J. Entomol. Res. Soc., 21(3): 281-289, 2019
Print ISSN:1302-0250
Research Article
Online ISSN:2651-3579

Color Characterization of *Ornithoptera croesus* Wallace, 1859 Female Depending of Differenet Heights (Lepidoptera: Papilionidae)

Abdu MAS'UD[1] Aloysius Duran COREBIMA[2]* Fatchur ROHMAN[2]
Mohamad AMIN[2] Alisi ALISI[3]

[1]Faculty of Teacher Training & Education, University of Khairun, Ternate, INDONESIA
[2]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Malang, Malang, INDONESIA
[3]Conservationists, Endemic Butterfly Island Bacan North Maluku, Ternate, INDONESIA
e-mails: abdumasud@unkhair.ac.id, *durancorebima@gmail.com, fatchur.rohman.fmipa@um.ac.id, mohamad.amin.fmipa@um.ac.id, alisibacanisland@gmail.com
ORCID IDs: 0000-0002-5813-7187, 0000-0002-2632-9467, 0000-0002-9270-603X, 0000-0002-7900-4017, 0000-0002-4028-2327

ABSTRACT

This study conducted in June-July 2015, using a survey method aimed at describing the characteristics of the body color and wing color of *Ornithoptera croesus* female, an endemic butterfly in Bacan island, in the Sibela Mountain conservation area. Purposive sampling was used to collect data in four different areas of different height, 20 m, 200 m, 400 m, and 800 m above sea level (ASL). Specimens were analyzed qualitatively. Females of *O. croesus* have different color of bodies and wings. There are specific differences related to the female wing color at the four different height. At the altitude of 20 meter ASL, the bottom part of wings has small white golden dots, or small white yellowish golden dots. At the altitude of 200 meter ASL the entire wing surface have pale brown color. At the altitude of 400 meter ASL the wing color have small white golden dots connecting directly to the yellow golden dots, and at the altitude of 800 meter ASL there are small white dots on the front bottom wings. These findings are new informations as the supplement to the female wing color description of Wallace (1869) said that female *O. croesus* had a dark colour marked with white and yellow spots.

Key words: Bacan island, butterfly, color characteristics, north mollucas, *Ornithoptera croesus.*

Mas'ud, A., Corebima, A.D., Rohman, F., Amin, M., & Alisi, A. (2019). Color characterization of *Ornithoptera croesus* Wallace, 1859 female depending of differenet heights (Lepidoptera: Papilionidae). *Journal of the Entomological Research Society,* 21(3), 281-289.

INTRODUCTION

O. croesus butterflies are endemic butterflies in Bacan Island of South Halmahera District. Geographically Bacan island is an isolated and separated island from the mainland of Halmahera Island. Bacan Island has a conservation area located in the Sibela Mountain having an area of ± 23 024 hectares up to the height of 2,118 m above sea level. It has a lot of endemic species of flora and fauna (BKSD, 1996). At this conservation area of Sibela Mountain are found *O. croesus* butterfles are found in the conservation area of Sibela mountain at various locations as their ecological niches. The hotspot of *O. croesus* has some characteristics such as related to the existence of Mussaenda and Asoka plants as their food.

The combination of body color and wing color of *O. croesus* butterflies found in Bacan Island is one of the main attractions making the conservation area of Sibela mountain more exotic. In addition to providing the charm and beauty to the nature due to their body color and wing color combination, *O. croesus* butterflies also play a role as pollinators in the ecosystems by pollinating a variety of plant species. Because butterflies have a very important role for the continuity and balance of the ecosystem, their existence becomes an indicator whether an ecosystem is in a good condition or bad condition (Boonvanno, Watanasit, & Surakrai, 2000; Amir, Noerdjito, & Kahono, 2003).

The wing of *O. croesus* have particular scales, which give particular patterns and colors on the wings of the butterfly. The uniqueness of the bright colors of the *O. croesus* butterflies is interesting to be studied. The researchers will always study and identify morphological characteristics related to the body color as well as wings color of the *O. croesus* butterflies.

Wallace (1869) said that *O. croesus* is an original butterfly of Australasia/ Indomalaya ecozone. It was said too that the female *O. croesus* had a dark colour marked with white and yellow spots, and the male *O. croesus* had a color which are velvety black and fiery orange. Furthermore, Collins & Morris (1985) also described the color characteristics of male *O. croesus* it was said that "*upper forewing (UFW) ground colour very dark brown with a broad iridescent orange radial band and short anal streak. Upper hindwing (UHW) orange with a narrow black margin and a golden yellow subcostal patch, discal and submarginal spots. Lower forewing (LFW) black with iridescent green submarginal and discal spots, radial band and a patch in the cell. Lower hindwing (LHW) yellow-green with black veins, subdiscal spots and a narrow margin, a yellow anal area and golden areas as on the upper surface*". Whereas related to the female *O. croesus*, it was said that "*upper forewing (UFW) dark brown ground colour with white markings including a cell spot, marginal fringe spots, submarginal and discal spots. Upper hindwing (UHW) darker than forewing with yellow brown distal patches and black subdiscal spots. Lower forewing (LFW)/ Lower hindwing (LHW) differs only in having paler markings"*. Peggie (2011) stated that the body and the wing color of the *O. croesus* butterflies are shiny green-golden color, wide grey color, golden orange, white-yellow, yellow-gray.

Research on characteristics of color variation the *O. croesus* butterflies have been conducted, by Wallace (1869), Collins & Morris (1985), and Peggie (2011). This research aims at describing the characteristics variations of the body color and the wing color of *O. croesus* female on four places of different heights.

MATERIALS AND METHODS

Research area where the *O. croesus* butterflies were collected was in the conservation area of Sibela Mountain, Bacan Island in four places of different heights, namely, 20 meters above sea level (lowland), 200 meters above sea level (Balittro), 400 meters above sea level (Ra River), 800 meters above sea level (Sibela sago pond or buffer zone). The map of the research area can be seen in (Fig. 1).

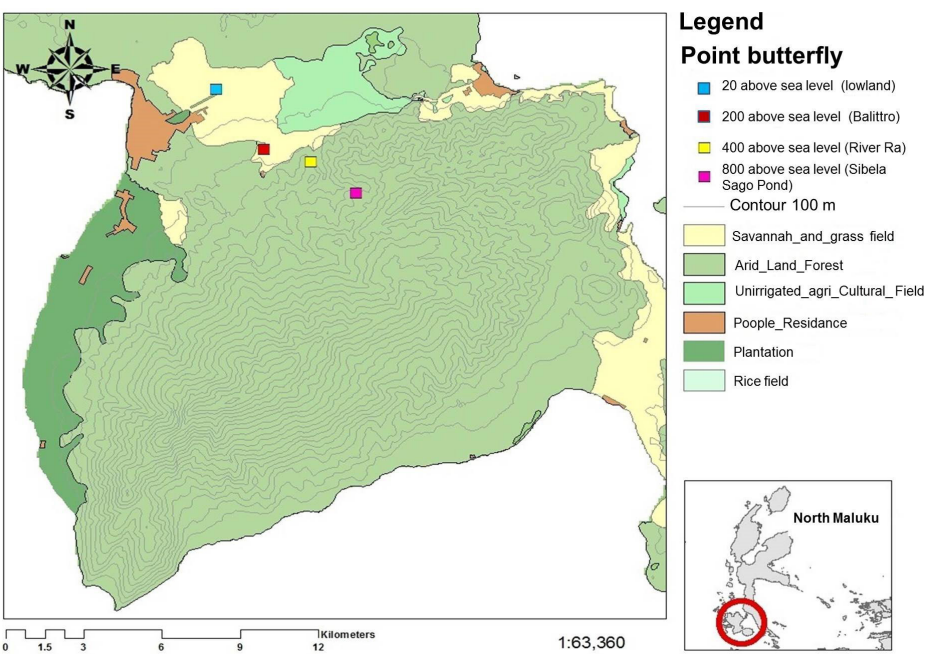

Fig. 1. The research area map located in the conservation area of Sibela Mountain in Bacan Island of South Halmahera, North Mollucas Indonesia.

The Method used in this research was survey method, and the research samples were taken by purposive sampling method. This research aimed to identify specimens of *O. croesus* butterflies, then the results of the identification were analyzed qualitatively and the sampling technique used was the sweeping technique (Leather, 2005). The *O. croesus* butterflies were caught in four places of different height, 20 meters above sea level, 200 meters above sea level, 400 meters above sea level, and 800 meters above sea level. In each place, 4 pairs of butterflies (male and female) were caught. Thus totally 32 butterflies were caught.

The tools used in this research were: 1) the insect sweep net, 2) altimeter for measuring the height of a place, 3) compass, 4) digital camera for specimen documentation. The materials used were camphor powder, papillot paper, plastic clips, and labels paper.

RESULTS

O. croesus found in conservation area of Sibela Mountain where Mussaenda plants grew. Mussaenda plants were food for Ornithoptera. At a height of 20 meters above sea level, there were a lot of Mussaenda and Asoka plants because local people grew and cultivated them as ornamental plants. At the height of 200 meters above sea level, and 400 meters above sea level, Mussaenda plants grew wildly in limited quantities. At the height of 800 meters above sea level, Mussaenda plants did not grow, but it was dominated by Gusale plants (*Octomyrtus lanceolante*) which were visited by *O. croesus*.

The data obtained in this study are in the character descriptions of the body color variations of *O. croesus* female butterflies as presented in (Figs. 2, 3, 4, 5 and Table 1).

Fig. 2. Color characteristics of female *O. croesus* at the height of 20 m above sea level (A= seen from the top; B= seen from the beside).

Fig. 3. Color characteristics of female *O. croesus* at the height of 200 m above sea level (A= seen from the top; B= seen from the beside).

Fig. 4. Color characteristics of female *O. croesus* at the height of 400 m above sea level (A= seen from the top; B= seen from the beside).

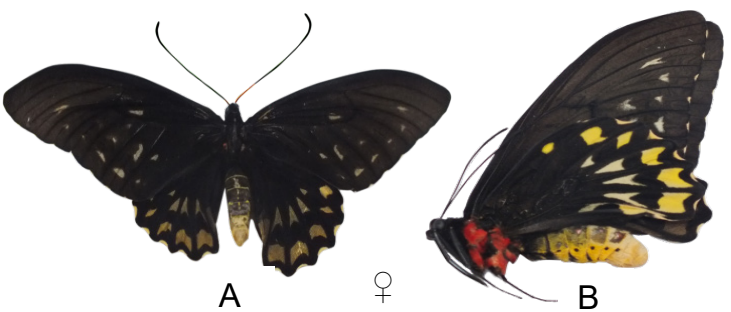

Fig. 5. Color characteristics of female *O. croesus* at the height of 800 m above sea level (A= seen from the top; B= seen from the beside).

The body color of male *O. croesus* is generally very bright with a beautiful color combination so that it attracts the attention of female *O. croesus* to copulate. The body color of female *O. croesus* generally has dark colors dominated by dark brown color, but it has good combinations of wing color and the color of other part of the body, so it looks beautiful.

Based on the (Figs. 2, 3, 4, and 5) above, the female *O. croesus* has body color variations which shows anomalous characteristic (Wallace, 1869). The color description of each part of the body of the *O. croesus* female butterfly can be seen in Table 1.

Based on the description (Table 1) that related to the characteristics of the body color, the head, antennae, proboscis, thorax and legs of a male *O. croesus* butterfly are black, while the abdomen is yellow. Generally, the wings of the male butterfly are black with golden yellow stripes in the center, shaping a circle and lines. Furthermore related to the body color of the female *O. croesus* butterfly, the head, antennae, proboscis, thorax, and legs are dark brown and black, while the abdomen is brownish white and yellow at the bottom. The wings of the female butterfly are generally dark brown, and having some golden white dots and yellow golden dots. Overally, the dominant color of the male *O. croesus* is black, while the dominant color of the female *O. croesus* is dark brown.

Table 1. Color description of each body part of female *O. croesus* butterflies.

No	Body Part	Color			
		Females			
		20 m asl	200 m asl	400 m asl	800 m asl
1	Head	Blackish-brown	Blackish-brown	Blackish-brown	Blackish-brown
2	Antena	Black	Black	Black	Black
3	Proboscis	Black	Black	Black	Black
4	Eyes	Dark brown	Dark brown	Dark brown	Dark brown
5	Upper Thorax	Dark brown with some greenish yellow specks along the upper center of the thorax	Dark brown with some greenish yellow specks along the upper center of the thorax	Dark brown with some greenish yellow specks along the upper center of the thorax	Dark brown with some greenish yellow specks along the upper center of the thorax
6	Lower Torax	Dark brown with red color on the edges of the thorax	Dark brown with red color on the edges of the thorax	Dark brown with red color on the edges of the thorax	Dark brown with red color on the edges of the thorax
7	Abdomen	Brownish white at the upper part and yellow at the bottom part spreading toward at the back part which is more yellow with brown dots in line with the segment	Brownish white at the upper part and yellow at the bottom part spreading toward at the back part which is more yellow with brown dots in line with the segment	Brownish white at the upper part and yellow at the bottom part spreading toward at the back part which is more yellow with brown dots in line with the segment	Brownish white at the upper part and yellow at the bottom part spreading toward at the back part which is more yellow with brown dots in line with the segment
8	Legs	Black	Black	Black	Black
9	Wings	The bottom wings of the female butterflies had several white golden specks, and some butterflies had white specks and yellow golden specks	The wings of the female butterflies were pale brown of the entire surface of the wings	The wings of the female butterflies had golden white dots that connected directly to the golden yellow dots	The wings of the female butterflies had variations of color patches of white spots on the bottom of the front wings

DISCUSSION

The results of this research indicate there are specific differences in the wing color of the female *O. croesus* at the four different locations of different height. The other findings of this research will be described further. At the height of 20 meters above sea level, the color of the bottom wings of the females has some white-golden dots; some have several white dots and yellow golden dots. At the height of 200 meters above sea level, the entire surface of the female wing is pale brown. Furthermore at the height of 400 meters above sea level, there are golden white dots connecting directly to the golden yellow dots at the bottom part of the wings of the female, and at the height of the 800 meters above sea level, the wings of the females have variations of white specks on the front bottom parts. The findings of this research give some additional information related to the description of Wallace (1869) concerning the characteristics of the body including color the wing of *O. croesus* butterflies, particularly those of females.

Color variations of a particular butterfly species can be seen from their color pattern difference. Furthermore Wallace (1869) stated that generally the characteristics of the body color of male and female *O. croesus* butterflies varies widely, especially the color of the wings. Color variation and color pattern are known as the effect of a combination

of genetic and environmental factors. One of the environmental factors that can affect the phenotype of a butterfly is the altitude of a place. Brown (1962) stated there were variations in the length and color of the wings of Draco butterflies (Hysperidae) at various places with different altitude. Joshi & Arya (2007) stated the similar thing that the butterfly species at the places with different altitude in west India experienced color variation. Forsman, Ringblom, Civantos, & Ahnesjo (2002) stated that the different color morphology was affected by genetic factors, but the response was also affected by the level of heat in the environment where the butterflies grew. Furthermore, Smetacek (2001) stated that the body color variation was genetic variation phenomenon. This was consistent with the statement of Zvereva & Rank (2003) that the phenotypic variation of insects species might occured due to the interaction of genes and environments. Sartiami, Sosromarsono, Buchori & Suryobroto (1999) stated that the species of insects tended to increase melanin gene expression at the lower temperatures, so the insects living in the lower temperature environments were generally darker in color.

This research investigated the characteristics relationship of the color and the wings of the butterflies in several locations with different altitude, to prove the effect of the altitude on the characterization of the color of butterflies. The results of this research showed that the spatial distribution female *O. croesus* in several places with different altitude in Sibela Mountain conservation area was caused by climatic factors and the availability of food at the observation sites. The favorite food of *O. croesus* was Mussaenda and Asoka plants. At observation site of 20 meters above sea level, there were a lot of Mussaenda and Asoka plants. At the observation site of 200 meters and 400 meters above sea level, there were a lot of Mussaenda plants. While at the altitude of 800 meters above sea level, there was not any Mussaenda plant, but it was dominated by gusale plants (*Octomyrtus lanceolante*). At the altitude of 800 meters above sea level, *O. croesus* used gusale flower (*Octomyrtus lanceolante*) as the source food. The amount of the food could affect the growth, development, reproduction, behavior, morphology and color of the butterflies. Mussaenda plants could grow along the conservation area of Sibela Mountain. Generally, the *O. croesus* butterflies ate the plants growing on the edge of the river to survive. Fitzgerald & Costa (1999) stated that the host plants, other than as a source of food, also served as a place for larva to get important nutrients and chemical substances which were necessary to form the color and the characteristics of adult butterflies. *O. croesus* butterflies were one of the animals belonging to the nectarinidae type (Dendang, 2009), that was an animal which sucked the nectars of flowers (honey) to live. The types of plants producing nectars as the source of food for adult *O. croesus* butterflies generally had attractive flowers. Adult butterflies were attracted to colors that were contrast because the spectrum of the color could be received by the eyes of the butterflies. Thus, flowers that had contrast color could attract adult butterflies (D'Abrera, 1990).

CONCLUSION

In conclusion the findings of this research indicate a new phenomenon that is renewing the description of Wallace (1869) concerning the character of wing color of

O. croesus butterflies, especially those of the females there were specific differences in the color of the wings of female *O. croesus* butterflies at four locations with different altitudes; 1) at the altitude of 20 meters above sea level, the bottom wings of the female butterflies had several white golden specks, and some butterflies had white specks and yellow golden specks; 2) at the altitude of 200 meters above sea level, the wings of the female butterflies were pale brown of the entire surface of the wings; 3) at the altitude of 400 meters above sea level, the wings of the female butterflies had golden white dots that connected directly to the golden yellow dots, and 4) at the altitude of 800 meter above sea level, the wings of the female butterflies had variations of color patches of white spots on the bottom of the front wings.

ACKNOWLEDGEMENTS

On this opportunity, the researchers would like to thank: Dr. Sundari., M.Pd, Djunijanti Peggie, M.Sc., Ph.D., Ismat Ishak, S.Pd, and Mukhlis, for the guidance, support and assistance in the collection and identification of the *O. croesus* samples found in the conservation area of Sibela Mountain in Bacan Island.

REFERENCES

Amir, M., Noerdjito, W.A, & Kahono, S. (2003). *Butterflies (Lepidoptera). Insect of the Halimun Mountain National Park in West Java, JICA*.

BKSD. (1996). Potential Assessment Report of the Conservation Area Mountain Nature Reserve Sibela in Bacan. Moluccas: Department of Forestry on Moluccas Provincial, 130, 92-93.

Boonvanno, K., Watanasit, S., & Surakrai, P.S. (2000). Butterfly diversity at ton nga-chang wildlife sanctuary, Songkhla Province, Southern Thailand, *Journal Science Asia*, 26, 105-110.

Brown, F.M. (1962). The variation of *Polites draco* (Hesperiidje) with altitude, *Journal of the Lepidopterists' Society*, 16(4), 239-242.

Collins, N.M. & Morris, M.G. (1985). Threatened swallowtail butterflies of the world. *The IUCN Red Data Book. IUCN, Gland and Cambridge*, 440, 294-295.

D'Abrera, B. (1990). *Butterflies of the Australian region*. (Revised 1st ed.). Melbourne and London: Hill house. pp. 416.

Dendang, B. (2009). The variety of butterflies in selabintana national park resort in Gede Pangrango mountain west java, *Journal of Forest Research and Natural Conservation*, 4(1), 25-36.

Fitzgerald, T. & Costa, J. (1999). Collective behavior in social caterpillars. *Information Processing in Social Insects*. 4, 379-400.

Forsman, A., Ringblom, K., Civantos, E., & Ahnesjo, J. (2002). Coevolution of color pattern and thermoregulatory behavior in polymorphic pygmy grasshoppers. *Tetrix undulate, Evolution,* 56, 349 360.

Joshi, P.C. & Arya, M. (2007). Butterfly communities along altitudinal gradients in a protected forest in the western Himalayas, India, *The Natural History Jounal of Chulalongkom University*, 7(1), 1-9.

Leather, S.R. (2005). Insect sampling in forest ecosystem. Methods In Ecology, by Blackwell Science Ltd, 276, 116-146.

Peggie, Dj. (2011). *Precious and Protected Indonesian Butterlies*. Jakarta: PT. Binamitra Megawarna. Jakarta, Indonesia, 22-23.

Sartiami, D., Sosromarsono S., Buchori D., & Suryobroto, B. (1999). Diversity species silverleaf whitefly fruit crops in Bogor region. The role of entomology in pest control eco-friendly and economical, *Proceedings of the National Seminar Entomological Society of Indonesia (PEI),* Bogor: PE.

Smetacek, P. (2001). The study of butterflies. 3 Intra specific variation, *Resonance*, 5(6), 8-14.

Wallace, A.R. (1869). The Malay Archipelago. Foreword 1987, by Lioyd Fernando. Printed in Singapore, 479, 257-258.

Zvereva, E.L. & Rank N.E. (2003). Host plant effects on parasitoid attack on the leaf beetle *Chrysomela lapponica*, *Oecologia*, 135, 258-267.

Received: November 04, 2017 *Accepted: September 23, 2019*