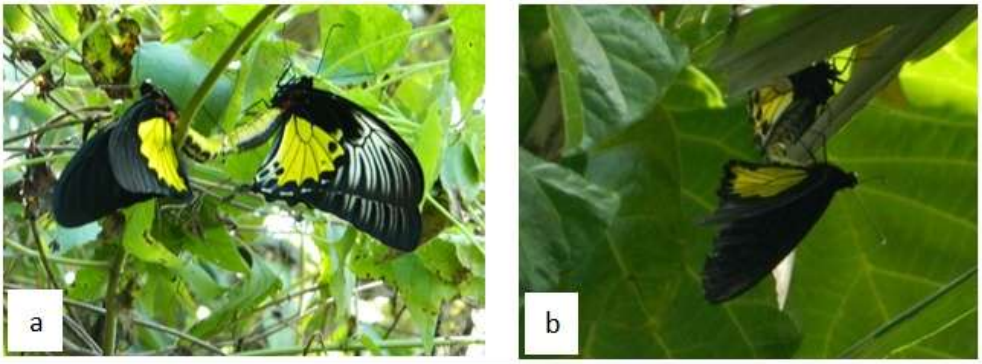

Figure 3.7. Copulation Position of *T. helena* that Depend on Each Other (a) and Opposite Each Other (b).

Temperature and humidity in the conservation site from September 2014 to July 2015 ranged from 24 - 34^0 C, with humidity of 60-80%. Temperature and humidity at the location of the study strongly support the life of *T. helena* because according to [13], butterflies require temperatures between 30 - 35^0C and the humidity between 64% - 94%. Most species of butterflies maintain body temperature at a temperature of 30 - 35^0C (1). Plants produce nectar most visited by *T. helena* to suck nectar were *Spatodea campanulata*. This plant species dominating Forest Park of Mount Tumpa (the importance value index was 27.9%).

IV. Conclusions

T. helena conservation area in Forest Park of Mount Tumpa, Manado has been set, and with added plant host for *T. helena* immatures (*A. tagala*), and plants produce nectar (*Hibiscus rosasinensis*, *Ixsor paiudosa*, and *Callistephus chineasis*), the number, frequency of visits, and the activity has increased in the conservation site. Conservation area dominated by *Spatodea campanulata* (the importance value index was 27.9%), the temperature of 24 - 34^0 C and humidity of 60 - 80% so that the forest park area of Mount Tumpa, strongly support conservation of *T. helena* in Manado, North Sulawesi.

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