

Biology of the angled castor, *Ariadne ariadne* (Linnaeus, 1763), in Vietnam

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Abstract

This paper provides the observation results made from March to December 2018 on the life cycle and other biological traits of the angled castor butterfly (*Ariadne ariadne* L.) in a captive breeding condition in Thua Thien Hue province, central Vietnam. Morphological and behavioral observations were made for all stages of the species.

Keywords

castor plant, life cycle, Nymphalidae.

1. Introduction

The angled castor butterfly (*Ariadne ariadne* L.) of Nymphalidae is found in Asia and common in South East Asia. Its larva has been recorded feeding most commonly on castor plant (*Ricinus communis* L.), thus given its English name. Food plants of the species also include *Tragia cannabinina*, *T. hispida*, *T. plukenetii*, and *T. involucrata* (Nitin et al., 2018; Bingham, 1907).

In Thua Thien Hue province, central Vietnam, the larva of this butterfly caterpillars was also recorded feeding on the castor plant (*Ricinus communis* L.). This butterfly is a common species in the area and also throughout Vietnam. This paper aims to provide the life cycle and other biological traits of the angled castor butterfly in a captive breeding condition in Thua Thien Hue province, central Vietnam.

2. Research methodology

The study was made from March to December 2018 in Thua Thien Hue province, central Vietnam.

The butterfly abundance and population fluctuation were observed in abandoned hill areas of the province (coordinates 16° 24' 53N, 107° 36' 08"–16° 24' 45", and 107° 35' 23"). Butterfly population fluctuation was observed every 5–7 days around the food plants in the areas.

Breeding of butterflies: Brood stock of adult butterflies was placed in a cage of 40×60×120cm, with a castor plant

inside the cage for oviposition. Egg laying activities were observed in the breeding cages and the laid eggs were counted.

Leaves with eggs were cut out to place in plastic breeding boxes. The humidity was about 60–80%, and the temperature 33–40°C. First instar larvae were fed with young leaves, while later instars were with intermediate-aged leaves. Leaves were changed every day, and breeding boxes were cleaned daily.

Adult butterflies were fed with honey diluted 50% in a net house at normal temperature and humidity conditions in the area.

Measurement of morphological data of the larvae were taken after molting and resuming to feed again. Temperature and humidity were measured 3 times per day around 8:00, 13:00 and 16:00.

3. Results and discussion

3.1. Morphology

Adults are medium-sized, with wingspan 53.06 ± 0.54mm. The wing upper side is orange brown, and the underside dark brown, with a white spot towards the apex of the forewing. Both fore and hind wings have wavy black lines running in parallel with one another (Fig. 1A, male; Fig. 1B, female).

Eggs have about 20–22 ridges running from the top with white hairs (Fig. 1C); the longest ridge is 1.12 ± 0.05mm.

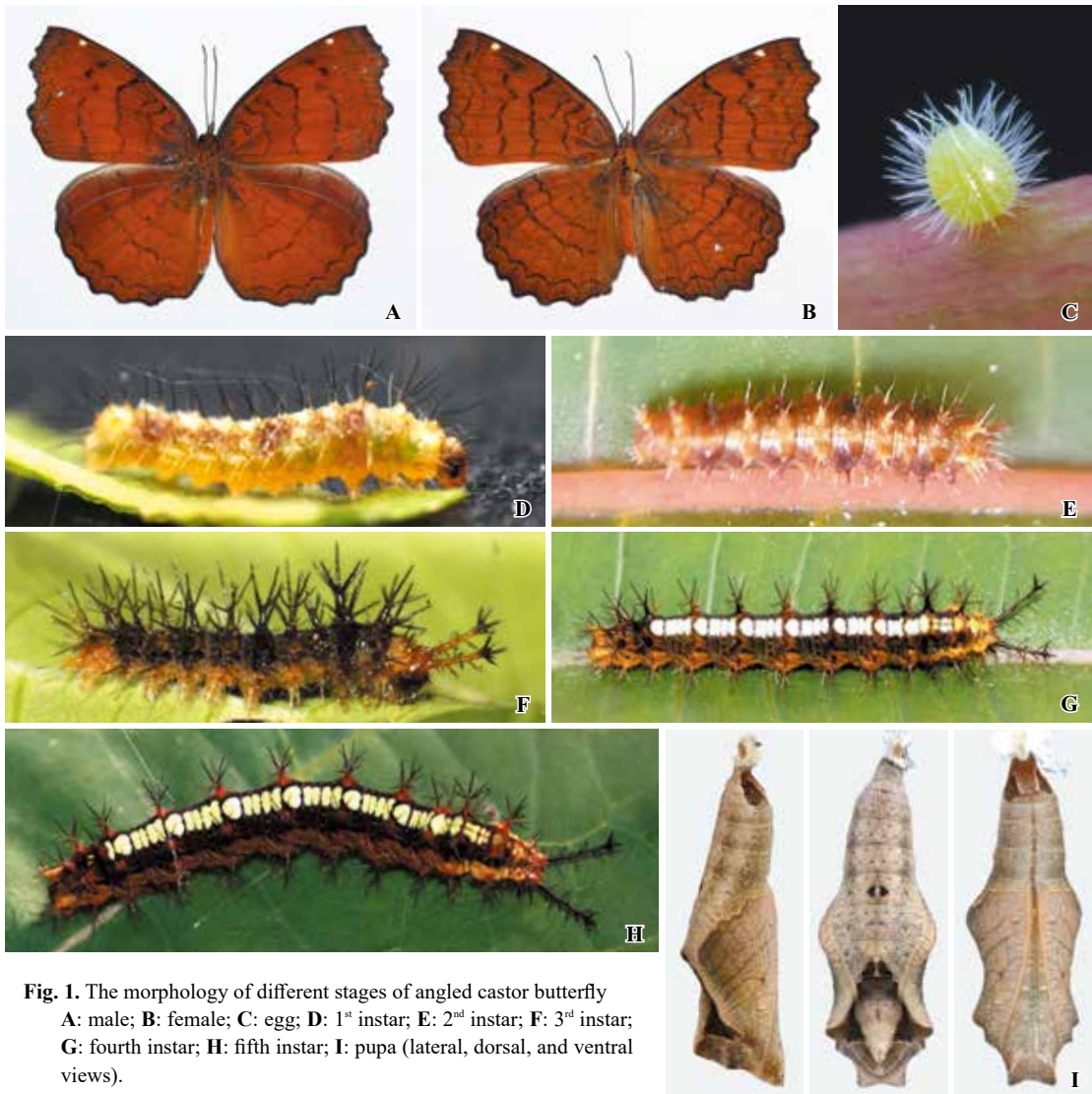


Fig. 1. The morphology of different stages of angled castor butterfly
A: male; **B:** female; **C:** egg; **D:** 1st instar; **E:** 2nd instar; **F:** 3rd instar;
G: fourth instar; **H:** fifth instar; **I:** pupa (lateral, dorsal, and ventral views).

The hairs on the egg are visible about 1 minute after oviposition. The color of the egg changes in the development process. The egg is green at first, and then turns light brown.

Larvae show typical nymphalid larval appearances. The first instar is 2.70 ± 0.13 mm in length. The newly hatched larva is pale gray, although it gradually turns brown with many pointed black spines around the body (Fig. 1D).

The second instar larva is 4.68 ± 0.14 mm in length. The larva turns yellow-brown with yellow stripes in the dorsal body center, light brown stripes on both sides. Each gray-colored spine has many small spines of the same size (Fig. 1E).

The third instar larva is 8.06 ± 0.26 mm in length. After molting, the larva has smooth white spines, light brown body with white horizontal stripes on the abdomen. Then the body turns dark black with black spines (Fig. 1F). The fourth instar larva is 12.24 ± 0.17 mm in length; with many pointed spines around the body, the shape and color similar to the third instar (Fig. 1G). The fifth instar larva is 27.87 ± 0.59 mm in length (Fig. 1H).

Pupa, 18.66 ± 0.18 mm in length, is mossy green at first, and then gradually turns grayish brown like dry leaves (Fig. 1I).

In Vietnam, two species of *Ariadne*, *A. ariadne* and *A. merione*, occur. Both adult butterflies are rather similar.

Table 1. Comparison of egg, larval and pupal sizes between *A. ariadne* and *A. morione*.

Species	Egg (mm)	Larva (mm)					Pupa (mm)	Source
		1 st instar	2 nd instar	3 rd instar	4 th instar	5 th instar		
<i>Ariadne ariadne</i>	0.8–1.5	1.3–4.1	4.1–6.2	6.2–9.1	10.7–14.2	23.6–32.2	16.9–20.7	This study
<i>Ariadne merione</i>	1–1.5	2–4	6–8	8–16	17–26	27–40	28–29	Bala <i>et al.</i> (2014)

The eggs, larvae and pupae of *A. ariadne* are smaller than those of *A. merione* (reported by Bala *et al.*, 2014), particularly in pupa (Table 1).

3.2. Population fluctuation

The angled castor butterflies fly around the year, but more common from July to October with the population peak in August (Fig. 2). They do not fly in rain or low temperature below 20°C.

3.3. Behavior

The highly territorial males of this species often rest near the host plants, ready to fly out to attack other butterflies, including conspecifics entering the “territory”. Once threatened by humans, they fly a short distance to escape the danger and then fly back to their territories. However, their territoriality is flexible; if they are deliberately driven to another area with host plants, they may establish new territories.

In captivity, the mating behavior took place from 7 am to 1 pm, mostly around 9 am. In particular, mature butterflies after 2 days, when released into cages, they immediately pair. In the nature, butterflies mate around 9–11 am (12 pairs observed), less seen in the afternoon (2 pairs observed).

In the cage, the pairing lasted from 20 to 600 minutes (some cases from 7:00 to 17:00), averaged 227.5 ± 32.6 minutes ($n = 30$). After mating for about 2 days, the female began to lay eggs. In the wild, mating occurs near the host plant. Eggs are laid sporadically near the edges of both upper and under sides of intermediate-sized leaves. In breeding conditions, females laid eggs on young leaves of the food plant, net of the cage and other wild plants (*Calotropis gigantea* (L.) W. T. Aiton).

Adult butterfly feeds on the nectar of plants in the area. Even in captive breeding conditions, they prefer feeding on flower nectar to 50% diluted honey (Table 2).

3.4. Biological development

In the breeding temperature and humidity, larvae were fed with castor plant leaves (*Ricinus communis* L.), and adults were fed with 50% diluted honey. In this setting, each developmental stage took the duration given in Table 3. The life cycle was completed in about 26.44 ± 0.69 days (from egg to adult butterfly).

3.5. Survival rate and fertility

In the breeding, the survival rate of the angled castor was very high, over 95%. The mortality was mainly due to injury in the care operations and picking of eggs and larvae

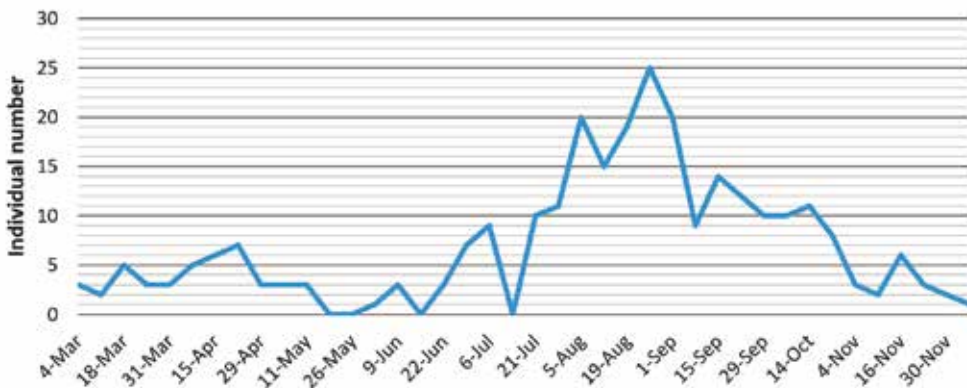


Fig. 2. Population fluctuation of the angled castor in the study area from March to December

in the first instar, and separating pupae from the breeding boxes.

In the wild, the survival rate of the species is very low due to the temperature and humidity factors, natural enemies such as wasps, ants, and spiders. A female lays 47.5 ± 2.91 eggs ($n = 8$).

3. Summary

In Thua Thien Hue province, Vietnam, the angled castor butterfly (*Ariadne ariadne*) flies around the year, though more commonly from July to October, and the adult population peaks in August.

In the captive breeding condition, the pairing of the butterflies lasts from 20 to 600 minutes with an average of 227.5 ± 32.6 minutes. After mating for about 2 days, the female begins to lay eggs. The angled castor is recorded feeding on the castor plant (*Ricinus communis* L.). In normal weather conditions in the study area (temperature 37–40°C and relative humidity 60–80%), the life cycle duration of the species is 26.44 ± 0.69 days (egg 3.04 ± 0.08 , larvae 16.25 ± 0.45 days, pupae 7.15 ± 0.16). Adult butterflies prefer feeding on flower nectar and (replaced by to) 50 % diluted honey. Adult butterflies fed with 50% diluted honey can live for 6.30 ± 0.26 days. The survival rate of the angled castor in the captive breeding condition is very high, over 95%.

Acknowledgements

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References

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Table 2. Feeding selection by the angled castor butterfly of experimental diets.

No.	Diets	Choice (%)
1	Pure honey	6.67
2	Diluted honey (50%)	25.33
3	Dilute honey (25%)	9.33
3	Rotting mango	12
4	Ripen banana	16
5	Flower nectar (<i>Ixora coccinea</i> , <i>Lantana camara</i>)	30.67
Total		100.00

Table 3. Development time of the angled castor.

Stages	Sample number	Complete time (day)	
		Time range	Average
Eggs	50	2–4	3.04 ± 0.08
Larvae			16.25 ± 0.45
First instar	30	2–3	2.43 ± 0.09
Second instar	30	2–3	2.36 ± 0.08
Third instar	30	2–3	2.60 ± 0.09
Fourth instar	30	2–3	2.76 ± 0.07
Fifth instar	30	5–7	6.10 ± 0.12
Pupae	20	6–8	7.15 ± 0.16
Adult	10	5–7	6.30 ± 0.26

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[和文摘要]

ベトナムにおけるカバタテハの生態

ベトナム中部のトゥアティエン＝フエ省におけるカバタテハ *Ariadne ariadne* の生態について、飼育記録も含めて報告する。本種は同地において普遍的に分布しており、主食草はトウダイグサ科のトウゴマ *Ricinus communis* である。その他に、トウダイグサ科 *Tragia* 属植物の記録もある。ベトナムには、*Ariadne* 属は2種分布している (*ariadne* とフタオビカバタテハ *merione*)。その幼生期を比較すると、卵から蛹の全てのステージにおいてフタオビカバタテハの方が大きく、特に蛹でその傾向が顕著であった。調査地においては周年発生しているが、特に7月

～10月にかけて多く、ピークは8月である。成虫には占有性があり、他の蝶が近づくとなわばりから排除するような行動が見られる。ただし占有地については1か所に固執はせず、状況によって変化することが観察された。交尾行動は午前7時～午後1時にかけて見られ、午前9時の頻度が最も高かった。飼育ケージ内においては、交尾が600分に及ぶ例も確認された。交尾後2日後には早は産卵を開始する。成虫は生息地において植物の蜜を吸う。飼育下においては、50%に希釈したハチミツを好む傾向がみられた。卵から成虫までに要する日数は、飼育下では平均すると約27日という結果となった。

(文責：宇野 彰)

Butterflies 投稿規定

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