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**THE LANTERNFLIES (HEMIPTERA: FULGOROMORPHA,
FULGORIDAE) OF KHAO KRACHOM MOUNTAIN, THAILAND**

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Summary. An annotated list of eighteen species of the family Fulgoridae from Khao Krachom Mountain, Ratchaburi Province of Thailand is given. Three species, *Pyrops connectens* (Atkinson, 1885), *Pyrops spinolae* (Westwood, 1842) and *Zanna nobilis* (Westwood, 1838), are recorded from Thailand for the first time and two species of the genus *Dichoptera* Spinola, 1839 represent a new country record or even a species new to science. Data on the preferred habitat and host plants of lanternflies are also provided and briefly discussed.

Key words: Fulgoroidea, fauna, new records, habitat, host plants, Southeast Asia.

К. Джаранайсакул, Дж. Констант. Фонарницы (Hemiptera: Fulgoromorpha, Fulgoridae) горы Као Крачом в Таиланде // Дальневосточный энтомолог. 2021. N 435. С. 7-19.

Резюме. Приводится аннотированный список 18 видов фонарниц (Fulgoridae), обитающих на горе Као Крачом в таиландской провинции Ратчабури. Впервые для фауны Таиланда приводятся три вида: *Pyrops connectens* (Atkinson, 1885), *Pyrops spinolae* (Westwood, 1842) и *Zanna nobilis* (Westwood, 1838), а два вида рода *Dichoptera* Spinola, 1839, ранее не указывавшегося из страны, вероятно являются новыми для науки. Приведены и проанализированы данные по местообитаниям и кормовым растениям фонарниц.

INTRODUCTION

The family Fulgoridae contains some of the most spectacular planthoppers, the lanternflies, and currently contains 142 genera and 773 species worldwide (Bourgoin, 2021). The fauna of Fulgoridae in Thailand comprises 24 species, which is considered a moderate number as compared to the neighbouring countries: 17 in Cambodia, 8 in Laos, 19 in Myanmar, 18 in Peninsular Malaysia and 37 in Vietnam (Nagai & Porion 1994; Constant *et al.*, 2016; Bourgoin, 2021). Most of their life history remains undocumented, except for *Pyrops candelaria* (Linnaeus, 1848) that was studied and documented (Kershaw & Kirkaldy, 1910) and some host plants and behavioural observations (Constant *et al.*, 2016; Constant & Pham, 2017; Jiaranaisakul *et al.*, 2018; Constant & Pham, 2019).

Khao Krachom Mountain is located in Suan Phueng district, Ratchaburi province, western Thailand at an altitude between 210 and 1132 m above sea level. The mountain is part of the Tenasserim Hills, a mountain chain which extends along approximately 1700 km from Dawna in Myanmar to the Kra Isthmus in Thailand and further south to Titiwangsa range in Malay Peninsula. This region shows a great diversity of habitats, resulting in a large number of species, including populations of globally important and endangered species. Between 1913 and 1985, the government had opened a tin mining concession in the Khao Krachom Mountain's area, which caused a lot of forest clearing. Furthermore, the area around the mountain has been turned into agriculture land. After 1991, the government canceled mining concessions, causing the villagers to develop resorts for tourism within the surrounding area. In 1995, the Khao Krachom Mountain and nearby areas fell under the supervision of the Royal Thai Army and were established as a Natural History Park, initiated by Her Royal Highness Princess Maha Chakri Sirindhorn. The Park covers 210 km² (13°31'27"–13°35'05"N and 99°09'48"–99°16'10"E) and includes all of Khao Krachom Mountain. Later in 2001, the Royal Forest Department mapped the proportions of each type of forest in the area, without specifying information and details about each type of forest. However, a serious biological survey of the area is still lacking, causing inaccurate documentation of its fauna and flora. Recently, four different types of forest are found in Khao Krachom Mountain:

- (1) dry evergreen forest that shows no shedding but has less moisture (less than 1500 mm of rain per year);
- (2) hill evergreen forest that is located at an altitude above 950 m and humid all year round (more than 1500 mm of rain per year); trees more than 20 m tall are present in this habitat;
- (3) mixed deciduous forest dominated by deciduous trees which lose their leaves during the dry season;
- (4) secondary forest dominated by bamboos; this type of forest is often subject to yearly forest fire.

This paper aims to document the Fulgoridae of Khao Krachom Mountain and provide notes on their natural history, notably their host plants, adding to the knowledge of the lanternflies of Thailand and more generally of Southeast Asia.

MATERIAL AND METHODS

The survey lasted from September 2017 to July 2020 with monthly fieldwork. Relevant data randomly collected since April 2013 is also included. The route used during the survey covers approximately 24 km². The type of forest and identification of plant species mainly follows Bunyavejchewin *et al.* (2016). The specimens were collected by sweep net, or by hand using 50 ml transparent tubes to slowly cover the specimen. The male terminalia were examined to confirm identification when necessary. They were cut from the abdomen by operating scissor and then placed in a 10% solution of potassium hydroxide (KOH) for a night. The pieces were examined in ethanol, and then placed in glycerine with the pinned specimen for preservation. Pictures were taken with a Canon EOS 7D camera with Canon EF 100 Macro lens and stacked with Photoshop CC 2019.

Abbreviations used for the collections: **KUKPS** – Department of Entomology, Kasetsart University Kamphaeng Saen Campus, Nakhon Pathom, Thailand; **RBINS** – Royal Belgian Institute of Natural Sciences, Brussels, Belgium; **RBMF** – Rabbit in the Moon Foundation, Ratchaburi, Thailand; **THNHM** – Thailand Natural History Museum, Pathum Thani, Thailand.

LIST OF SPECIES

Suborder Auchenorrhyncha Duméril, 1806

Infraorder Fulgoromorpha Evans, 1946

Family Fulgoridae Latreille, 1807

Genus *Aphaena* Guérin-Ménéville, 1834

Aphaena aurantia (Hope, 1840)

Fig. 1A-B

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'17.7"N, 99°12'00.6"E, h=960 m, hill evergreen forest, on Meliaceae, 28.XII 2019, 2♂, leg. K. Jaranaisakul (RBMF).

REMARKS. The specimens were found sitting on a tree of the plant family Meliaceae. One specimen was observed during trophobiotic interaction with a moth of the genus *Amphigonia* Guenée, 1852 (Lepidoptera: Erebidae).

Aphaena najas Schmidt, 1906

Fig. 1C

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'13.1"N, 99°12'15.6"E, h=1010 m, hill evergreen forest, on *Eurycoma longifolia* Jack (Simaroubaceae), 3.VI 2018, 1♀, leg. K. Jaranaisakul (RBMF).

REMARKS. This species was found feeding on *Eurycoma longifolia* (new host plant record) together with *Aphaena* sp.

Aphaena sp.

Fig. 1D-E

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'13.1"N, 99°12'15.6"E, h=1010 m, hill evergreen forest, on *Eurycoma longifolia* Jack (Simaroubaceae), V 2018, 2♂, leg. K. Jaranaisakul (RBMF); the same data, 4.VI.2018, 4♀, leg. K. Jaranaisakul (2♀ in RBMF; 2♀ in THNHM).

REMARKS. The taxonomy of the genus *Aphaena* is not fully resolved and needs a complete revision (Constant *et al.*, 2016). The specimens were found along a ridge and cliff on *Eurycoma longifolia* (new host plant record). In February – April 2020, the habitat where this species was found together with *A. naja*, was burnt by forest fires. Subsequent monitoring in May – June 2020 did not allow to find any additional specimens of *Aphaena* sp.

Genus *Dichoptera* Spinola, 1839

REMARKS. Here this genus is recorded from Thailand for the first time. The taxonomy of *Dichoptera* is in need of a full revision (Constant *et al.*, 2016). One species, *D. conspersa* Schmidt, 1911, was described from Thailand, Bangkok (Schmidt, 1911) but none of the two species listed hereunder seems to match the illustrations of *D. conspersa* provided by Melichar (1912: pl. 1, figs 7–9). However, a full study of the genus based on the type material is necessary to confirm or refute the possible status of the species from Khao Krachom Mountain.

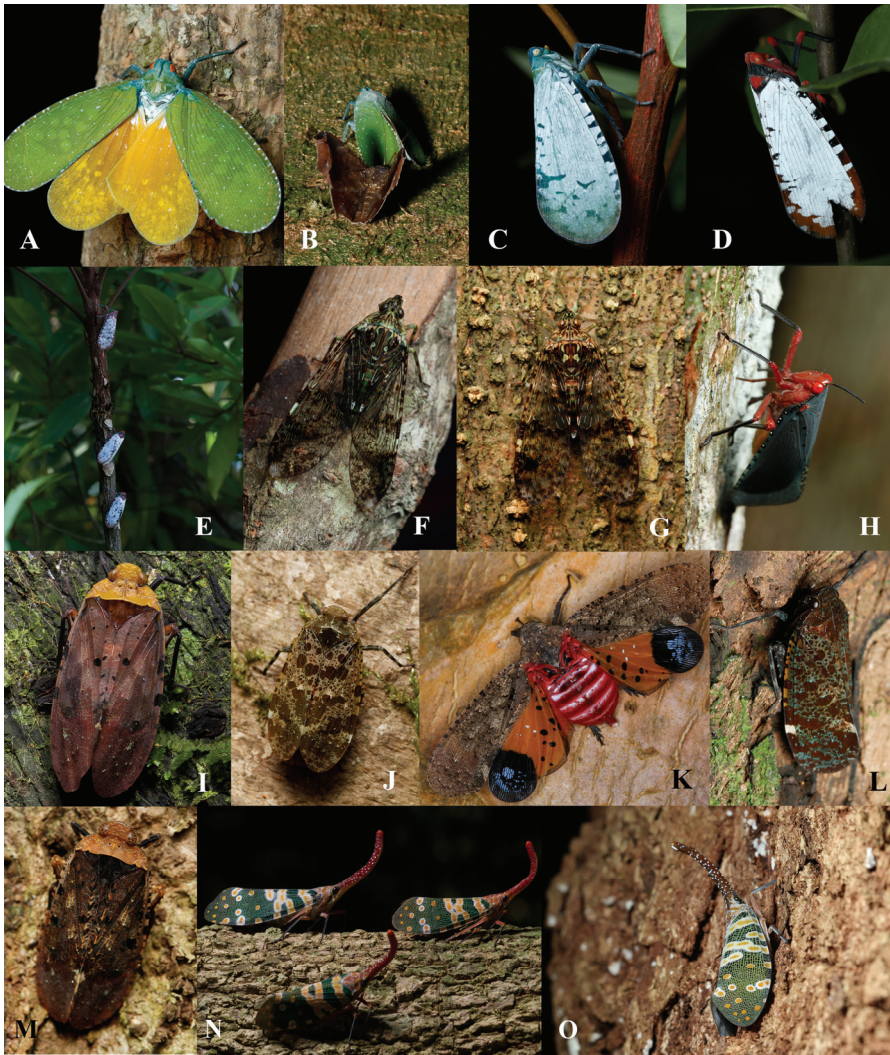


Fig. 1. Lanternflies in nature in Khao Krachom Mountain. A, B – *Aphaena aurantia*, 28.XII 2019: A – showing posterior wings after being disturbed; B – trophobiosis with a moth; C – *Aphaena najas* on host plant, 3.VI 2018; D, E – *Aphaena* sp. on host plant, 4.VI 2018; F – *Dichoptera* sp. 1, 15.IX 2018; G – *Dichoptera* sp. 2, 19.V 2020; H – *Kalidasa nigromaculata*, 9.VI 2020; I – *Penthicides atomaria*, 26.X 2017; J – *Penthicides caja*, 11.II 2020; K – *Penthicides pulchella*, 15.XI.2017; L – *Penthicides variegata*, 19.V 2020; M – *Penthicides warleti*, 28.XII 2019; N, O – *Pyrops candelaria*, 15.XI 2019.

***Dichoptera* sp. 1**

Fig. 1F

MATERIAL EXAMINED (from photograph). Khao Krachom Mountain: 13°34'15.0"N, 99°13'04.0"E, h=200 m, secondary forest, 15.IX 2018, 1♀, photo K. Jiaranaisakul.

REMARKS. Unfortunately, the specimen hopped off before we could collect it.

***Dichoptera* sp. 2**

Fig. 1G

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'17.0"N, 99°11'52.1"E, h=1010 m, hill evergreen forest, on *Quercus* sp. (Fagaceae), 19.V 2020, 7♂, 2♀, leg. K. Jiaranaisakul (6♂, 1♀ in RBMF; 1♂, 1♀ in RBINS).

REMARKS. Specimens were observed on and collected from trees of the genus *Quercus* (Fagaceae), a new host plant record for the genus *Dichoptera*.

Genus *Kalidasa* Kirkaldy, 1900

***Kalidasa nigromaculata* (Gray, 1832)**

Fig. 1H

MATERIAL EXAMINED. Khao Krachom Mountain: 13°33'16.8"N, 99°12'29.3"E, h=620 m, dry evergreen forest mixed with secondary forest, on *Ailanthus triphysa* (Dennst.) Alston (Simaroubaceae), 5.VI 2020, 1♀, leg. K. Jiaranaisakul (RBMF).

REMARKS. A specimen was observed feeding on *Ailanthus triphysa* (new host plant record).

Genus *Penthicodes* Blanchard, 1845

***Penthicodes atomaria* (Weber, 1801)**

Fig. 1I

MATERIAL EXAMINED. Khao Krachom Mountain: 13°34'07.1"N, 99°11'46.0"E, h=920 m, dry evergreen forest mixed with secondary forest, on *Castanopsis diversifolia* (Kurz) King ex Hook.f. (Fagaceae), 1.X 2019, 1♀, leg. K. Jiaranaisakul (RBMF); 13°33'43.6"N, 099°12'24.1"E, h=560 m, secondary forest, 20.XII 2019, 1♀, leg. P. Dawwrueng (RBMF).

REMARKS. This species is known to feed on *Castanopsis diversifolia* (Fagaceae), *Lagerstroemia macrocarpa* Wall. ex Kurz (Lythraceae) and *L. loudonii* Teijsm. & Bin (Lythraceae) (Jiaranaisakul *et al.*, 2018).

***Penthicodes caja* (Walker, 1851)**

Fig. 1J

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'18.5"N, 99°12'02.6"E, h=980 m, hill evergreen forest, on *Syzygium* sp. (Myrtaceae), 10.II 2020, 4♂, 1♀, leg. K. Jiaranaisakul (RBMF); the same data, 22.II 2020, 1♂, 1♀, leg. K. Jiaranaisakul (THNHM).

REMARKS. As the other species in the genus *Penthicodes*, this one is nocturnal. All specimens were observed feeding at night on *Syzygium* sp. (Myrtaceae) and one additional specimen was observed resting on an unidentified plant in the family Meliaceae without sapping on 11.II 2020.

***Penthicodes pulchella* (Guérin-Méneville, 1838)**

Fig. 1K

MATERIAL EXAMINED. Khao Krachom Mountain: 13°33'43.6"N, 99°12'24.1"E, h=560 m, secondary forest, on *Lagerstroemia cf. floribunda* (Lythraceae), 12.IX 2019, 1♂, leg. K. Jiaranaisakul (RBMF).

REMARKS. This species is known to feed on *Cratoxylum formosum* Benth. & Hook. f. ex Dyer (Hypericaceae), *Lagerstroemia cf. floribunda* (Lythraceae) and *Xylia xylocarpa* (Roxb.) Taub. (Fabaceae) (Jiaranaisakul *et al.*, 2018).

***Penthicodes variegata* (Guérin-Méneville, 1829)**

Fig. 1L

MATERIAL EXAMINED Khao Krachom Mountain: 13°32'44.9"N, 99°12'13.3"E, h=700 m, dry evergreen forest, on Dipterocarpaceae, VI.2019, 2♂, leg. K. Jiaranaisakul (RBMF); the same data, on Magnoliaceae, 18.VI 2019, 1♀, leg. K. Jiaranaisakul (RBMF); the same data, on *Litchi chinensis* Sonn. (Sapindaceae), 21.III 2020, 1♂, leg. K. Jiaranaisakul (RBMF); 13°33'59.0"N, 99°11'45.3"E, h=840 m, dry evergreen forest, 29.V 2020, 1♂, leg. K. Jiaranaisakul (RBMF).

MATERIAL EXAMINED (from photograph). Khao Krachom Mountain: 13°32'17.0"N, 99°11'52.1"E, h=1010 m, hill evergreen forest, on *Garcinia cf. celebica* (Clusiaceae), 15.IX 2018, 1♀, photo K. Jiaranaisakul.

REMARKS. The specimens were collected from *Garcinia cf. celebica* (Clusiaceae), *Litchi chinensis* (Sapindaceae) (new host plant record), and unidentified trees of the families Dipterocarpaceae and Magnoliaceae.

***Penthicodes warleti* Constant, 2010**

Fig. 1M

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'17.0"N, 99°11'52.1"E, h=1010 m, hill evergreen forest, on *Castanopsis* sp. (Fagaceae), 5.IX 2017, 1♂, 1♀, leg. K. Jiaranaisakul (KUKPS); 13°32'17.7"N, 99°12'00.6"E, h=960 m, hill evergreen forest, on *Garcinia* sp. (Clusiaceae), 28.XII 2019, 1♂, 2♀, leg. K. Jiaranaisakul (RBMF).

REMARKS. The species was recorded from *Castanopsis* sp. (Fagaceae) (Jiaranaisakul *et al.*, 2018) and *Garcinia* sp. (Clusiaceae).

Genus *Pyrops* Spinola, 1839

***Pyrops candelaria* (Linnaeus, 1758)**

Fig. 1N-O

MATERIAL EXAMINED. Khao Krachom Mountain: 13°34'07.1"N, 99°11'46.0"E, h=920 m, dry evergreen forest mixed with secondary forest, on *Schima wallichii* (DC.) Korth. (Theaceae), 23.VII 2019, 1♀, leg. K. Jiaranaisakul (THNHM); 13°33'05.2"N, 99°12'16.3"E, h=630 m, dry evergreen forest, on *Dimocarpus longan* Lour. (Sapindaceae), 15.XI 2019, 1♂; leg. K. Jiaranaisakul (RBMF).

REMARKS. The recorded host plants of this species are *Dimocarpus longan* (Sapindaceae), *Litchi chinensis* Sonn. (Sapindaceae), *Mangifera indica* L. (Anacardiaceae) and *Nephelium longana* (Lam.) Cambess. (Sapindaceae) (Kershaw & Kirkaldy, 1910; Constant *et al.*, 2016). We also found it on *Schima wallichii* (Theaceae) (new host plant record).



Fig. 2. Lanternflies in nature in Khao Krachom Mountain. A, B – *Pyrops connectens*, 8.IV 2013 (© S. Ruchisansakul); C – *Pyrops itoi* tended by ants, 27.VII 2020 (© B. Wongdee); D, E – *Pyrops spinolae* on host plant: D – feeding on *Pometia pinnata* Forst. (Sapindaceae), 5.IX 2017; E – on *Balakata baccata* (Roxb.) Esser (Euphorbiaceae), 19.VI 2019; F, G – *Pyrops viridirostris*, 9.VI 2020; H – *Saiva gemmata*, 20.IV 2020; I–L – *Zanna nobilis*: I – adults on unidentified vine, 10.II 2020; J – adults and nymphs at night, 10.II 2020; K – molting, 23.II 2020; L – mating, 23.II 2020.

***Pyrops connectens* (Atkinson, 1885)**

Fig. 2A-B

MATERIAL EXAMINED (from photograph). Khao Krachom Mountain: dry evergreen forest, 8.IV 2013, 4 ex., photo S. Ruchisansakul.

REMARKS. This species was described from Myanmar (Distant, 1906) and here recorded from Thailand for the first time.

***Pyrops itoi* (Satô et Nagai, 1994)**

Fig. 2C

MATERIAL EXAMINED (from photograph). Khao Krachom Mountain: 13°32'21.6"N, 99°11'54.1"E, h=1024 m, hill evergreen forest, 27.VII 2020, 1 ex., photo B. Wongdee.

REMARKS. The specimens were observed and photographed during trophobiotic interaction with ants of the genus *Camponotus* Mayr, 1861 (Formicidae).

***Pyrops spinolae* (Westwood, 1842) (new country record)**

Fig. 2D-E

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'18.5"N, 99°12'02.6"E, h=980 m, hill evergreen forest, on *Balakata baccata* (Roxb.) Esser (Euphorbiaceae), VI 2019, 1♂, leg. K. Jiaranaisakul (RBMF); the same data, on *Pometia pinnata* Forst. (Sapindaceae), 19.XI 2019, 1♀, leg. K. Jiaranaisakul (RBMF); the same data, on *Pometia pinnata* Forst. (Sapindaceae), 23.III 2020, 1♂, leg. K. Jiaranaisakul (RBMF).

REMARKS. Observed specimens confirm *Pometia pinnata* (Sapindaceae) as a host tree for this species (new host plant record). One specimen was collected on *Balakata baccata* (Euphorbiaceae) but more observation are needed to confirm this potential host plant.

***Pyrops viridirostris* (Westwood, 1848)**

Fig. 2F-G

MATERIAL EXAMINED. Khao Krachom Mountain: 13°34'07.1"N, 99°11'46.0"E, h=920 m, dry evergreen forest mixed with secondary forest, on *Schima wallichii* (DC.) Korth. (Theaceae), 29.V 2020, 1♀, leg. K. Jiaranaisakul (RBMF).

REMARKS. This species was observed feeding from *Schima wallichii* (Theaceae) (new host plant record).

Genus *Saiva* Distant, 1906

***Saiva gemmata* (Westwood, 1848)**

Fig. 2H

MATERIAL EXAMINED. Khao Krachom Mountain: 13°33'05.2"N, 99°12'16.3"E, h=630 m, dry evergreen forest, on Meliaceae, 27.VIII 2019, 1♀, leg. K. Jiaranaisakul (RBMF); the same data, on *Dimocarpus longan* Lour. (Sapindaceae), 20.IV 2020, 1♂, leg. K. Jiaranaisakul (RBMF); 13°32'32.8"N, 99°12'08.1"E, h=960 m, hill evergreen forest, on *Pometia pinnata* Forst. (Sapindaceae), 20.V 2020, 1♀, leg. K. Jiaranaisakul (RBMF); 13°34'07.1"N, 99°11'46.0"E, h=920 m, dry evergreen forest, on *Schima wallichii* (DC.) Korth. (Theaceae), 29.V 2020, 1♀, leg. K. Jiaranaisakul (RBMF).

REMARKS. The species was found on *Dimocarpus longan* (Sapindaceae), *Pometia pinnata* (Sapindaceae), and *Schima wallichii* (Theaceae) (all new host plant records) and an unidentified tree in the family Meliaceae.

Genus *Zanna* Kirkaldy, 1902

***Zanna nobilis* (Westwood, 1838)**

Fig. 2I-L

MATERIAL EXAMINED. Khao Krachom Mountain: 13°32'18.5"N, 99°12'02.6"E, h=980 m, hill evergreen forest, on *Garcinia* cf. *celebica* (Clusiaceae), 10.IV 2018, 1♀, leg. K. Jiaranaisakul (RBMF); the same data, on *Aphanamixis polystachya* (Wall.) R.Parker (Meliaceae), 16.II 2019, 1♂, leg. K. Jiaranaisakul (RBMF); 13°32'32.8"N, 99°12'08.1"E, h=960 m, hill evergreen forest, on unidentified vine, 11.II 2020, 3♂, 2♀, leg. K. Jiaranaisakul (RBMF).

REMARKS. This species is recorded from Thailand for the first time. Specimens were collected at altitude 960–980 m on *Garcinia* cf. *celebica* (Clusiaceae) and *Aphanamixis polystachya* (Meliaceae) but more observation is needed to confirm or refute these host trees. In addition, we found a high number of nymphs moult into adults in February and also found them mating at the end of the same month. This data could lead us to an understanding of their life cycles in the future.

DISCUSSION

The present first entomological survey of Khao Krachom allowed to document 18 species of Fulgoridae from this mountain with new data of host plants for many of them. As a result, 27 species of Fulgoridae are now known from Thailand which is slightly less than Vietnam (Fig. 3). However, the number of species from Thailand is probably still much under the real figure (Jiaranaisakul & Constant, unpublished data). A list of the species found in Khao Krachom with the types of forests where they were observed, is given in Table 1.

Table 1. The habitats of Fulgoridae in Khao Krachom Mountain.

No	Species	Types of forest		
		dry evergreen	hill evergreen	secondary forest
1.	<i>Aphaena aurantia</i>		x	
2.	<i>Aphaena najas</i>		x	
3.	<i>Aphaena</i> sp.		x	
4.	<i>Dichoptera</i> sp. 1			x
5.	<i>Dichoptera</i> sp. 2		x	
6.	<i>Kalidasa nigromaculata</i>	x		
7.	<i>Penthicodes atomaria</i>	x		x
8.	<i>Penthicodes caja</i>		x	
9.	<i>Penthicodes pulchella</i>			x
10.	<i>Penthicodes variegata</i>	x	x	
11.	<i>Penthicodes warleti</i>		x	
12.	<i>Pyrops candelaria</i>	x		
13.	<i>Pyrops connectens</i>	x		
14.	<i>Pyrops itoi</i>		x	
15.	<i>Pyrops spinolae</i>		x	
16.	<i>Pyrops viridirostris</i>	x		
17.	<i>Saiva gemmata</i>	x	x	
18.	<i>Zanna nobilis</i>		x	
	Total:	7	11	3

The hill evergreen forest is the habitat with the highest number of Fulgoridae species, followed by the dry evergreen forest. We did not find any species in mixed deciduous forest since we have only surveyed a few times in this type of forest, hence the lack of data may only reflect this collecting bias. Three species were found in two different types of forest: *Penthicodes atomaria* in dry evergreen forest and secondary forest, and *P. variegata* and *Saiva gemmata* in dry evergreen forest and hill evergreen forest. This again could only mirror the low number of data available for each of the observed species. Our study provides host



Fig. 3. Fulgoridae diversity in Thailand and neighbouring countries (according to Nagai & Porion, 1996; Bourgoin, 2021, and present data). ● – Khao Krachom Mountain.

plant data for 18 species and shows that the preferred host plant families for Khao Krachom Fulgoridae are, by order of lanternfly species abundance: Sapindaceae (4 lanternfly species), Clusiaceae, Fagaceae, Simaroubaceae and Theaceae (3 species), Lythraceae and Meliaceae (2 species), and Dipterocarpaceae, Euphorbiaceae, Fabaceae, Hypericaceae, Magnoliaceae and Myrtaceae (1 species). A total of 22 different tree species in 13 botanical families were documented to be host plants for lanternflies in Khao Krachom Mountain (Table 2).

Table 2. The known host plants of Fulgoridae in Khao Krachom Mountain.

S P E C I E S	CL	DI	EU	FA	FG		HY	LY			MG	ML	MY	SA		SI	TH
	<i>Garcinia cf. celebica</i> <i>Garcinia</i> sp. Unidentified	<i>Balakata baecata</i> <i>Xylia xylocarpa</i>	<i>Castanopsis diversifolia</i> <i>Castanopsis</i> sp. <i>Quercus</i> sp.	<i>Cratoxylum formosum</i> <i>Lagerstroemia cf. floribunda</i> <i>Lagerstroemia loudonii</i> <i>Lagerstroemia macrocarpa</i>	Unidentified	<i>Aphanamixis polystachya</i> Unidentified	<i>Syzygium</i> sp.	<i>Dimocarpus longan</i> <i>Litchi chinensis</i> <i>Pometia pinnata</i>	<i>Ailanthus triphysa</i> <i>Eurycoma longifolia</i> <i>Sehima wallichii</i>								
1												X					
2																	X
3																	X
4						X											
5																X	
6					X				X	X							
7												X	X				
8				X			X	X									
9	X	X								X				X			
10		X			X												
11													X	X			X
12			X												X		
13																	X
14													X	X			X
15	X										X						

Abbreviations. **Host plant families:** CL – Clusiaceae; DI – Dipterocarpaceae; EU – Euphorbiaceae; FA – Fabaceae; FG – Fagaceae; HY – Hypericaceae; LY – Lythraceae; MG – Magnoliaceae; ML – Meliaceae; MY – Myrtaceae; SA – Sapindaceae; SI – Simaroubaceae; TH – Theaceae. **Lanternflies species:** 1 – *Aphaena aurantia*; 2 – *A. najas*; 3 – *Aphaena* sp.; 4 – *Dichoptera* sp. 2; 5 – *Kalidasa nigromaculata*; 6 – *Penthicodes atomaria*; 7 – *Penthicodes caja*; 8 – *Penthicodes pulchella*; 9 – *Penthicodes variegata*; 10 – *Penthicodes warleti*; 11 – *Pyrops candelaria*; 12 – *Pyrops spinolae*; 13 – *Pyrops viridirostris*; 14 – *Saiva gemmata*; 15 – *Zanna nobilis*.

According to their wide distribution in Thailand and/or in neighbouring countries, a number of additional species can be expected to occur in Khao Krachom Mountain, as listed here: *Aphaena amabilis* (Hope, 1843), *Polydictya thompsoni* Constant et Pham, 2019, *P. tricolor* (Westwood, 1845), *P. vietnamica* Constant et Pham, 2008, *Pyrops clavatus* (Westwood, 1839), *P. karenius* (Distant, 1891), *P. lathburii* (Kirby, 1818), *P. peguensis* (Schmidt, 1911), *Saiva cardinalis* (Butler, 1874), *Zanna affinis* (Westwood, 1839), and *Z. chinensis* (Distant, 1893).

In 2020, Khao Krachom Mountain encountered a forest fire crisis that destroyed many square kilometers of habitat and may cause the population of some species to decline. The fire was more active in the northern part of the mountain and the most altered habitat were the mixed deciduous forest and the secondary forest which contain a very small number of lanternfly species (no species for the former and 3 species for the latter, respectively). However, there are still many areas within Khao Krachom that have not been surveyed yet, and the return of the species in the burnt areas will be an interesting topic for future study. Thus, surveying with the cooperation of “citizen scientists” in the area, such as villagers or border patrol police could provide a lot more data, as already shown in Cambodia by Constant *et al.*, (2016), which can be used to secure the long term protection of this forest.

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REFERENCES

- Bourgoin, T. 2021. *FLOW (Fulgoromorpha Lists on The Web): a world knowledge base dedicated to Fulgoromorpha*. Version 8. Available from: <http://hemiptera-databases.org/flow/> (accessed 3 February 2021)
- Bunyavejchewin, S., Chamlongrach, Y., Buasalee, R. & Rayangkul, P. 2016. *Trees & Forest of Huai Kha Kaeng Wildlife Sanctuary*. Thai Long-Term Forest Ecological Research & The Rabbit in the Moon Foundation, Bangkok. 694 pp.
- Constant, J. 2010. The lanternfly genus *Penthicodes*: key to the species and review of the “*Ereosoma* group” with two new species and one new subspecies (Hemiptera: Fulgoromorpha: Fulgoridae). *Zootaxa*, 2523: 1–26. DOI: <https://doi.org/10.5281/zenodo.196336>
- Constant, J., Phauk, S. & Bourgoin, T. 2016. Updating lanternflies biodiversity knowledge in Cambodia (Hemiptera: Fulgoromorpha: Fulgoridae) by optimizing field work surveys with citizen science involvement through Facebook networking and data access in FLOW website. *Belgian Journal of Entomology*, 37: 1–16.
- Constant, J. & Pham, H.T. 2017. Review of the *clavatus* group of the lanternfly genus *Pyrops* (Hemiptera: Fulgoromorpha: Fulgoridae). *European Journal of Taxonomy*, 305: 1–26. DOI: <https://doi.org/10.5852/ejt.2017.305>

- Constant, J. & Pham, H.T. 2019. *Polydictya* lanternflies of the Indochinese region: Six new species and identification key (Hemiptera: Fulgoromorpha: Fulgoridae). *Belgian Journal of Entomology*, 86: 1–42.
- Jiaranaisakul, K., Makbun, N., & Constant, J. 2018. The lanternflies of the *Penthicodes (Ereosoma) atomaria*+ species group in Thailand: New records and host plants (Hemiptera: Fulgoridae). *Belgian Journal of Entomology*, 71: 1–15.
- Kershaw, J.C.W. & Kirkaldy, G.W. 1910. A memoir on the anatomy and life-history of the homopterous insect *Pyrops candelaria* (or "candle-fly"). *Zoologische Jahrbücher. Abteilung für Systemetik, Ökologie und Geographie der Tiere. Jena*, 29: 105–124.
- Melichar, L. 1912. Monographie der Dictyophorinen (Homoptera). *Abhandlungen der K. K. Zoologisch-botanischen Gesellschaft in Wien*, 7(1): 1–221.
- Nagai, S. & Porion, T. 1996. *Fulgoridae 2: Catalogue illustré des faunes asiatique et australienne*. Sciences Nat, Compiègne. 80 pp.
- Schmidt, E. 1911. Beitrag zur Kenntnis der Homopteren. (Neue Gattungen und Arten). *Entomologische Zeitung. Herausgegeben von dem entomologischen Vereine zu Stettin*, 72: 238–307.