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Geographical Distribution and Status of *Actias* Moths in Thailand

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ABSTRACT

Geographical distribution and status of *Actias* moths was assessed at 46 forest stations throughout Thailand from January 2004 to December 2006. At each station, an eighteen watt black light was operated against a white sheet from 6:00 pm to 6:00 am daily. All *Actias* moths were observed and collected twice during the trapping period at 10:00 pm and 6:00 am. Distribution, abundance, seasonality and status were analyzed. Three out of the four *Actias* species previously encountered in Thailand were collected: *A. maenas* Doubleday, *A. selene* Hübner and *A. rhodopneuma* Röber. *A. maenas* was the most widespread species in the country with an average of 0.001037 individuals/spot sample and was found all year round. The highest abundance was in Narathiwat province, the northernmost border of the Sundaic region. *A. selene* was found at higher latitudes ranging from 20 °N at Doi Chiang Dao, Chiang Mai to 13 °N at Prachub Kirikhan province with an average of 0.003303 individuals/spot sample and were found all year round, with the highest abundance in July. By applying IUCN Categories & Criteria *A. maenas* and *A. selene* were designated as Vulnerable (VU) and Near Threatened (NT) species respectively. *A. rhodopneuma* moths were found only at Doi Phuka National Park, Nan province with 0.000263 individuals/spot sample from February to April and are therefore designated as a Critically Endangered (CR) species. *A. sinensis* was not found during this study and is therefore assigned the status of extinct (EX).

Keywords: Geographic distribution range, *Actias* moths, seasonality, status, Thailand

INTRODUCTION

Thailand is located between latitude 5 ° 37 / N to 20 ° 27 / N with an area of 513,115.029 km^2 in Indochinese and Malayan sub-regions. The Isthmus of Kra is 45 km wide and is located at 10 ° 30 / N latitude which divides Thailand into 2 phyto-geographical transitions: southern and northern transitions. The southern transition is perhumid with a wet seasonal evergreen dipterocarp rain forest which is widely and prominently portrayed as a major Indochinese - Sundaic plant boundary [1,2]. The northern transition is a seasonal evergreen rain forest and mixed moist deciduous forest. The Isthmus of Kra is also used as a zoogeographical transition for forest birds [3], mammals [4], rodents [5], amphibians [6] and butterflies [7].

The Kangar - Pattani (Kra ecotone) line runs from west to east between Kangar (Malaysia) and Pattani (Thailand) at 7 °N latitude along the Thai - Malay border [8] where the Sundaland starts and covers a small portion of southern Thailand, Pattani, Yala and Narathiwat [9]. In case of terrestrial zoogeographical zones, Sundaland covers the lands on the Sunda shelf, the Malayan peninsula south of the Isthmus of Kra, the island of Sumatra, Borneo, Palawan, Java, Bali and small islands in between and around these large islands [11].

Actias spp. (Saturniidae: Lepidoptera) contain 20 - 25 species [10] and are large, yellow moths with long tails. These moths are protected under the Wild Animal Reservation and Protection Act 1992 (WARPA 1992) but are not included in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). There are four species of *Actias* moths reported in Thailand by Pinratana and Lampe [11] (i.e. *A. maenas, A. selene, A. rhodopneuma* and *A. sinensis*). *A. maenas* is distributed from the North of India to Malaya, Java, and Sulawesi [12]. *A. selene* is distributed from Afghanistan through the Indian sub-region to China and Korea and to Sundaland [13]. Pinratana and Lampe [11] also reported a rare species, *A. rhodopneuma* which is distributed from India, China, Burma and Thailand while, *A. sinensis* is distributed from South China and Thailand.

This is the first study to examine a long term monitoring on a geographical range the distribution and abundance of *Actias* moths in Thailand. The results from this study can be used to rank the conservation status of *Actias* spp. and make decisions on natural resources management and for support of the Biodiversity Convention.

MATERIALS AND METHODS

Forty six forest stations (A - AT) were grouped into 15 degrees from 6 °N to 20 °N throughout Thailand (**Table 1, Figure 1**). At each station, an 18 watt black light trap was set against a white sheet from 6:00 pm to 6:00 am daily from January 2004 to December 2006. All *Actias* moths were observed, collected and counted twice during the trapping period at 10:00 pm and 6:00 am and sent to the Forest Entomology and Microbiology group in Bangkok. The moths were set and identified by using both

Moths of Thailand Vol. I, Saturniidae [11] and the Identification Guide for Regulated Insects [14]. Geographical distribution of *Actias* moths were plotted into map of Thailand. The relative abundance (Individuals/spot sample) was calculated as:

$$\text{Relative abundance} = \frac{\text{Total number of moth individuals}}{\text{Total surveying days} \times 2} \quad (1)$$

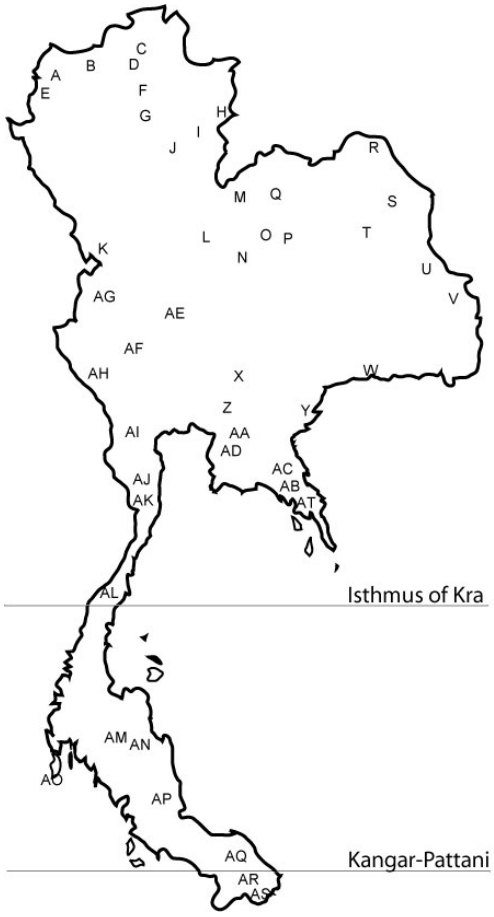

Figure 1 Forty six black light trap localities in Thailand. Letter symbols represent study sites. For detailed descriptions of each study sites see **Table 1**.

The seasonality was analysed by categorizing into two zoogeographical transitions [7]: above and below the Isthmus of Kra. Moth conservation status was assigned using the International Union for the Conservation of Nature and Natural Resources (IUCN) Categories & Criteria (C.3.1) [15].

Table 1 Geographical range (°N) and 46 localities of *Actias* moth study sites.

Geographical range (°N)	Localities
20	H.M. the Queen's Initiatives "Suan Pah Sirikit" Project (A), Doi Chiang Dao Wildlife Research Station (B), Chiang Rai Forest Training Center (C), Doi Luang National Park (D), Mae Umlong Forest Plantation (E), Mae Ga Forest Tree Seed Orchard (F)
19	The 1st Forest Entomology and Microbiology Research Center (G), Doi Phu Kha National Park (H), Khun Sathan Watershed Research Station (I), Mae Yom Watershed Research Station (J), Phu-wua Wildlife Sanctuary (R)
18	Phu Ruea National Park (M), Kao Kloi - Na Klang Forest Development Project (Q), Phu Phan National Park (S)
17	Lan Sang National Park (K), Khao Kayang Forest Plantation (L), Huai E-mai Watershed Research Station (N), The 2nd Forest Entomology and Microbiology Research Center (O), Phu Wiang National Park (P), Lampao Non Hunting Area (T), Phu Sa Dok Bua National Park (U)
16	Kaeng Tana National Park (V), Phu Kae Botanical Garden (AE), Huai Kha Khaeng Wildlife Sanctuary (AG)
15	Huai Tabtan - Huai Samran Wildlife Sanctuary (W), The 2nd Silviculture Center (X), Phu Tuae Forest Plantation (AF), Mae Klong Watershed Research Station (AH)
14	Pang Sida National Park (Y), Raboket Forest Plantation (Z), Khao Ang Runai Wildlife Sanctuary (AA), Bangphra Reservoir Non Hunting Area (AD), Forest Product Extension and Development Center (AI)
13	Khao Klue Check Point (AB), The 3rd Forest Entomology and Microbiology Research Center (AC), Phetchaburi Forest Fire Control Station (AJ), Nong Plub-Huai Sat Yai Forest Fire Control Station (AK), Tung Plane Dam (AT)
11	Tha Sae Forest Plantation (AL)
9	Tapi Watershed Research Station (AM), Pak Panang Watershed Research Station (AN)
8	Khao Prataew Wildlife Extension and Conservation Station (AO), Khao Chong Wildlife Extension and Conservation Station (AP)
7	Songkla Lake Watershed Research Station (AQ)
6	Pikunthong Forest Experiment Station (AR), Hala-Bala Wildlife Research Station (AS)

RESULTS AND DISCUSSION

Three species of *Actias* moths were found in this three year monitoring period: *A. maenas, A. selene* and *A. rhodopneuma.*

A. maenas was assigned as Vulnerable (VU) according to IUCN Categories & Criteria (C.3.1) [15] A2ab. The observed population size of *A. maenas* has decreased by ≥ 30 % over the last three generations (**Table 2**). The geographical distribution of *A. maenas* showed that this moth species was the most widespread species throughout Thailand ranging from latitude 6 °N at Hala Bala Wildlife Research Station (AS), Narathiwat province to latitude 20 °N at Doi Chiang Dao Wildlife Research Station (B), Chiang Mai province (**Figure 2a**). The average abundance was 0.001037 individuals/spot sample (**Table 2**) and the highest abundance was observed at Hala Bala Wildlife Research Station in Sundaland [9] with 0.01773 individuals/spot sample (**Figure 3a**). *A. maenas* occurred all year round. The localities below the Isthmus of Kra (**Figure 4a**) had a higher abundance than the localities above the Isthmus of Kra (**Figure 4b**).

A. selene was assigned as Near Threatened (NT). Even though this species did not classify for Critically Endangered (CR), Endangered (EN) and Vulnerable (VU) at the present, the population size of this species has been in decline (**Table 2**) and may reach the threatened category in the near future. The geographical distribution was observed from 20 °N at Doi Chiang Dao Wildlife Research Station (B), Chiang Mai province to 13 °N at Nong Plub-Huai Sat Yai Forest Fire Control Station (AK), Prachub Kirikhan Province (**Figure 2b**). Interestingly, we never found *A. selene* along the Peninsula of Thailand during our study, while Holloway [13] reported the subspecies *A. selene vanderberghi* in the lowland forest through Sumatra (Sundaland) but in rare numbers. Therefore, it might be possible to find *A. selene* in other localities south of the Isthmus of Kra. The average abundance of *A. selene* was 0.003303 individuals/spot sample (**Table 2**) and occurred all year round with the greatest abundance in June (**Figure 4c**).

A. rhodopneuma was assigned as Critically Endangered (CR) according to IUCN Categories & Criteria (C.3.1) [15] B1ab (iv,v). *A. rhodopneuma* was found only at one location at Doi Phu Kha National Park, Nan province (**Figure 2c**) with an area less than 100 km^2. *A. rhodopneuma* has continued to decline in terms of the number of locations where this species is found and the number of mature individuals of this species per location. This species prefers to be found at a high elevation such as Doi Phu Kha National Park where the light trap location was set at 1,303 meters above mean sea level for a short period (i.e. 3 months/year) during February to April (**Figure 4e**) with an average abundance of 0.000264 individuals/spot sample (**Table 2**). However, this species is even found at 2,000 meters above mean sea level in the central Laos [16,17].

A. sinensis was assigned as Extinct (EX) because we did not capture this moth in any light traps during the 3 year period of this long term study.

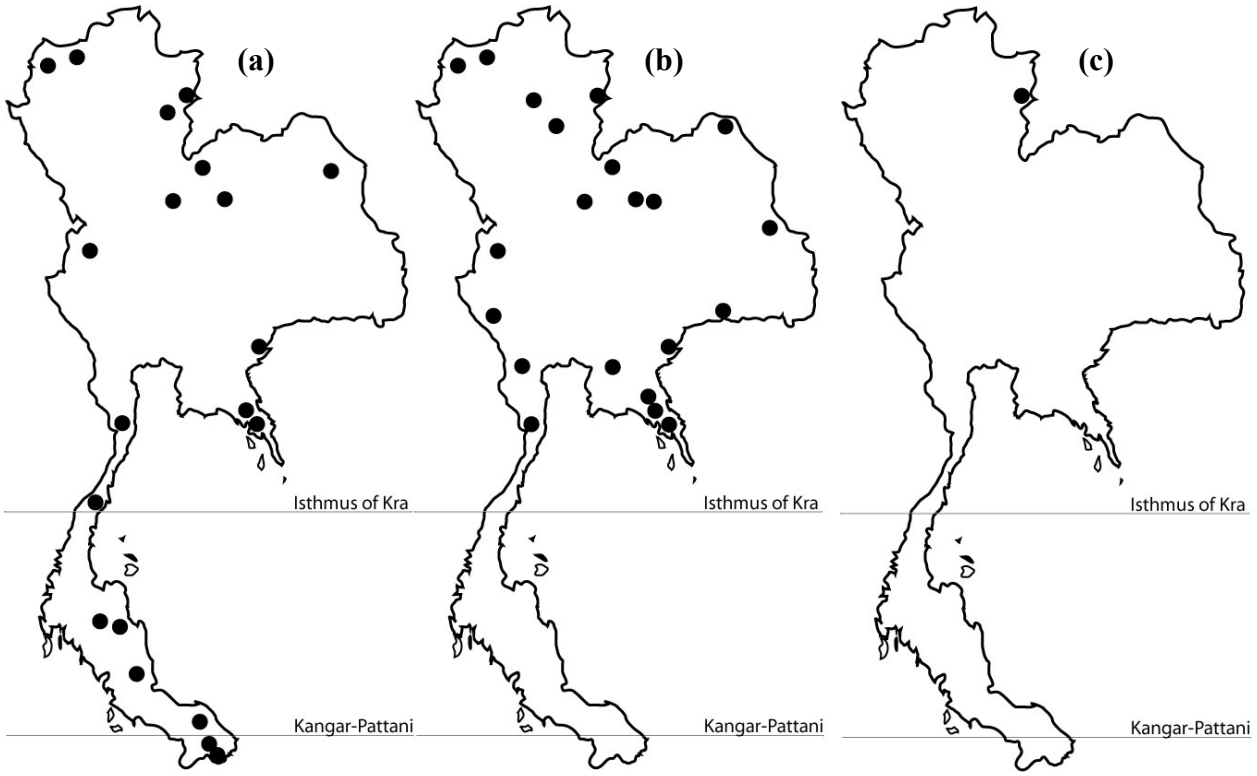

Figure 2 The *Actias* moths localities; *A. maenas* (a), *A. selene* (b) and *A. rhodopneuma* (c)

Table 2 Abundance and conservation status of *Actias* moths in Thailand.

***Actias* moth species**	**Status**	**Relative abundance (individuals/spot sample)**			
		2004	**2005**	**2006**	**Mean±SD**
A. maenas	Vulnerable (VU)	0.00142	0.00097	0.00072	0.001037±0.000350
A. selene	Near Threatened (NT)	0.00364	0.00498	0.00129	0.003303±0.001868
A. rhodopneuma	Critically Endangered (CR)	0.00051	0.00028	0	0.000263±0.000255
A. sinensis	Extinct (EX)	0	0	0	0

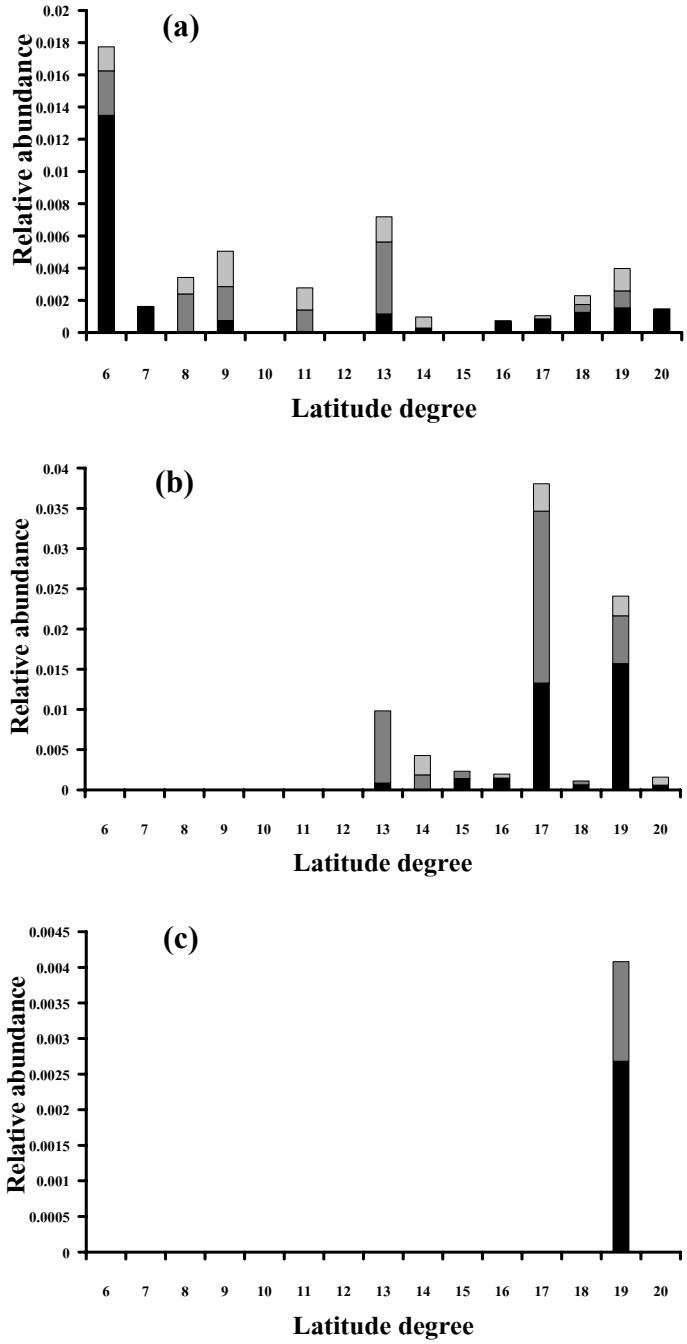

Figure 3 The geographical distribution and abundance of *Actias* moths in Thailand: *A. maenas* (a), *A. selene* (b) and *A. rhodopneuma* moths (c) in 2004 (■), 2005 (▩) and 2006 (□)

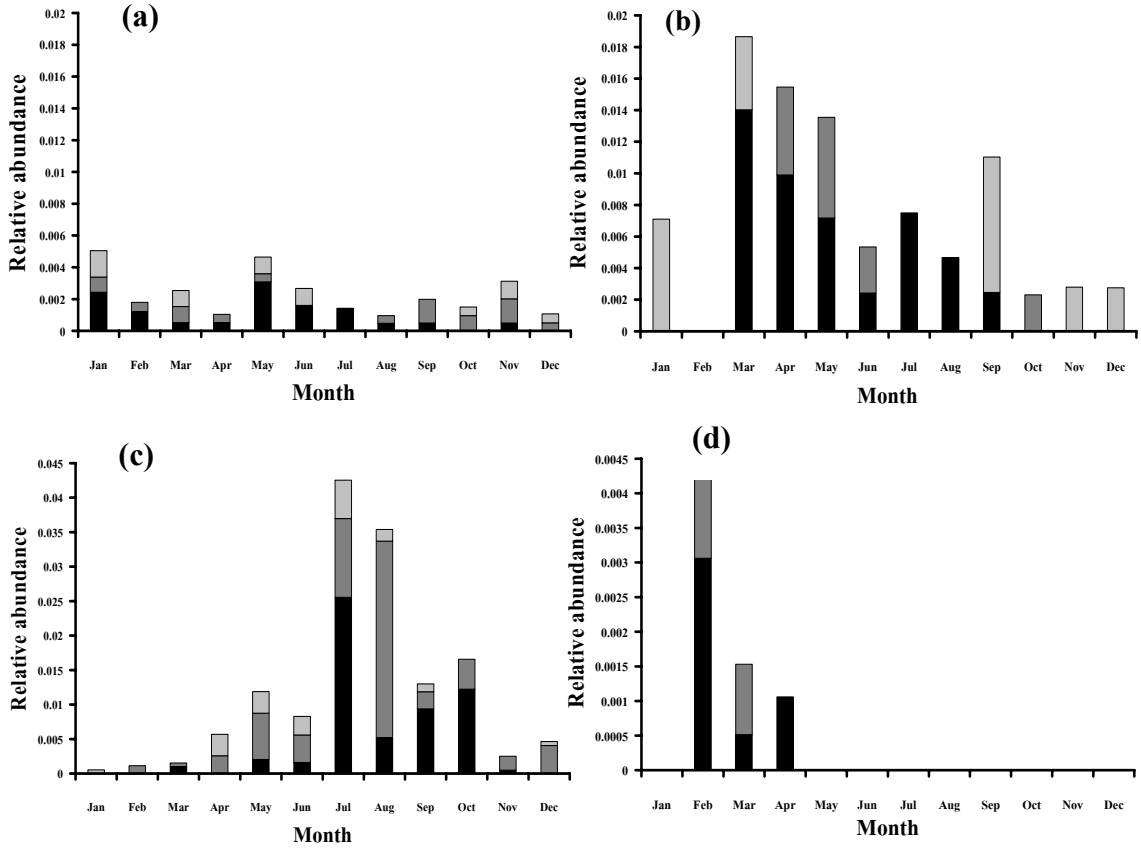

Figure 4 Monthly abundance of *Actias* moths in Thailand from January 2004 - December 2006. Occurrence of *A. maenas* moth north of the Isthmus of Kra (a), *A. maenas* south of the Isthmus of Kra (b), *A. selene* moths north of the Isthmus of Kra (c) and *A. rhodopneuma* moths at Doi Phu Kha National Park, Nan Province (d) on 2004 (■), 2005 (▩) and 2006 (□)

CONCLUSIONS

Long term monitoring programs are essential for monitoring conservation status of *Actias* moths in Thailand. If we could increase the study sites, and/or continue our long term monitoring, we expect that we might be able to find extinct moth species (i.e. *A. sinensis*) in one or more of our study sites in the near future. For the threatened moth species, *A. maenas*, and *A. rhodopneuma* we hope to improve their conservation status by running a strong conservation management program. Finally, for the near threatened moths, *A. selene*, we should have a proper conservation management program before this moth species becomes a threatened species.

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บทคัดย่อ

สุรชัย ชลดำรงค์กุล นพชนม์ ทับทิม และ สังวล รัตนจันทร์

เขตการแพร่กระจายและสถานภาพของผีเสื้อหางยาวในสกุล *Actias* ในประเทศไทย

การศึกษาเขตการแพร่กระจายของผีเสื้อหางยาวสกุล *Actias* ดำเนินการในสถานีป่าไม้จำนวน 46 แห่ง กระจายทั่วประเทศ โดยแต่ละสถานีติดตั้งกับดักแสงไฟแบล็คไลท์ขนาด 18 วัตต์ บนฉากผ้าสีขาว จากเดือนมกราคม 2547 ถึงธันวาคม 2549 เปิดไฟทุกวันตั้งแต่เวลา 18:00 น. ถึง 6:00 น. สำรวจผีเสื้อหางยาวทุกตัวที่บินมาเล่นไฟในเวลา 22:00 น. และ 6:00 น. วิเคราะห์เขตการแพร่กระจาย ความชุกชุม ฤดูกาล และ สถานภาพ ซึ่งพบผีเสื้อหางยาว 3 ใน 4 ชนิดที่มีรายงานว่าพบในประเทศไทย คือ ผีเสื้อหางยาวตาเดียวปีกลายหยัก (*Actias maenas* Doubleday) ผีเสื้อหางยาวสี่ตาปีกลายตรง (*A. selene* Hübner) และผีเสื้อหางยาวตาเดียวปีกลายตรง (*A. rhodopneuma* Röbe) โดยผีเสื้อหางยาวตาเดียวปีกลายหยักเป็นผีเสื้อที่พบมีการกระจายที่กว้างทั่วประเทศด้วยความชุกชุมเฉลี่ย 0.001037 ตัว/การสำรวจ 1 ครั้ง และพบได้ตลอดปี และมีความชุกชุมสูงสุดที่จังหวัดนราธิวาส ซึ่งเป็นจุดเริ่มต้นของเขตซุนดา ขณะที่ผีเสื้อสี่ตาปีกลายตรงเป็นผีเสื้อที่มีเขตแพร่กระจายจากแนวเส้นรุ้งที่ 20 องศาเหนือ ที่ดอยเชียงดาว จังหวัดเชียงใหม่ จนถึงแนวเส้นรุ้งที่ 13 องศาเหนือ ที่จังหวัดประจวบคีรีขันธ์ ด้วยความชุกชุมเฉลี่ยปีละ 0.003303 ตัว/การสำรวจ 1 ครั้ง พบผีเสื้อชนิดนี้ได้ตลอดปี โดยมีความชุกชุมสูงสุดที่เดือนกรกฎาคม ซึ่งผีเสื้อหางยาวตาเดียวปีกลายหยัก เป็นผีเสื้อที่มีแนวโน้มใกล้สูญพันธุ์ (Vulnerable; VU) และผีเสื้อหางยาวสี่ตาปีกลายตรง มีสถานภาพเป็นผีเสื้อที่ใกล้ถูกคุกคาม (Near Threatened; NT) ส่วนผีเสื้อหางยาวตาเดียวปีกลายตรงเป็นผีเสื้อที่ใกล้สูญพันธุ์อย่างยิ่ง (Critically Endangered; CR) ซึ่งจะพบได้เฉพาะที่อุทยานแห่งชาติดอยภูคา จังหวัดน่าน ในช่วงเดือนกุมภาพันธ์ ถึงเมษายน ด้วยความชุกชุมเฉลี่ยปีละ 0.000263 ตัว/การสำรวจ 1 ครั้ง อย่างไรก็ตาม จากการสำรวจยังไม่พบผีเสื้อหางยาวสี่ตาปีกลายหยัก ทำให้สรุปได้ว่าผีเสื้อหางยาวสี่ตาปีกลายหยักมีสถานภาพสูญพันธุ์ (Extinct; EX)

กลุ่มงานกีฏวิทยาและจุลชีววิทยาป่าไม้ กรมอุทยานแห่งชาติสัตว์ป่าและพันธุ์พืช 61 ถนนพหลโยธิน เขตจตุจักร กรุงเทพมหานคร 10900