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Aggregation of *Euploea* Butterflies in Sabah, Malaysia*

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Abstract

Euploea butterflies aggregating in the Bandukan Park in Keningau, Sabah, Malaysia were sampled in August of 1987 to investigate their reproductive activities. Almost all females of the 3 dominant species, *E. tulliolus*, *E. sylvester* and *E. modesta* had both mature eggs and spermatophore(s), which shows that they were active in reproductive activities unlike the monarch butterflies in overwintering colonies.

Introduction

The author found *Euploea* butterflies aggregating here and there in the Bandukan Park in Keningau, Sabah, Malaysia in August, 1987. The park is located on the River Baiayo at the foot of the Crocker Range with the altitude of about 300 m (Figs. 1-2). The

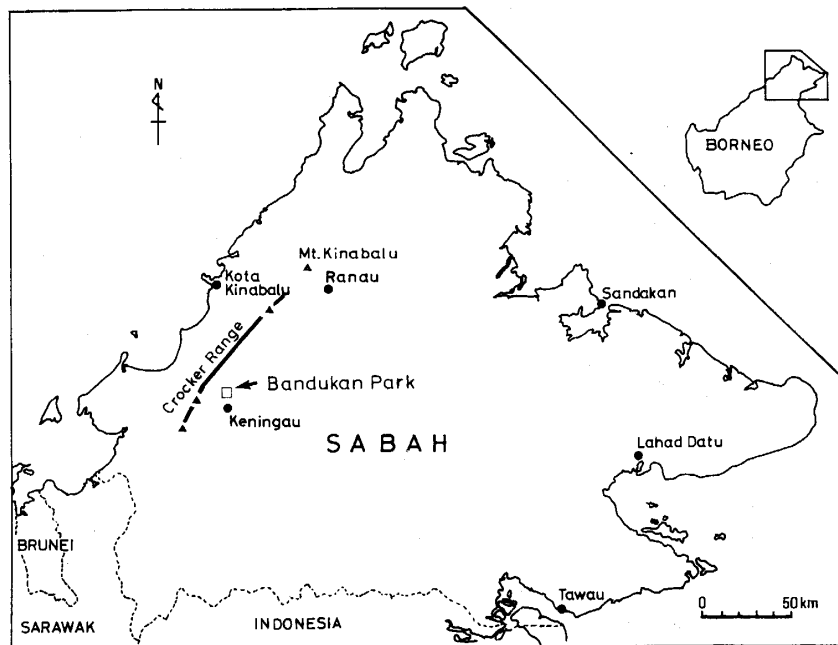
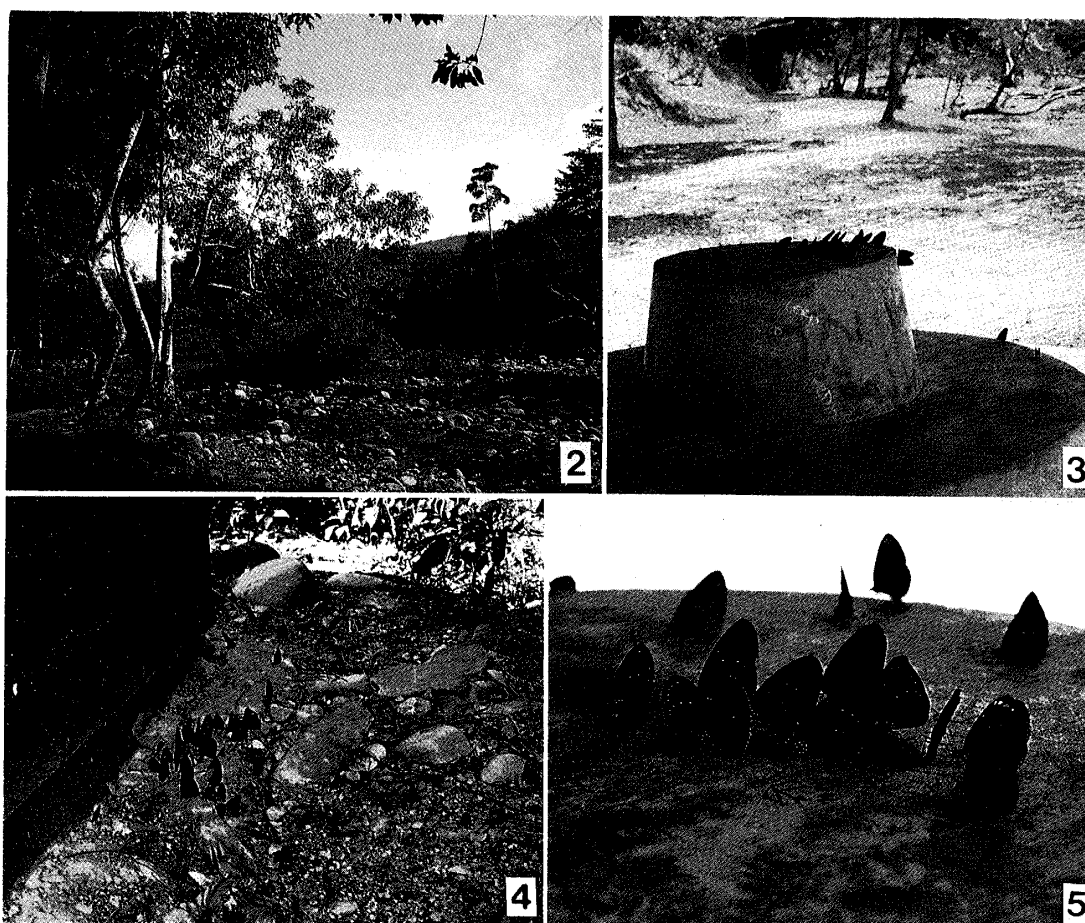


Fig.1 Location of the Bandukan Park in Keningau, Sabah, Malaysia.

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Figs.2-5 2. A scenery in the Bandukan Park located on the River Baiayo at the foot of Crocker Range in Sabah, Malaysia. 3. A concrete bench on which *Euploea* butterflies were observed aggregating in August, 1987. 4-5. *Euploea* butterflies gathering and extending proboscises behind a toilet (4) and on a concrete bench (5) in the Bandukan Park.

butterflies were observed to gather and extend their proboscises at concrete benches, toilet, fire sites, dung of water buffalo, etc. (Figs. 3-5).

In danaid butterflies, two types of adult aggregation have been known. Instances of the overwintering congregation have been observed in *Danaus plexippus* in U. S. A. and Mexico¹⁾, *Euploea* butterflies in Taiwan²⁾ and *Ideopsis similis* in Amami Isl. in southern Japan³⁾. It has been proved in the former two cases that the butterflies, at least females, in the assemblages are in the state of reproductive diapause during the winter: no mature eggs are found in the ovaries and the mating activity is suppressed.

On the other hand, another type of aggregation is observed in the breeding season and it may be a rather trivial phenomenon in danaid butterflies. For example, some *Euploea* species are often seen aggregating on flowers, leaves, tree trunks, the moist ground, animal feces, etc⁴⁾. It will be naturally expected that these butterflies are highly active in reproduction.

In the present report, the author listed *Euploea* butterflies collected in the Bandukan park and described their ovarian status to clarify the meaning of aggregation.

Materials and Methods

Euploea butterflies feeding at concrete benches in the Bandukan park were collected and soaked in the 70% ethyl alcohol solution in the Bandukan park on August 19 and 20, 1987. Alcoholic butterflies were identified and sexed in Japan. Some of the females were dissected under the microscope to observe ovaries and spermatophores. The developmental stage of ovary was defined as follows: 0: no visible eggs; I: small immature eggs; II: large immature eggs; III: mature eggs were found.

The freshness of wings was also assessed and graded to the percentage of the intact portion of marginal edge as follows: A : 100% ; B : >90% ; C : >70% ; D : >30% ; E : <30% of wing margins were intact.

Table 1. Number and sex ratio of *Euploea* species collected at Bandukan Park in Keningau, Malaysia in August of 1987.

| species | N(%) | male | female | female/male | P ¹⁾ |
|------------------------|------------|------|--------|-------------|-----------------|
| <i>E. tulliolus</i> | 147(48.2%) | 86 | 61 | 0.709 | P<0.05 |
| <i>E. sylvester</i> | 131(43.0%) | 13 | 118 | 9.077 | P<0.01 |
| <i>E. modesta</i> | 22(7.2%) | 16 | 6 | 0.375 | P<0.05 |
| <i>E. mulciber</i> | 3(1.0%) | 3 | 0 | 0.000 | — |
| <i>E. eyndhovii</i> | 1(0.3%) | 1 | 0 | 0.000 | — |
| <i>E. leucostictos</i> | 1(0.3%) | 1 | 0 | 0.000 | — |
| total | 305 indiv. | | | | |

1) significance by Chi-square test

Table 2. Stage of ovaries and copulation ratio in females of three *Euploea* species collected at Bandukan park, Keningau in August of 1987.

| species | No. female collected | No. sampled | stage of ovaries 1) | | | | 2) No. (%) copulated |
|---------------------|----------------------|-------------|---------------------|---|----|-----|-------------------------|
| | | | 0 | I | II | III | |
| <i>E. tulliolus</i> | 61 | 20 | 0 | 0 | 1 | 19 | 19 (95%) |
| <i>E. sylvester</i> | 118 | 30 | 0 | 0 | 0 | 30 | 30 (100%) |
| <i>E. modesta</i> | 6 | 6 | 0 | 0 | 0 | 6 | 6 (100%) |

1) 0: no visible oocytes; I: small oocytes; II: large oocytes; III: mature oocytes exist.

2) no. of individuals having spermatophore(s).

Table 3. Freshness of wings in females of three *Euploea* species collected at Bandukan park, Keningau in August of 1987.

| species | No. female collected | No. sampled | freshness of wings 1) | | | | |
|---------------------|----------------------|-------------|-----------------------|---|----|----|---|
| | | | A | B | C | D | E |
| <i>E. tulliolus</i> | 61 | 20 | 3 | 7 | 7 | 3 | 0 |
| <i>E. sylvester</i> | 118 | 30 | 2 | 4 | 12 | 10 | 2 |
| <i>E. modesta</i> | 6 | 6 | 0 | 1 | 2 | 2 | 1 |

1) % outer margins of wings remains intact. A: 100%; B: >90%; C: >70%; D: >30%; E: <30%.

Results

Three hundred and five specimens collected and alcoholized at the Bandukan park in Keningau, Saban, Malaysia were dominated by *Euploea tulliolus* (48.2%), *E. sylvester* (43.0%) and *E. modesta* (7.2%). The rests were 3 males of *E. mulciber* and one male of *E. eyndhovii* and *E. leucostictos* (Table 1). It is intriguing that the sex ratio was much female biased in *E. sylvester* and slightly male biased in both *E. tulliolus* and *E. modesta*.

All the females dissected were proved to have both mature eggs (stage III) and one or more spermatophore(s) except a single virgin female *E. tulliolus* whose ovaries were still stage II (Table 2).

Discussion

The results clearly show that the *Euploea* butterflies collected in the Bandukan park were active in the reproductive status: the mating and oviposition might occur in the Bandukan park at the time of collection though these reproductive activities were not observed actually.

It has been known, however, that in *D. plexippus* the mating activity is enhanced and the copulations occur in the overwintering assemblage in spring⁵⁾. The fact that wings of most females examined were more or less worn (Table 3) may show that the butterflies in the assemblage of Bandukan were just after the termination of reproductive diapause. The uniformity in the ovarian development (see Table 2) may also support the assumption.

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