

Distribution of the Flying Lizard Genus *Draco* Linnaeus, 1758 (Squamata: Agamidae) of the Reference Collection of the Natural History Museum, National Science Museum, Thailand

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ABSTRACT

The study of distribution of flying lizard genus *Draco* in Thailand based on data in the Reference Collection of the Natural History Museum, National Science Museum, Thailand (THNHM) concluded that there are nine species of flying lizard in the museum collection and the distribution of flying lizard in Thailand was the most common in the south, east, west, center, north and northeast, respectively. However, this information was not sufficient to cover the total number of flying lizard species distributed in Thailand. This information indicates that the herpetological collection of the Natural History Museum, National Science Museum, Thailand is still incomplete, and that flying lizard distribution and diversity is probably much richer than demonstrated. New distribution records were discovered of *Draco blanfordii* in the central and eastern regions, which were of *Draco fimbriatus* in the east and *Draco melanopogon* in the north, northeast, and west. The results of this report made it possible to estimate the distribution of each species of flying lizard in Thailand. Further surveys and distribution studies can be used in the management of protected animal conservation areas under the law of the Ministry of Natural Resources and Environment of Thailand.

Keywords: *Draco*, Distribution, Thailand Natural History Museum

INTRODUCTION

The flying lizard genus *Draco* (family Agamidae) is distributed from Southwest India through Southeast Asia, including the Malay Peninsula, the Philippines, and Thailand (Taylor, 1963; Honda *et al.*, 1999; Nabhitabhata *et al.*, 2000; McGuire and Dudley, 2011). Thailand is a country in the center of continental Southeast Asia. Located in the tropics, about four-fifths of the country has a border with the neighboring countries of Myanmar, Laos, and Cambodia. The southern part of central and eastern Thailand is bordered by the Gulf of Thailand. The southern part of western Thailand is the northern part of the Thai Peninsula, which extends south to the border with Malaysia. The western part of the peninsula is bordered by Myanmar's southernmost border, and the rest is bordered by Andaman Sea, while the eastern part of the peninsula is bordered by the Gulf of Thailand. Northern Thailand is a region of several mountain ranges with steep-sided valleys and peaks over 2000 meters in elevation including Thailand's highest peak, Doi Inthanon, which is 2565 meters in

elevation. Northeastern Thailand is dominated by the Khorat Plateau, an undulating plain covering some 400 kilometers. Elevations are generally less than 250 meters. Western Thailand is a mountainous region which includes the southern extension of the western highlands running parallel to the Myanmar border, with summits generally between 1000 and 2000 meters in elevation. The Central Plain forms the broad heartland of Thailand, crossed by a network of rivers and canals which drain into the Chao Phraya, the country's principal river in the center of the country. Eastern Thailand is located between the Khorat Plateau and the sea. The terrain is mountainous with forest. From the top of hills just a few hundred meters in the western part of the region become higher towards the east, with the highest being Khao Soi Dao, which is 1670 meters in elevation. Southern Thailand or Peninsular Thailand covers about 84,000 square kilometers in a narrow north-south strip of land, separated from Western Thailand region by the Isthmus of Kra (Ridd *et al.*, 2011).

The lizard genus *Draco* currently consists of 40 species

(Uetz *et al.*, 2020). In Thailand, 12 species are found (Uetz *et al.*, 2020). They are found in forest habitats throughout Thailand (Chan-ard *et al.*, 2015). The purpose of this report was to present the distribution of the flying lizard genus *Draco* in Thailand examined from data in the Reference Collection of Natural History of Natural History Museum, National Science Museum, Thailand (THNHM). The results of this report are useful information that will be helpful to estimate the distribution of each species of flying lizard in Thailand, the study of the distribution which was discovered in new areas, surveys, the collection of specimens in the museum, and the management of conservation areas in Thailand. This is of importance because the flying lizard species in Thailand are on the list of protected species according to Thai Law (Ministry of Natural Resources and Environment, 2003).

MATERIALS AND METHODS

The data are based on examination of the museum collections during 1967-2020 from the Reference Collection of Natural History of Natural History Museum, National Science Museum, Thailand (THNHM). Nine species of flying lizards were examined: *Draco blanfordii*, *Draco fimbriatus*, *Draco maculatus*, *Draco maximus*, *Draco melanopogon*, *Draco obscurus*, *Draco quinquefasciatus*, *Draco taeniopterus* and *Draco volans*. The numbers and species were cited the study by Srichairat *et al.* (2017) to create a list and maps of the distribution of species in Thailand.

RESULTS AND DISCUSSION

Draco blanfordii Boulenger, 1885

WEST: Kanchanaburi: Tarn Lod Cave; **Phetchaburi:** Tho Thip Waterfall, Kaeng Krachan National Park. **CENTRAL: Kamphaeng Phet:** Khlong Lan National Park; **Uthai Thani:** Khao Nang Rum Wildlife Research Station (Huai Kha Khaeng Wildlife Sanctuary). **EAST: Chanthaburi:** Phlio Waterfall. **SOUTH: Krabi:** Khao Nor Chuchi National Park, Mu Koh Lanta National Park; **Narathiwat:** Hala-Bala Wildlife Sanctuary; **Phuket:** Ton Sri Waterfall; **Nakhon Si Thammarat:** Karom Waterfall, Khao Nan National Park; **Pattani:** Na Pradu; **Ranong:** Koh Phayam; **Songkhla:** Ton Nga Chang Waterfall; **Surat Thani:** Trang; **Trang:** Khao Chong, Ton Te Waterfall.

Draco fimbriatus Kuhl, 1820

EAST: Trat: Koh Kut; **SOUTH: Nakhon Si Thammarat:** Khao Luang National Park.

Draco maculatus Gray, 1845

NORTH: Chiang Mai: Doi Suthep-Pui National Park; **Lampang:** Hang Chat. **NORTHEAST: Nakhon Ratchasima:** Khao Yai National Park; **Bueng Kan:** Phu Wua Wildlife Sanctuary. **WEST: Kanchanaburi:** Thong Pha Phum National Park. **CENTRAL: Bangkok:** Siam Farm Bangkok, Bang Phlat; **Nakhon Nayok:** Khlong Maduea Waterfall. **EAST: Chachoengsao:** Khao Ang Rue Nai Wildlife Sanctuary; **Chanthaburi:** Khao Soi Dao Wildlife Sanctuary; **Trat:** Koh Kut. **SOUTH: Nakhon Si Thammarat:** Klong Klay; **Narathiwat:** Hala-Bala Wildlife Sanctuary, Su-ngai Kolok; **Phuket:** Ton Sri Waterfall; **Pattani:** Na Pradu, Nong Chik; **Surat Thani:** Pak Chalui; **Songkhla:** Boripat Waterfall; **Trang:** Koh Libong.

Draco melanopogon Boulenger, 1887

NORTH: Chiang Mai. **NORTHEAST: Loei:** Phu Luang Wildlife Sanctuary; **Nakhon Ratchasima:** Sakaerat Environmental Research Station. **WEST: Phetchaburi.** **SOUTH: Krabi; Nakhon Si Thammarat:** Karom Waterfall; **Narathiwat:** Hala-Bala Wildlife Sanctuary, Su-ngai Kolok; **Satun; Surat Thani:** Ban Na San; **Trang:** Khao Ban Tad Wildlife Sanctuary; **Yala:** Bannang Sata.

Draco obscurus Boulenger, 1887

SOUTH: Yala: Bannang Sata.

Draco quinquefasciatus Hardwicke & Gray, 1827

EAST: Trat: Koh Chang. **SOUTH: Krabi:** Mu Koh Lanta National Park; **Narathiwat:** Sukhirin.

Draco taeniopterus Günther, 1861

NORTH: Nan: Khun Nan National Park. **WEST: Kanchanaburi:** Tarn Lod Cave, Thong Pha Phum National Park; **Phetchaburi:** Tho Thip Waterfall, Kaeng Krachan National Park; **Tak:** Thung Yai Wildlife Sanctuary, Umphang. **EAST: Chachoengsao:** Khao Ang Rue Nai Wildlife Sanctuary; **Chanthaburi:** Khao Soi Dao Wildlife Sanctuary, Phlio Waterfall; **Chon Buri:** Chao Bo Thong Waterfall, Khao Khieo Open Zoo; **Sa Kaeo:** Pang Sida National Park; **Trat:** Khlong Chao Waterfall, Koh Kut. **SOUTH: Krabi:** Khao Pra Bangkram Wildlife Sanctuary, Mu Koh Lanta National Park; **Nakhon Si Thammarat:** Karom Waterfall, Khao Nan National Park; **Phang Nga:** Koh Similan, Mu Koh Surin National Park; **Phuket:** Koh Racha; **Ranong:** Bang Non; **Satun:** Phu Pha Phet Cave; **Songkhla:** Boripat Waterfall; **Surat Thani:** Ban Na San, Khao Sok National Park, Pak Chalui; **Trang:** Kantrang, Khao Chong, Koh Libong.

Draco volans Linnaeus, 1758

CENTRAL: Bangkok: Siam Farm Bangkok, Bang

Phlat. **SOUTH: Krabi:** Mu Koh Lanta National Park; **Nakhon Si Thammarat:** Khao Nan National Park; **Pattani:** Na Pradu; **Phatthalung:** Thale Noi Waterbird Park, Khuan Khanun; **Yala:** Bannang Sata.

Eight species of flying lizards were examined: *Draco blanfordii*, *Draco fimbriatus*, *Draco maculatus*, *Draco melanopogon*, *Draco obscurus*, *Draco quinquefasciatus*, *Draco taeniopterus* and *Draco volans*. The species were cited the study by Srichairat *et al.* (2017). According to a study by Srichairat *et al.* (2017), *Draco maximus*

was found in the preserved specimen collection from THNHM; (Numbers 02203, 02204, 02206–02218, 13564–13566 and 13568). These specimens were previously described as *D. blanfordii*. However, the current study did not find a definite distribution in Thailand for *D. maximus* in the Reference Collection of the Natural History Museum in the THNHM collection, so these provinces in Thailand could not be identified and mapped. The species from this study differed from the study of Taylor (1963), Musters (1983) and Nabhitabhata *et al.* (2000) who reported *D. haematopogon* had been

Table 1. Localities of flying lizard genus *Draco* in Thailand, from this study and published accounts

Species	Region	Province	Source
<i>Draco blanfordii</i>	West	Kanchanaburi	Nabhitabhata <i>et al.</i> (2000); This study Pauwels <i>et al.</i> (2003); Pauwels and Chan-ard (2006); Pauwels <i>et al.</i> (2009); This study
		Phetchaburi	
	Central	Kamphaeng Phet	This study
		Uthai Thani	This study
	East	Chanthaburi	This study
	South	Krabi	Nabhitabhata <i>et al.</i> (2000); This study
		Narathiwat	Nabhitabhata <i>et al.</i> (2000); This study
		Phuket	Nabhitabhata <i>et al.</i> (2000); Leong <i>et al.</i> (2003); This study
		Nakhon Si Thammarat	Nabhitabhata <i>et al.</i> (2000); This study
		Pattani	Nabhitabhata <i>et al.</i> (2000); This study
		Ranong	Nabhitabhata <i>et al.</i> (2000); This study
	Songkhla	Nabhitabhata <i>et al.</i> (2000); This study	
	Surat Thani	Nabhitabhata <i>et al.</i> (2000); This study	
	Trang	Nabhitabhata <i>et al.</i> (2000); This study	
<i>Draco fimbriatus</i>	East	Trat	This study
	South	Nakhon Si Thammarat	Nabhitabhata <i>et al.</i> (2000); This study
<i>Draco maculatus</i>	North	Chiang Mai	Nabhitabhata <i>et al.</i> (2000); This study
		Lampang	
	Northeast	Nakhon Ratchasima	Nabhitabhata <i>et al.</i> (2000); This study Nabhitabhata <i>et al.</i> (2000); This study
		Bueng Kan	
	West	Kanchanaburi	Nabhitabhata <i>et al.</i> (2000); This study
	Central	Bangkok	This study
		Nakhon Nayok	Nabhitabhata <i>et al.</i> (2000); This study
	East	Chachoengsao	This study
		Chanthaburi	This study
		Trat	This study
	South	Nakhon Si Thammarat	This study
		Narathiwat	This study
		Phuket	Leong <i>et al.</i> (2003); This study
Pattani		This study	
Surat Thani		Nabhitabhata <i>et al.</i> (2000); This study	
Songkhla		This study	
Trang		This study	

Table 1. Localities of flying lizard genus *Draco* in Thailand, from this study and published accounts (continued)

Species	Region	Province	Source
<i>Draco melanopogon</i>	North	Chiang Mai	This study
		Northeast	Loei
	Nakhon Ratchasima		This study
	West		Phetchaburi
	South	Krabi	Nabhitabhata <i>et al.</i> (2000); This study
		Nakhon Si Thammarat	Nabhitabhata <i>et al.</i> (2000); This study
		Narathiwat	Nabhitabhata <i>et al.</i> (2000); This study
		Satun	This study
		Surat Thani	Nabhitabhata <i>et al.</i> (2000); This study
		Trang	Nabhitabhata <i>et al.</i> (2000); This study
Yala		Nabhitabhata <i>et al.</i> (2000); This study	
<i>Draco obscurus</i>	South	Yala	Nabhitabhata <i>et al.</i> (2000); Chan-ard <i>et al.</i> (2015); This study
<i>Draco quinquefasciatus</i>	East	Trat	This study
	South	Krabi	This study
		Narathiwat	Nabhitabhata <i>et al.</i> (2000); This study
<i>Draco taeniopterus</i>	North	Nan	This study
	West	Kanchanaburi	Nabhitabhata <i>et al.</i> (2000); This study
		Phetchaburi	Pauwels and Chan-ard (2006); Pauwels <i>et al.</i> (2009); This study
		Tak	This study
	East	Chachoengsao	This study
		Chanthaburi	Nabhitabhata <i>et al.</i> (2000); This study
		Chonburi	This study
		Sa Kaeo	This study
	South	Trat	Nabhitabhata <i>et al.</i> (2000); This study
		Krabi	Nabhitabhata <i>et al.</i> (2000); This study
		Nakhon Si Thammarat	Nabhitabhata <i>et al.</i> (2000); This study
		Phang Nga	Pauwels <i>et al.</i> (2000); Pauwels <i>et al.</i> (2002); This study
		Phuket	Nabhitabhata <i>et al.</i> (2000); Leong <i>et al.</i> (2003); This study
		Ranong	Nabhitabhata <i>et al.</i> (2000); This study
		Satun	This study
		Songkhla	This study
Surat Thani		Nabhitabhata <i>et al.</i> (2000); This study	
Trang		Nabhitabhata <i>et al.</i> (2000); This study	
<i>Draco volans</i>	Central	Bangkok	This study
	South	Krabi	This study
		Nakhon Si Thammarat	Nabhitabhata <i>et al.</i> (2000); This study
		Pattani	This study
		Phatthalung	This study
Yala	Nabhitabhata <i>et al.</i> (2000); This study		

found at Koh Pha Ngan, Thailand; however, this study did not find *D. haematopogon* at Koh Pha Ngan in the Reference Collection of the Natural History Museum.

Draco blanfordii was described as one of three commonly found flying lizard species that has been reported distributed from northern to southern Thailand

(Srichairat *et al.*, 2014; Chan-ard *et al.*, 2015). This study found that this species was found in western, central, southern, and eastern Thailand, but it was not found in

northern and northeastern Thailand. Furthermore, *D. blanfordii* was also found in Phuket province as well as research by Leong *et al.* (2003) and Kaeng Krachan

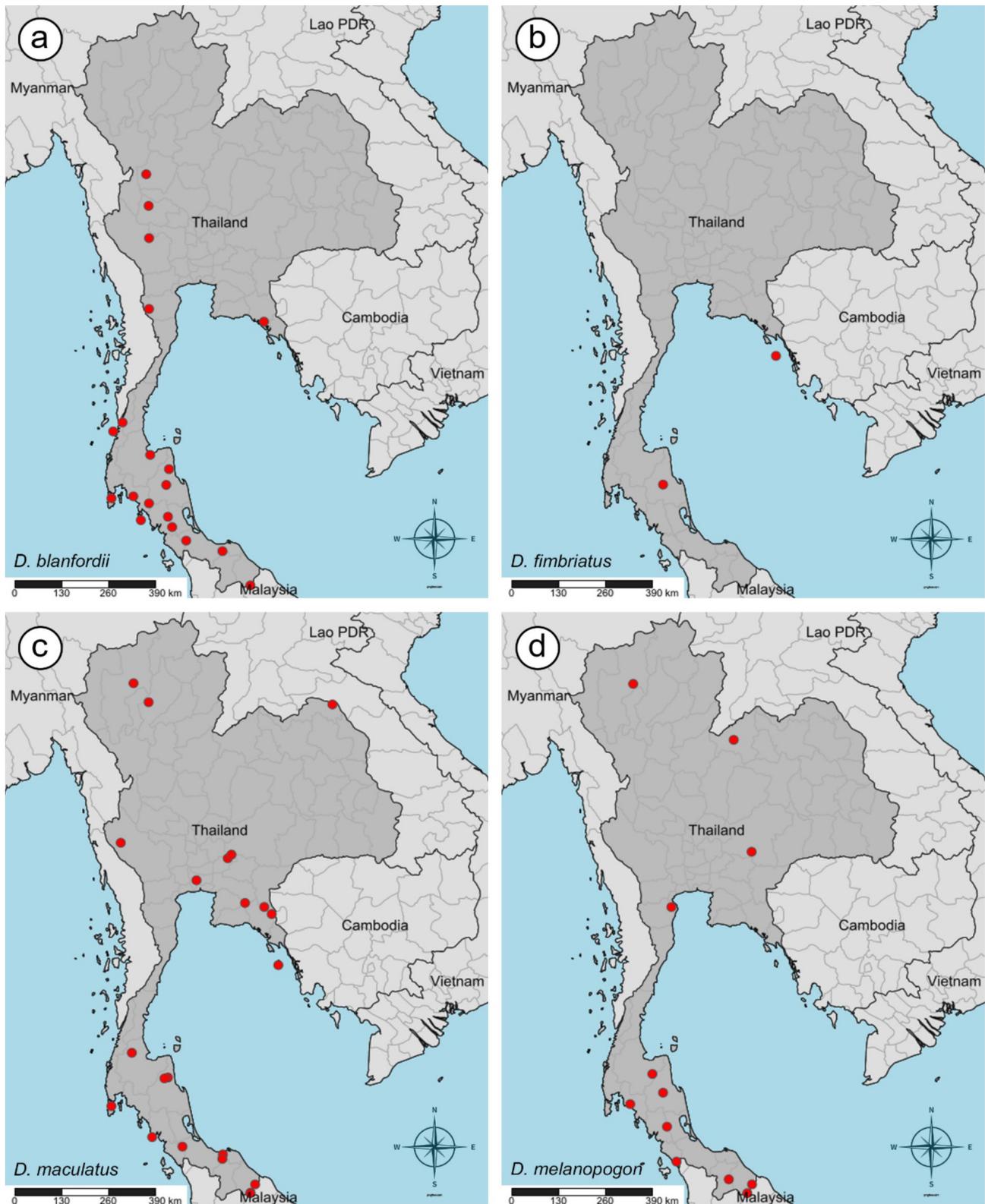


Figure 1. Maps: Geographical distribution of (a) *Draco blanfordii*, (b) *Draco fimbriatus*, (c) *Draco maculatus* and (d) *Draco melanopogon* with red points as localities from this study based on the Reference Collection of Natural History of Natural History Museum, National Science Museum, Thailand (THNHM).

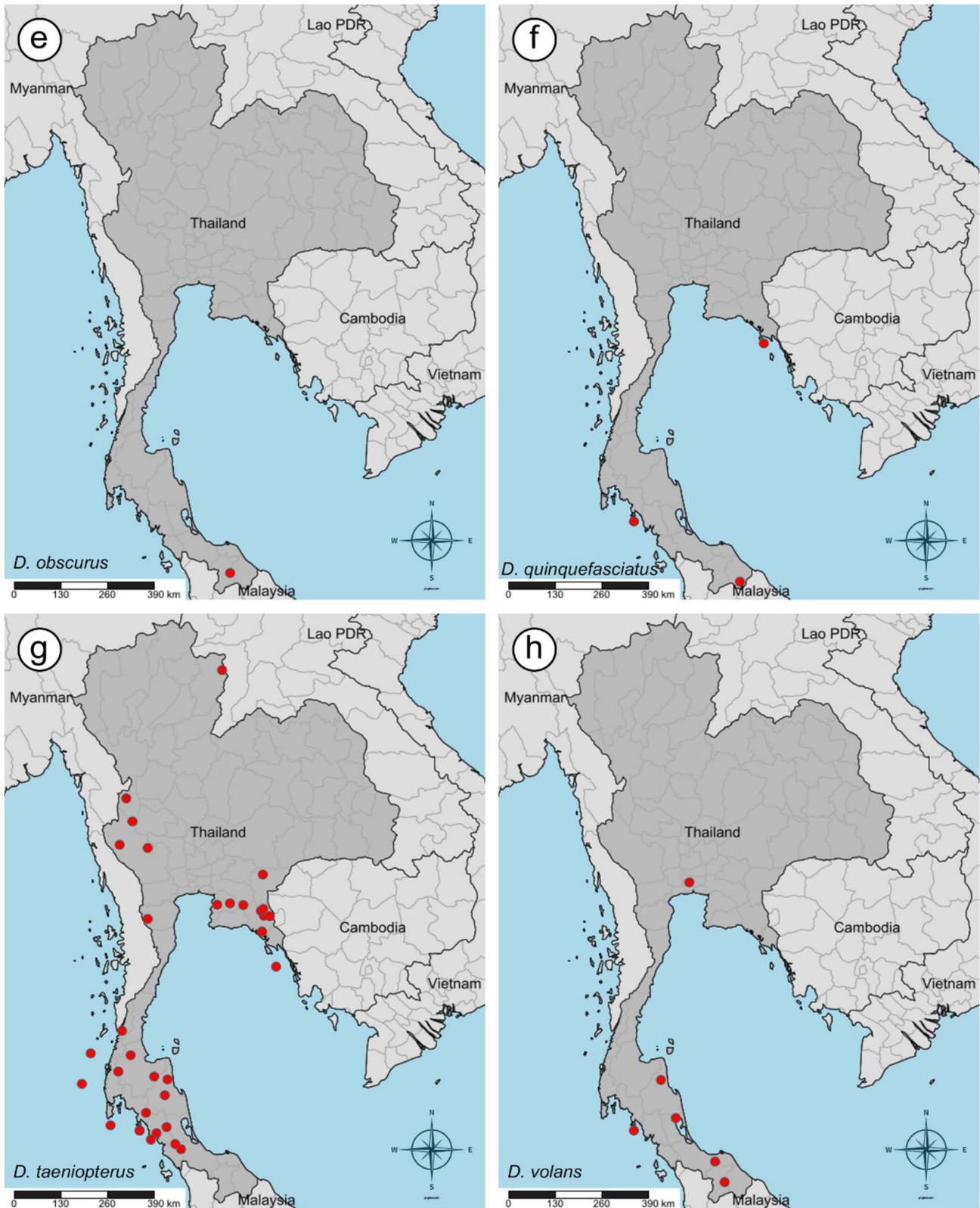


Figure 2. Maps: Geographical distribution of (e) *Draco obscurus*, (f) *Draco quinquefasciatus*, (g) *Draco taeniopterus* and (h) *Draco volans* with red points as localities from this study based on the Reference Collection of Natural History of Natural History Museum, National Science Museum, Thailand (THNHM).

National Park, Phetchaburi province, as well as research by Pauwels *et al.* (2003), Pauwels and Chan-ard (2006) and Pauwels *et al.* (2009). *Draco maculatus* and *Draco*

taeniopterus were described as two of three commonly found flying lizard species that were distributed in all regions (Musters, 1983; Srichairat *et al.*, 2014).

This study found these species in all regions, except *Draco taeniopterus*, which is not found in northeastern and central Thailand. This was different from the description by Chan-ard *et al.* (2015), in which it was found in Nakhon Ratchasima, northeastern Thailand. Furthermore, *Draco maculatus* was also found in Phuket province by Leong *et al.* (2003). *Draco taeniopterus* was also found in Phang-nga province by Pauwels *et al.* (2000) and Pauwels *et al.* (2002), Phuket province by Leong *et al.* (2003), and Phetchaburi province by Pauwels and Chan-ard (2006) and Pauwels *et al.* (2009). *Draco fimbriatus* was found in the southern provinces in peninsular Thailand by Chan-ard *et al.* (2015) and in eastern Thailand. *Draco melanopogon* was found in all regions except central and eastern Thailand. This was different from the description by Chan-ard *et al.* (2015), in which it was found only in the peninsular Thailand, south of the Isthmus of Kra. *Draco obscurus* in this study was found in Yala province, southern Thailand in the description by Chan-ard *et al.* (2015). This species was more common in southern Thailand. *Draco quinquefasciatus* in this study was found in eastern and southern Thailand, as well as in the description by Chan-ard *et al.* (2015). Finally, *Draco volans* was found mostly in the southern Thailand and in central Thailand. In the work of Nabhitabhata *et al.* (2000), *Draco volans* was found mostly in the southern Thailand.

CONCLUSION

This study concluded that the distribution of flying lizards in Thailand was the most common in the south with 8 species (*Draco blanfordii*, *D. fimbriatus*, *D. maculatus*, *D. melanopogon*, *D. obscurus*, *D. quinquefasciatus*, *D. taeniopterus* and *D. volans*), followed by the east with 5 species (*D. blanfordii*, *D. fimbriatus*, *D. maculatus*, *D. quinquefasciatus* and *D. taeniopterus*), the west 4 species (*D. blanfordii*, *D. maculatus*, *D. melanopogon* and *D. taeniopterus*), the Central with 3 species (*D. blanfordii*, *D. maculatus* and *D. volans*), the north 3 with species (*D. maculatus*, *D. melanopogon*, and *D. taeniopterus*), and the northeast with 2 species (*D. maculatus* and *D. melanopogon*).

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