

## Special article

# Characterization of venomous snakes of Thailand

Lawan Chanhome<sup>a</sup>, Merel Jack Cox<sup>b</sup>, Taksa Vasaruchapong<sup>a</sup>, Narongsak Chaiyabutr<sup>a</sup>, Visith Sitprija<sup>a</sup>  
<sup>a</sup>Queen Saovabha Memorial Institute, The Thai Red Cross Society, Bangkok 10330, Thailand, <sup>b</sup>1113  
25<sup>th</sup> Avenue, Altoona, Pennsylvania 16601-2947, USA

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**Background:** Envenoming by snakebite is an important public health problem in rural tropics. Venomous snake families such as Elapidae and Viperidae frequently produce severe poisoning. Anti-venoms are not available for all venomous snakes of Thailand and there is need for more development in this field.

**Objective:** We characterized the important venomous snakes' distribution of Thailand.

**Method:** Venomous snake species are described in details including their identification, range, and extraterritorial distribution.

**Result:** Eighteen snake species of the family Elapidae are summarized in their characteristics and distribution. There are three species of *Naja*, one species of *Ophiophagus*, three species of *Bungarus*, four species of *Calliophis*, one species of *Sinomicrurus*, two species of *Laticauda*, and four species of subfamily Hydrophiinae. Fifteen snake species of the family Viperidae consisting of one species of subfamily Viperinae and fourteen species of subfamily Crotalinae are also discussed.

**Conclusion:** All these snakes are venomous and their venom is potentially fatal since birth.

**Keywords:** Elapidae, Thailand, Thai snakes, venomous snakes, viperidae

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Venomous snakes are widely distributed throughout the world and are found on every continent except frozen Antarctica. Envenoming by snakebite is an important public health problem in rural tropics where human populations experience high morbidity and mortality. Clinical features of envenomed victims involve different organs and tissues. Severe cases result from bites by snakes of the families Elapidae (cobras, kraits, mambas, coral snakes, Australian species, and sea snakes) and Viperidae (pit vipers and true vipers) [1]. The greatest impact of venomous snakes is felt in South Asia, Southeast Asia, and sub-Saharan Africa, where estimates of at least 421,000 to 1,841,000 envenomations and 20,000 to 94,000 deaths occur annually [2]. There are at least 196 species and subspecies of snakes presently indigenous to Thailand and 59 species and subspecies would qualify as venomous members of the families Elapidae and Viperidae [3]. However, more new snake

species are found and this number will probably change through the years. It is also important to remember that venom from all venomous snakes is potentially fatal since birth. Some of the 59 species and subspecies are discussed in detail.

## FAMILY ELAPIDAE

Each member of this family is capable of inflicting fatal bites on human beings. The anterior maxillary teeth are hollow, fixed fangs used for conducting venom from venom glands into prey or potential predators. Elapidae found in Thailand are six genera of *Naja*, *Ophiophagus*, *Bungarus*, *Calliophis*, *Sinomicrurus*, *Laticauda*, and a subfamily Hydrophiinae.

### I. Genus *Naja*

The elongated nuchal ribs enable members of this genus to expand the anterior of the neck into a "hood", which is the characteristic of cobras. When threatened, cobras will raise the anterior portions of their bodies, spread their hood, usually hiss loudly, and strike in an attempt to bite and defend themselves. A pair of fixed anterior fangs is present.

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**Correspondence to:** Lawan Chanhome, Queen Saovabha Memorial Institute, The Thai Red Cross Society, Bangkok 10330, Thailand. E-mail: lchanhome@yahoo.com

***Naja kaouthia* (Monocled Cobra; Figure 1)**

This snake is non-spitting. Median lethal dose (LD<sub>50</sub>) of its venom is 0.28-0.33 mg/gram of mouse body weight [4-6].

Identification

Adults are 1000 to 1900 mm in length, with maximum of 2300 mm. The head is barely distinct from the neck and cylindrical body. The coloration and pattern are variable. The dorsal surface may be yellow, brown, gray, or blackish and with or without ragged or clearly defined cross bands. The throat is usually immaculate and followed by a dark band. Hood marks are usually 0- or mask-shaped, sometimes scrambled but rarely absent. The ventral surface is the same color as the dorsal but the sub-caudals are light with dark edges. Yellow forms without hood pattern or throat pattern occur in Thailand. Cobras are nocturnal and crepuscular. In Thailand, breeding occurs during August to January. Gravidity occurs 55 to 66 days after copulation as observed in the eggs laid in captivity at the QSMI Snake Farm. Clutches of 10-37 eggs were laid in October to March and then hatched in December to May after 51 to 69 days of incubation. Eggs averaged 23 to 40 mm in width, 41 to 57 mm in length, and weighed 19.8 to 34.0 gm. Neonates weighed 13.2 to 18.8 gm and were 315 to 355 mm in length [7]. Prey includes small mammals, chicks, other snakes, amphibians, and fish. Captive specimens have been maintained on a diet of rodents, chicks, ducklings, *Hemidactylus* sp., frogs, and fish. They have also eaten homemade sausages.

Range

Their range is variable but they are found most commonly in moist lowlands, in dry evergreen forests, and near human habitation. They frequently seek refuge in termite mounds. They are found up to 1620 m in China. In Thailand, they are presumed to be present in all provinces.

Extraterritorial

This snake is found in Bangladesh, Bhutan, Cambodia, China, India, Laos, West Malaysia, Myanmar, Nepal, and Vietnam.

***Naja siamensis* (Indochinese Spitting Cobra; Figure 2)**

The ability to “spit” venom up to two meters gives this snake a very effective defensive mechanism. When the venom enters its antagonist’s eyes, severe irritation results in a loss of interest in the cobra. When

the venom is washed from the eye promptly, the irritation is temporary and there are no records of permanent blindness or fatalities among humans. However, if the eyes are not treated promptly or if victims scratch their eyes to relieve irritation, permanent blindness is possible. This cobra also bites and injects venom when necessary to defend itself or to secure food. LD<sub>50</sub> of its venom is 1.07-1.42 mg / gram of mouse body weight [4, 5].

Identification

Adults are from 1200 to 1590 mm in length, but specimens up to 1600 mm have been recorded. The head is barely distinct from the neck and cylindrical body. The coloration and pattern are highly variable. Specimens from north and northeast Thailand tend to be uniformly brown or greenish dorsally. Specimens from central Thailand also are variable. Some may be completely black or black and white and with or without speckling or crossbanding. Such specimens may have white ventral surfaces with or without markings. Others from central Thailand are primarily brown or gray brown with or without lighter crossbands on the dorsal surface, but often with several broad dark bands across the ventral surface. Hood markings of specimens from northern, northeastern, and southeastern Thailand are “V” or “U”-shaped or often spectacle shaped. However, hood markings may be faint or absent. Specimens from central Thailand often have “H-shaped” hood marking or none at all.

This snake is terrestrial. In Thailand, breeding is from March to July, with clutches of 5 to 28 eggs being laid from May to September and hatching from July to November, requiring 55 to 80 days of incubation. Eggs are 21 to 26 mm in width, 41 to 48 mm in length, and weigh 13.4 to 19.4 gm. Neonates weigh 4.0 to 13.6 gm and are 200 to 320 mm in length [7]. A wide variety of prey is consumed, including other snakes, frogs, small mammals, and chicks. Captives have been maintained on a diet of mice and an occasional *Hemidactylus* sp.

Range

They are found in deciduous and evergreen forests as well as agricultural areas. Often found in termite mounds. Its range includes north, northeast and central regions of Thailand plus the provinces of Ratchaburi, Phetchaburi, and Kanchanaburi.

Extraterritorial

The Indochinese Spitting Cobra also inhabits Cambodia, Laos, and Vietnam.



Figure 1. Monocled Cobra

***Naja sumatrana* (Equatorial Spitting Cobra, Golden Spitting Cobra; Figure 3)**

This snake can spit its venom the same as *Naja siamensis*. It should be approached with the same caution. LD<sub>50</sub> of its venom is 1.14 mg / gram of mouse body weight [5].

Identification

Adults reach a total length of 1160 to 1480 mm. The head is barely distinct from neck and cylindrical body. Coloration is variable, although most Thai specimens are yellowish to light brown but some are entirely bluish-black. There is no hood marking on either of the yellow or black forms. This snake is nocturnal and crepuscular. In Thailand, breeding is in November to March. At the QSMI Snake Farm, gravidity followed 41 days after observed copulations. Clutches of 7 to 10 eggs were laid in December to April and hatched in February to June in 69 to 73 days. Eggs were 25 to 30 mm in width, 50 to 60 mm in length, and weighed 21.8 to 27 gm. Neonates weighed approximately 20 to 21 gm and were 340 to 370 mm in length [7]. Prey includes amphibians, reptiles, small mammals, and chicks.

Range

This snake is found in evergreen forests and agricultural areas up to 1100 m. Its Thai range includes Krabi, Narathiwat, Nakhon Si Thammarat, Pattani, Phang-nga, Phatthalung, Songkhla, Surat Thani, Trang, and Yala.

Extraterritorial

This snake is found in Brunei Darussalam, Indonesia, East Malaysia, Philippines, and Singapore.



Figure 2. Indochinese Spitting Cobra



Figure 3. Equatorial Spitting Cobra, Golden Spitting Cobra

**II. Genus *Ophiophagus***

***Ophiophagus hannah* (King Cobra; Figure 4)**

The quantity of venom injected with each bite results in a high mortality rate. Research at QSMI revealed that LD<sub>50</sub> of its venom varies with age in this species, as follows, fully adult 2.12, one year to one year and 11 months 0.45, two years to two years and 11 months 1.27, three years to three years and 11 months 2.5 µg/gram of mouse body [6].

Identification

This is the largest venomous snake in the world with a record length of 5850 mm. Wild caught adult specimens are usually 3180 to 4000 mm in length. The head is distinct from the cylindrical body. When the hood is extended, it is longer and narrower than those of other species of *Naja*. The coloration and

pattern are variable within Thailand. Adult specimens from the north are dark with black bands, those from southern Thailand olive or brownish without bands. Juveniles differ markedly. They are black with distinct narrow white or yellow crossbands, chevron-shaped with apexes pointing anteriorly. Their heads are black with four white crossbars, two near the snout, one just behind the eyes and one farther back. This snake is diurnal and terrestrial. In Thailand, breeding is in November to March. Observations at the QSMI Snake Farm revealed that gravidity is 50 and 59 days after observed copulation. Clutches of 12 to 51 eggs were laid in January to May and hatched in March to July, after an incubation period of 51 to 79 days. The eggs were 23 to 33 mm in width, 31 to 73 mm in length, and weighed 18.4 to 40 gm. Hatchlings were 480 to 650 mm in length and weighed 12.2 to 24 gm [7]. Females build a nest, deposit their eggs in it, and guard them during incubation. King Cobras prey almost exclusively on other snakes and lizards although captives have been trained to eat rodents, frogs, and homemade sausages.

#### Range

Primarily a forest snake found in moist, dense forests, including mangrove, it ranges from sea level up to 1300 m. It has been recorded in every region of Thailand.

#### Extraterritorial

This snake is found in Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, India, Indonesia, Laos, East and West Malaysia, Myanmar, Nepal, Philippines, Singapore, and Vietnam.



**Figure 4.** King Cobra

### **III. Genus *Bungarus***

The head is slightly distinct from the neck. The eyes are moderate to small with round pupils. The dorsal body scales are smooth. The vertebral scale row is distinctly enlarged throughout the body on Thai species. The maxillary bone has two anterior fixed, venom conducting teeth followed by two to four small solid teeth. The tail is moderate and the ventral tail scales may be single or paired.

#### ***Bungarus candidus* (Malayan Krait; Figure 5)**

This snake accounts for a large number of bites and the highest snakebite fatalities in Thailand [8]. Its venom possesses a powerful neurotoxin of which the median lethal dose ( $LD_{50}$ ) is 0.053-0.070  $\mu\text{g}/\text{gram}$  of mouse body weight and the dry venom yield range 0.023-0.032 % per gram of snake body weight [9]. The *Bungarus candidus* bite is often virtually painless and therefore disregarded by the victim. It quickly strikes at night when foraging for food and is often confused with the harmless *Lycodon ophiophagus* and *Lycodon subcinctus*.

#### Identification

Adults average 1000 to 1550 mm in length. The body is cylindrical without a dorsal ridge but the vertebral scale row is enlarged. The surface has 25 to 36 black crossbands separated by white interspaces. The black bands do not enter the white ventral surface. The scales of the white dorsal bands often have distinct black specks on adults. The dorsal head surface is black and continuous with the first black body marking creating an indistinct V-shaped mark. The chin, neck, and ventral surface are white. The head is not distinct from the neck. It is nocturnal and terrestrial. In Thailand, breeding occurs in December to January with clutches of 4 to 10 eggs being laid February to March. Hatching is April to May after 46 to 54 days of incubation. Eggs are 12.0 to 19.5 mm in width, 31 to 59 mm in length, and weigh 3.0 to 7.0 gm. Neonates weigh 5.0 to 8.0 gm and are 270 to 340 mm [7]. Prey includes other snakes, but also probably includes lizards [10]. Captives have eaten rodents, fish, chicken, and homemade sausages [11, 12].

#### Range

Often found near human habitation and wooded areas between 545 and 1500 m, it is distributed in every Thai region.

#### Extraterritorial

This snake is found in Cambodia, Laos, Peninsular Malaysia, Singapore, and Vietnam.

***Bungarus fasciatus* (Banded Krait; Figure 6)**

This snake is sluggish during the day but extremely active at night. LD<sub>50</sub> of its venom is 3.09 mg / gram of mouse body weight [13].

Identification

Wild caught adults average 1200 to 2070 mm with a recorded maximum size of 2125 mm. Captive bred adult specimens average 1200 to 1410 mm in total length. The head is not distinct from the neck and body. The body is triangular in cross section; the tail is short and very blunt. The dorsal body surface has a series of 15 to 30 yellow bands with intervening black bands throughout the body. Both yellow and black bands are of equal width and encircle the body. The head is black with yellow lips. An elongate black marking occurs on the neck and extends forward to the top of the head where it terminates or merges with the black color of the head. It is nocturnal and terrestrial. In Thailand, breeding is from January to March, with clutches of 4 to 14 eggs laid March to May, and hatching in May to July after 59 to 62 days of incubation. Eggs are 26 to 30 mm in width, 46 to 56 mm in length and weigh 21.4 to 22.8 gm. Hatchlings weigh 14.0 to 19.6 gm and are 265 to 335 mm in length [7]. Prey includes mostly other snakes but lizards, rodents, frogs, fish, and chicken eggs [10]. Homemade sausages also have been eaten by captives [12].

Range

Recorded up to 2300 m. in scrub woodlands and open fields as well as near human habitation, it inhabits every region in Thailand.

Extraterritorial

This snake is found in Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, India, Indonesia, Laos, East and West Malaysia, Myanmar, Nepal, Singapore, and Vietnam.

***Bungarus flaviceps flaviceps* (Red-headed Krait; Figure 7)**

This snake is an uncommon but truly beautiful snake. A wild caught female was kept in captivity for seven years and 172 days at the snake farm of the Thai Red Cross Society on a diet of non-venomous snakes (*Enhydryis* sp.). LD<sub>50</sub> of its venom is 0.18 mg/gram of mouse body weight [13].

Identification

The average adult length is 1260 to 1740 mm, but the record is up to 1955 mm in total length. The head, neck, and tail are bright red. The dorsal body surface is bluish black with a thin white line separating the dorsal scales from the ventrals. The vertebral ridge is

elevated. The red color of the tail extends slightly anteriorly on to the back as a red vertebral line. The bluish-black of the body extends on to the neck and head as a central line. The ventral surface is white with black-edged ventrals. Their ventral surfaces are blackish. It is nocturnal and terrestrial. In Thailand, breeding occurs in July to October with clutches of 4 to 8 eggs laid in September to December. Hatching is in November to February after 81 to 84 days of incubation. Eggs are 19 to 23 mm in width, 39 to 50 mm in length, and weigh 9.4 to 10.0 gm. Hatchlings weigh 7.2 to 8.5 gm and 330 to 350 mm in length [7]. Prey primarily on other snakes [10] but has eaten skinks.

Range

Forested lowlands and hilly regions up to 900 m, this snake has only been seen in southern and western Thailand.

Extraterritorial

This snake is found in Indonesia, West Malaysia, Myanmar, Singapore, and Vietnam.

**Asian Coral Snakes**

**IV. Genus *Calliophis***

The members of this genus are small and not often encountered. Therefore, there are few records of their bites.

***Calliophis bivirgatus flaviceps* (Blue Long-glanded Coral Snake; Figure 8)**

The venom gland of this snake extends past the jaw into the anterior one third of the body. Dry venom yield from adults range 56.63-71.40 mg per snake. LD<sub>50</sub> of its venom is 0.81 µg/gram of mouse body weight [6].

Identification

Adults average 1060 to 1570 mm; the record length is 1850 mm. The dorsal body surface is bluish-black with a gray or bluish line dorsolaterally from head to tail. The head, tail, and ventral surface are surface red. It is nocturnal, terrestrial, and oviparous but clutch size is unknown. It preys mainly on other snakes, but also frogs and lizards.

Range

This snake is found from sea level to 1330 m in grassy areas as well as evergreen forests in southern Thailand and Petchaburi province.

Extraterritorial

This snake is found in Indonesia, West Malaysia, and Singapore.



Figure 5. Malayan Krait



Figure 6. Banded Krait

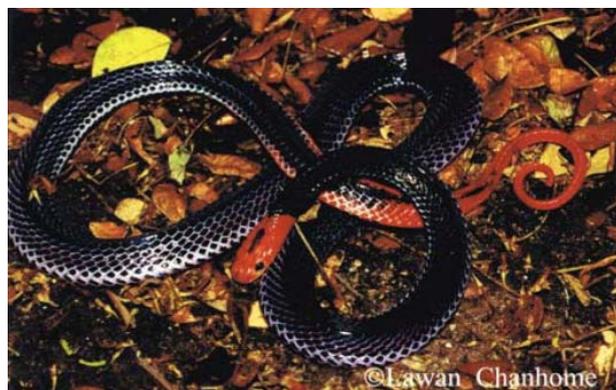


Figure 7. Red-headed Krait



Figure 8. Blue Long-glanded Coral Snake

### *Calliophis gracilis* (Gray Coral Snake)

#### Identification

The maximum adult length is 735 mm, the average is 350 to 500 mm. The dorsal body pattern is light or brownish gray with black-edged scales and a thin black vertebral stripe connected to a series of small black spots. A lateral stripe connects a series of large black spots that alternate with the smaller vertebral spots. There are black girdles on the neck and tail. The dorsal surface of the head is dark with symmetrical markings. The ventral surface of the body has alternating black and yellow bands. The ventral surface of the tail has orange and black bands. The tail is very short and ends in a blunt point. It is nocturnal, terrestrial, and semi fossorial. Oviparous but no records of clutch size are known. It preys on fossorial snakes and lizards.

#### Range

Found from sea level to 900 m in forests and scrublands under logs, forest litter, and in rock crevices, it is recorded only in the hills of Pattani province.

### *Calliophis intestinalis lineatus* (Brown Long-glanded Coral Snake; Figure 9)

#### Identification

The maximum adult length is 580 mm. The coloration and pattern are highly variable throughout its range. The dorsal head surface is dark, the lips light with black edges, and the throat and chin light. The dorsal body surface is reddish brown with a light vertebral stripe extending from the base of the head but becoming faint posterior. As many as 11 dark dorsolateral stripes extend from head to tail. The dark dorsal color extends across the ventral to form bands separated by light ventral scales with dark edges. The subcaudals are light with one band a few subcaudals behind vent. It is nocturnal, semi fossorial, and oviparous with clutches of up to four eggs. It preys on fossorial snakes.

#### Range

This snake is found in evergreen forests from sea level up to 1500 m in the southern provinces of Thailand.

Extraterritorial

This snake is found in Indonesia, West Malaysia, and Singapore.

***Calliophis maculiceps* (Small-spotted Coral Snake; Figure 10)**

When disturbed, this snake displays the ventral side of its tail, similar to some members of the non-venomous genera *Cylindrophis* and *Oligodon*.

Identification

This small, slender snake averages 300 to 350 mm in total length, the maximum being near 500 mm. The dorsal body surface is reddish brown but the pattern is variable. A vertebral stripe may extend the length of or only over part of the body. It also may be replaced by a series of dots or the vertebral ridge may be devoid of any markings. The flanks may have dark spots varying from very small to large. The head is usually dark with some lighter markings. The tail is very short. There are two dark bands around the tail. The ventral surface is red and that of the tail has black spots. It is semi fossorial, terrestrial, nocturnal, and oviparous with clutches of two to five eggs. Little is known of the prey but small snakes and lizards are probably included.

Range

This snake inhabits evergreen forests up to 1300 m throughout Thailand.

Extraterritorial

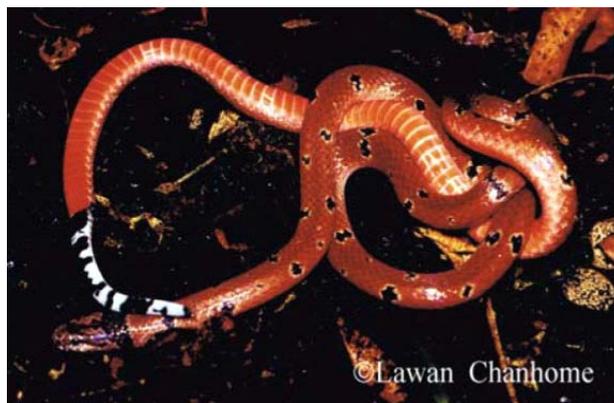
This snake is found in Cambodia, West Malaysia, Myanmar, and Vietnam.

**V. Genus *Sinomicrurus***

This new genus was recently described primarily as the result of DNA research and a better understanding of internal characteristics [14].



**Figure 9.** Brown Long-glanded Coral Snake



**Figure 10.** Small-spotted Coral Snake

***Sinomicrurus maclellandi maclellandi* (MacClelland's Coral Snake)**

Identification

Males attain lengths of roughly 650 mm; females average 800 mm. in total length. The dorsal body surface is reddish brown with 23 to 40 narrow, dark, light edged crossbands. The rounded, short head is barely distinct from the neck and cylindrical body. The head is dark anterior to the eyes followed by a white band posterior to eyes and then a dark band. The ventral surface is whitish to yellow with black markings. The tail is short and blunt. It is terrestrial, crepuscular, and nocturnal. This is an oviparous species with clutches of 4 to 14 eggs reported. It preys primarily on other snakes.

Range

This snake is found in forests, usually under litter, between 215 to 2483 m in China. In Thailand, its range includes Chachoengsao, Chiang Mai, Loei, Nakhon Ratchasima, Phetchaburi, and Tak.

Extraterritorial

This snake is found in Bangladesh, China, India, Laos, Myanmar, and Vietnam.

**VI. Genus *Laticauda***

Members of this genus spend most of their time searching for food in marine waters but they breed and deposit their eggs on land; thus, they are not aquatic. They are oviparous whereas true sea snakes in Subfamily Hydrophinae are livebearers. In addition, members of genus *Laticauda* have well developed ventral scales, giving them mobility on land. Large nostrils are lateral on the head. The cylindrical bodies are followed by vertically flattened tails. Snakes living in a salt-water environment have evolved salt glands

located beneath the tongue, so called “sublingual glands”. In order to maintain a low blood salt level, the salt gland secretes the concentrated electrolytes into a tongue sheath that is expelled by the extension of the tongue [15, 16]. The maxillary bone has anterior, short, fixed fangs followed by one or two solid teeth.

### ***Laticauda colubrina* (Yellow-lipped Sea Snake)**

#### Identification

The maximum adult length is 1525 mm. Adult males average 875 mm in length and adult females average 1420 mm. The head is barely distinct from the neck and the only slightly compressed body. The eyes are small and the pupils round. The dorsal body is grayish blue with dark crossbands that may or may not encircle body. The ventral surface is yellowish between any encircling crossbands that may be present. The head is mostly black with a yellow band extending from eye to eye through the prefrontals. The upper lip scales are yellow. Both the chin and throat are black, the black color extending back to merge with the first crossband. This snake is nocturnal and oviparous with clutches of 7 to 10 eggs laid on land. Prey includes eels, including the carnivorous Moray Eel.

#### Range

This snake is found in marine water, land rocky coasts, and islands. It distributes in Krabi, Phang-nga, and Phuket on the Andaman Sea Coast.

#### Extraterritorial

This snake is found in Australia, China, El Salvador, India, Indonesia, Japan, East and West Malaysia, Myanmar, Mexico, New Zealand, Nicaragua, Philippines, West Pacific Ocean to Fiji, New Caledonia, Singapore, Solomon Islands, and Sri Lanka.

### ***Laticauda laticaudata* (Black-banded Sea Snake; Figure 11)**

#### Identification

Males average 910 mm and females average 1070 mm in total length. The head is barely distinct from the neck and sub cylindrical body, which is of nearly uniform diameter throughout. The dorsal body surface is light or dark bluish gray with black crossbands of uniform width complete or incomplete ventrally and encircling body. The head is black with a curved yellow mark and may extend to the snout and down behind eye. The lips are dark brown; the ventral surface is yellow with alternating black bands. Tails are vertically flattened. It is oviparous. Clutches

of seven eggs were reported. It preys on fish, including eels.

#### Range

This species is semi aquatic and often found on rocky coastal islands. The only Thai record is along the coast of Krabi on the Andaman Sea.

#### Extraterritorial

This snake is found in Australia, China, Fiji Islands, India, Indonesia, Japan, East and West Malaysia, Melanesia, Myanmar, New Caledonia, Papua New Guinea, Philippines, Polynesia, Solomon Islands, and Sri Lanka.

### **Subfamily Hydrophiinae**

Members of this subfamily live in the marine waters of some of the world’s oceans, seas, and gulfs. Life in a marine environment has been facilitated by several evolutionary changes and adaptations that distinguish them from terrestrial snakes. Each is ovoviviparous, has a vertically flattened tail to facilitate locomotion, and has degenerated ventral shields because they are useless for locomotion in an aquatic environment. Their valved nostrils are closed when diving to keep the salt water from entering their bodies. Excessive salt intake is expelled by a salt gland. Their skins are extraordinarily resistant to the passage of water from their bodies and salt into their bodies. Oxygen can pass through their skins and cutaneous respiration is an important mode of oxygen intake for hydrophiine sea snakes [17]. Although they must surface in order to breathe, they require less oxygen than terrestrial species and can remain submerged for long periods.

### ***Enhydrina schistosa* (Common or Beaked Sea Snake; Figure 12)**

This snake is reported to have the most potent venom of any of the sea snakes and to bite readily. Fatalities have been reported.

#### Identification

Adults have an average total length of 1400 mm, with the maximum recorded to 1580 mm. The young are 150 to 280 mm at birth. The head is not or is barely distinct from neck and body. The maxillary bone has two anterior fixed fangs followed by three or four solid teeth. The body is elongated, stout, and strongly compressed posteriorly. The ventral scales are distinct throughout, but not much wider than adjacent body scales. The head is brownish black; the body is gray black with a series of 40 to 55 black bands two to six

scales wide that encircle the body. The young are dark gray dorsally but whitish below. With age, this pattern changes to a uniform dark gray. Females collected from Songkhla Lake in December to January were found to be gravid. This snake is a livebearer with litters of 4 to 33 young. It preys on eels, catfish, and other fish.

#### Range

Live primarily in estuaries and coastal waters but recorded well up the Mekong River and in the Grand Lake of Cambodia. In Thailand, they are distributed along both coasts of peninsular Thailand.

#### Extraterritorial

This snake is found in Australia, Bangladesh, Cambodia, India, Indonesia, Madagascar, East and West Malaysia, Myanmar, Oman, Pakistan, Philippines, Seychelles, Sri Lanka, United Arab Emirates, and Vietnam.

### ***Hydrophis brookii* (Brooke's Sea Snake; Figure 13)**

#### Identification

Adult males can be up to 1035 mm, whereas females have only been recorded at 965 mm of the total length. Neonates are 330 to 340 mm. The head is small and indistinct from the neck. The head is blackish or grayish with a curved yellow mark across the snout and extending back along the sides of the head. Sometimes there is a connecting band of yellow across the frontal and parietals. The body is very long and very slender anteriorly but compressed posteriorly, its greatest diameter is 2.5 to 3 times that of the neck. The dorsal body surface is grayish with 60 to 80 dark gray broad bands encircling the body anteriorly but narrowing on the sides and perhaps incomplete posteriorly. The pattern and markings often fade with age. The ventral scales are not twice the size of adjacent body scales but still distinct throughout. *Hydrophis brookii* collected from Songkhla Lake in February to March contained some gravid females. Copulation was once observed in wild caught, captive specimens in October at the QSMI Snake Farm. Two males performed a pre breeding activity in front of a female similar to the combat dances observed in terrestrial elapid snakes. She ultimately bred with both males but at different times (unpublished data). This snake is a livebearer with 5 to 7 embryos reported. It preys on bottom, rock, and reef dwelling prey.

#### Range

Live in the shallow coastal waters of Chon Buri,

Pattani, Samut Sakhon, Songkhla in Gulf of Thailand and Trang on the Andaman Sea.

#### Extraterritorial

This snake is found in Indonesia, East and West Malaysia, and Vietnam.

### ***Hydrophis obscurus* (Russel's Sea Snake; Figure 14)**

#### Identification

The total length of males has been measured at 1190 mm whereas females grow to a length of 1200 mm. The head is small and not distinct from the neck. The body is long and slender anteriorly, but compressed posteriorly. The head is brown with yellow spots on the nasals and prefrontals. Young specimens are black to bluish black with 35 to 68 yellow or whitish bars, which may encircle the body posteriorly. The tail has 8 to 10 yellow bands and nine brown bands. The dorsal surface of the head has a curved yellow mark, its apex at the snout and the remainder extending posteriorly to the parietals. The ventral scales are not twice as wide as the adjacent body scales but they remain distinct throughout. The color and pattern fade with age. Litters of 5 to 10 are reported.

#### Range

Often found in brackish mouths of rivers but also found along coastal waters. This species was recently discovered in Thai waters in Ranong on the Andaman Sea.

#### Extraterritorial

This snake is found in Bangladesh, India, Myanmar, and Sri Lanka.

### ***Lapemis curtus* (Curtus' Sea Snake; Figure 15)**

#### Identification

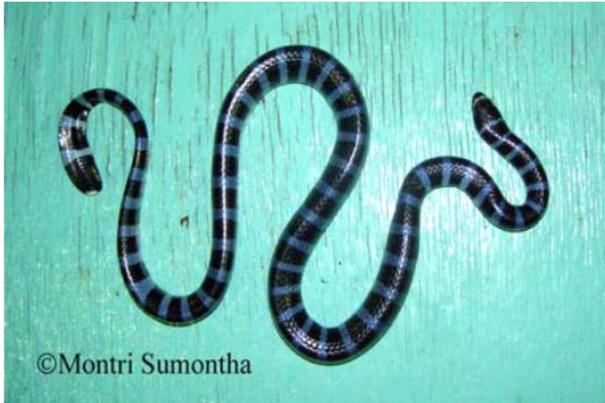
Adults reach total lengths of 860 mm. Neonates are 250 to 355 mm. The body is short and stout, the diameter of the neck being half or more than half of the greatest diameter of the body. They have greenish or yellowish dorsally with 35 to 50 pale olive to pale gray bars that taper to points on the sides. These bars may continue to encircle body and they may unite along the vertebral area. A narrow ventral stripe or a broad irregular band may be present. The head is pale olive to black, with or without yellow markings across the snout and along the sides. The ventral scales are small and usually distinct anteriorly but may be very small or absent posteriorly. This snake is a livebearer with litters of 3 to 6. It preys on pelagic fish as well as eels.

Range

Lives in coastal waters and estuaries, but also recorded up rivers. It is common in the Gulf of Thailand and the Andaman Sea.

Extraterritorial

This snake is found in Australia, Bangladesh, China, India, Indonesia, West Malaysia, Myanmar, New Caledonia, Papua New Guinea, Philippines, Singapore, Sri Lanka, and Vietnam.



**Figure 11.** Black-banded Sea Snake



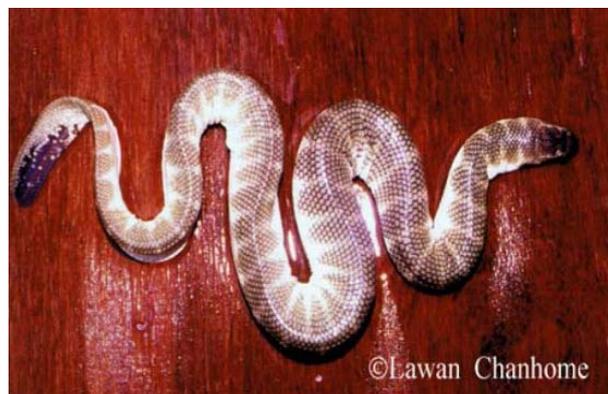
**Figure 12.** Common or Beaked Sea Snake



**Figure 13.** Brooke's Sea Snake



**Figure 14.** Russel's Sea Snake



**Figure 15.** Curtus' Sea Snake

## FAMILY VIPERIDAE

Members of this family differ from members of family Elapidae in having venom-conducting fangs that are not fixed. When the mouth is opened these fangs rotate forward and make an angle of approximately 90 degrees with the roof of the mouth. When the mouth is closed, they fold backward and lie flat against the roof of the mouth. Some members have heat sensitive glands that enable them to find prey.

### Subfamily Viperinae

Members of this subfamily are referred to as true vipers. They lack heat sensitive pits. Only one member of this subfamily is found in Thailand.

#### *Daboia russelii siamensis* (Siamese Russell's Viper; Figure 16)

This snake hisses loudly and is quick to strike when threatened. Its venom is potent. It is a leading source of snakebites in Myanmar. Captives have been successfully maintained on a diet of mice. This subspecies rivals *Python reticulatus* in its ability to swallow large prey. They wait to ambush until prey wanders close and then strike.

#### Identification

Males have been recorded at 1270 mm in length. The head is covered with small, keeled scales and distinct from the neck and stout, cylindrical body. Loreal pits are absent. The nostrils are very large. The dorsal body surface is light brown with three longitudinal rows of spots of varying size that are dark brown with black edges. The dorsal head surface has three dark brown markings separated by lighter lines. The ventral surface is light mottled with small brown dots. The maxillary bone has two hinged anterior fangs followed by 9 to 11 solid teeth. This species is nocturnal, terrestrial, and a livebearer with litters of 20 to 63. Neonates weigh 7.2 to 14.4 gm and are 240 to 300 mm in length [7]. It preys primarily on mammals, toads, and frogs, which it waits for in ambush.

#### Range

Its range is discontinuous and it is found in a variety of habitats up to 2100 m. Records exist for the presence of Russell's Viper in Central Thailand. It has been reported in Nakhon Ratchasima, but its presence in Chumphon and Prachuap Khiri Kan Provinces lack confirmation.

#### Extraterritorial

This snake is found in Cambodia, China, and Myanmar.

### Subfamily Crotalinae

Venomous snakes characterized by a distinct sensory pit located between the eyes and nostrils. Both semi arboreal and terrestrial members of this subfamily are found in Thailand.

#### *Calloselasma rhodostoma* (Malayan Pit Viper; Figure 17)

This venomous snake possesses hemotoxic venom that also results in tissue damage and blistering. LD<sub>50</sub> of its venom is 5.04 µg/gram of mouse body weight [6]. A female was observed developing a nest in Nakhon Ratchasima Province. She laid a clutch of eggs and remained entwined around the clutch for 56 consecutive days from August thru October [18].

#### Identification

Total lengths are 590 to 960 mm. Males may have 750 mm and the generally larger females may be to 1000 mm in total length. The head is distinct from the neck and moderately stout body. The snout is pointed and slightly upturned. The body is gray, reddish, or light brown with dark brown saddles with light edges extending across the vertebral ridge. The dorsolateral sides are lighter in color. Large shields cover the dorsal surface of the head. The top of the head is dark and the upper lip scales are whitish. A dark area extends posteriorly from the eyes to the base of the jaws between the lighter upper lip scales and a light line extends posteriorly from the eyes. The ventral surface is grayish white mottled with small areas of light brown. The tail is short. Juveniles have light tails used to lure prey within striking distance. This snake is nocturnal and terrestrial. In Thailand, breeding is in March to May. At the QSMI Snake Farm, it was noted that gravidity followed after 69, 75, and 78 days from captive copulation. Clutches of 10 to 30 eggs were laid in May to September, and hatched in June to October, after incubation periods of 32 to 45 days. Eggs were 17.0 to 22.5 mm in width, 23 to 32 mm in length, and weighed 6.2 to 7.8 gm. Hatchlings weighed 2.2 to 6.6 gm and were 135 to 185 mm in length [7]. This species is an ambush predator. Preys include small mammals, frogs, geckoes, and probably any other small animal that comes within striking distance.

#### Range

It is a lowland species inhabiting wooded areas, especially near the sea. Often found in dry or relatively dry habitats and at the elevations of up to 1981 m in Vietnam. This snake is found throughout Thailand.

Extraterritorial

This snake is found in Cambodia, Indonesia, Laos, West Malaysia, Singapore, and Vietnam.

***Trimeresurus (Cryptelytrops) albolabris albolabris* (White-lipped Pit Viper; Figure 18)**

Extreme taxonomic confusion surrounds this subspecies. Consequently, locality records for Malaysia, Kalimantan, Bangladesh, and Nepal have been questioned. This snake is quick to strike in defense, but few fatalities result. LD<sub>50</sub> of its venom is 0.50 µg/gram of mouse body weight [19].

Identification

Adults average 600 to 940 mm with the maximum of 1000 mm in total length; females are larger than males. Neonates are 120 to 240 mm. The triangular head is, distinct from the neck and stout body. The body and head are predominantly green to yellowish-green. The sides of the head below the eyes are yellow, white, or pale green and the lips are very light. The dorsal surface of the tail is reddish brown. The ventral surface of the body and tail are yellowish. Males have a white line along edges of the ventral scales and the first dorsal scale row. This line is absent or indistinct in females.

This snake is nocturnal and arboreal but often found foraging for food on the ground at dusk. Prey includes small mammals, birds, frogs, and lizards. In Thailand, breeding is in September to November, with litters of 3 to 30 born in February to May. Gravidity is 157 and 160 days from captive copulations observed at the QSMI Snake Farm. Neonates weighed 3.6 to 5.2 gm and were 200 to 230 mm in total length [7]. Prey includes small mammals, toads, frogs, birds, probably lizards.

Range

Found in urban areas as well as forested areas up to 1600 m, this snake spends day light hours in low bushes, trees, or bamboo thickets. Its range includes all of Thailand.

Extraterritorial

This snake is found in Bangladesh, Cambodia, China, India, Indonesia, Laos, Myanmar, and Vietnam.

***Trimeresurus (Cryptelytrops) kanburiensis* (Kanburi Pitviper; Figure 19)**Identification

The maximum total length of this species is 667 mm. The head is flat, triangular, and distinct from the neck. The dorsal body surface is grayish-brown in

females and olive or grayish-brown with vertebral white dots in males. There are light brown or dark olive-brown crossbands one to two scales wide extending down the sides. Isolated dorsal scales of the same color extend along the first two dorsal scale rows, sometimes separated by olive, grayish brown or white scales. The dorsal head surface is brown, the darker brown marblings on the sides of the head are paler, and there are slight postocular streaks. The lower lips, chin, and throat are whitish-brown; the ventral surface is creamish. The body is slender but that of females is somewhat thicker. This snake is nocturnal and arboreal, with litters of about 12. Captive specimens have eaten lizards, frog, and pinky mice.

Range

Found in deciduous and evergreen forests up to 1000 m. It is an endemic species found only in Kanchanaburi.

Extraterritorial

This snake is only found in Thailand.

***Trimeresurus (Cryptelytrops) macrops* (Big-eyed Pit Viper; Figure 20)**

This species is often confused with *Trimeresurus (Popeia) popeiorum popeiorum*. Captives have been maintained on mice and *Hemidactylus* sp. LD<sub>50</sub> of its venom is 0.70 µg/gram of mouse body weight [19].

Identification

Adults are 520 to 660 mm in total length and females are larger than males. The triangular head is distinct from the neck and slender, cylindrical body. The scales behind the eyes are strongly keeled. The dorsal surface of the head and body are green to bluish-green. The lips, chin, and throat are light bluish green. The ventral scales are bluish but bluish green on the lateral margins. The tail is reddish brown but the subcaudals are slightly bluish. The big eyes are golden yellow. Young specimens may have a white postocular stripe, present on males, infrequent on females. This species is arboreal and nocturnal, but often found on ground foraging for food at night. In Thailand, breeding occurs September to November with litters of 5 to 14 born in February to May. Gravidity was 158 days from captive copulations observed at the QSMI Snake Farm [7]. It preys on small rodents, birds, tree frogs, and lizards.

Range

Found below 500 m including areas of human habitation. It has been recorded in Central and Northeast Thailand.

Extraterritorial

This snake is found in Cambodia, Laos, and Vietnam.

***Trimeresurus (Cryptelytrops) purpureomaculatus* (Shore Pit Viper, Mangrove Pit Viper; Figure 21)**

This venomous snake is very quick to strike. LD<sub>50</sub> of its venom is 0.40 µg / gram of mouse body weight [19].

Identification

Adults range from 680 to 1070 mm, with the maximum record of 1000 mm in total length. The head is triangular and distinct from the neck and relatively stout body. The dorsal surface is purplish-brown with variable crossbands, sometimes with green variegations. The dorsolateral surface is greenish with darker blotches, sometimes the dark edges of the

ventral scales and first dorsal scale rows form a thin line along the body. The head is blackish-brown but the chin and throat are speckled with dark markings. The ventral surface is uniform olive or greenish-white or speckled. Nocturnal and arboreal but frequently forages for prey on the ground. In Thailand, breeding occurs in September to November with litters of 7 to 15 born from February to May. The neonates weight 4.0 to 10.0 gm and are 190 to 270 mm in length [7]. Prey consists of small mammals, birds, lizards, and probably frogs.

Range

Found off the shores of islands and coastal areas in mangrove environments in southern Thailand.

Extraterritorial

This snake is found in Indonesia, West Malaysia, Myanmar, and Singapore.



Figure 16. Siamese Russell's Viper



Figure 17. Malayan Pitviper



Figure 18. White-lipped Pitviper



Figure 19. Kanburi Pitviper



Figure 20. Big-eyed Pitviper

***Trimeresurus (Cryptelytrops) venustus* (Beautiful Pitviper; Figure 22)**

This snake was formerly confused with *Trimeresurus (Cryptelytrops) kanburiensis*. LD<sub>50</sub> of its venom is 3.0 µg/gram of mouse body weight [19].

Identification

Adults range from 350 to 700 mm in length and females are larger than males. The head is triangular and distinct from the neck and elongated body. The dorsal surface is dark green with irregular zigzag shaped rusty brown or purplish markings. The tail is progressively brown with green dots. The dorsal surface and sides of the head are green with some irregular blotches. The lower lips, chin, and throat are greenish white. The ventral surface is pale green. The tail is reddish-brown. It is arboreal and probably nocturnal, with 5 to 16 neonates per litter. Neonates weigh 1.6 to 2.8 gm and are approximately 190 to 196 mm in length [7]. Captive specimens have eaten geckos. The species is reported to include small rodents, frogs, and lizards in its diet.

Range

Found in the evergreen forests of southern Thailand.

Extraterritorial

This snake is found in West Malaysia.

***Trimeresurus (Parias) hageni* (Hagen's Pitviper; Figure 23)**

LD<sub>50</sub> of the venom of this snake is 0.50 µg/gram of mouse body weight [19].

Identification

The maximum adult length is 1100 mm; hatchlings are about 240 mm. The head is triangular and distinct



Figure 21. Shore Pit Viper, Mangrove Pitviper

from the neck and cylindrical, moderately slender body. The green head scales do not have black edges but there is a pink postocular stripe. The eyes are green. The body is predominantly green, usually with a row of pink to white spots along the dorsolateral scales. The subcaudals are without thick black edges. This species is reported to be arboreal, with clutches of 13 to 17 eggs.

Range

Found in evergreen forests up to 600 m in the southern provinces of Thailand.

Extraterritorial

This snake is found in Indonesia, West Malaysia, and Singapore.

***Trimeresurus (Popeia) popeiorum* (Pope's Bamboo Pitviper; Figure 24)**

Identification

Adults average 500 to 700 mm in total length with the maximum confirmed total length of 975 mm. Males may be up to 821 mm and females grow up to 677 mm in total length. Neonates are 120 to 200 mm at birth. The head is short, rounded, triangular, and distinct from the neck and cylindrical body. The eyes are large red and the vertical pupils yellow. The dorsal surface of the head and body are predominantly green. The ventrals and labials are pale green. Males have a red above white postocular stripe that continue along the first body scale row and ventral scales. There are no such stripes on females. The tail is reddish brown. It is nocturnal and arboreal, but found foraging on the ground. A livebearer with litters of 2 to 12 recorded. This snake preys on small mammals, frogs, and lizards.

Range

This northern species is found in evergreen forests

from 790 to 1500 m in the provinces of Chiang Mai, Chiang Rai, Phetchaburi, Lampang, and Uthai Thani.

Extraterritorial

This snake is found in India, Laos, West Malaysia, Myanmar, Vietnam, and Singapore. Locality records for northeast Bangladesh, Cambodia, Nepal, and Vietnam are under review.

***Trimeresurus (Viridovipera) gumprechtii* (Gumprecht's Green Pitviper)**

The past records for *Trimeresurus stejnegeri* in Thailand were those of *Trimeresurus (Viridovipera) gumprechtii*.

Identification

The maximum total length is approximately 850 mm in males and approximately 1200 mm in females. The head is triangular and distinct from the neck. The body is moderately elongated and cylindrical and the tail is rather long and prehensile. Males are bright green in overall coloration with red eyes and a postocular stripe that is white below but thicker and red above. There also is a ventrolateral stripe that is red below and white above and a series of white dots along the vertebral ridge. The tail is mostly rusty brown or reddish and the ventral surface is yellow to yellowish green. Females are dark green in overall coloration with yellow eyes. Crossbars and white vertebral dots are absent. A faint white postocular stripe may be present or absent. There is a thin white or blue ventrolateral stripe. The tail is mostly rusty brown or reddish and the ventral surface is yellow to yellowish green. The interstitial skin is black in both males and females. This snake is nocturnal and arboreal but also found foraging for prey on the ground. Prey includes small mammals and skinks. It produces living young.

Range

A forest snake usually found from 350 to 1350 m in thick bush, including bamboo thickets, near streams. Its range includes northern, northeastern, and eastern Thailand.

Extraterritorial

This snake is found in China, Laos, Myanmar, and Vietnam.

***Trimeresurus (Viridovipera) vogeli* (Vogel's Green Pitviper; Figure 25)**

Identification

The maximum total length is 1570 mm in males, and 1116 mm in females. The head is triangular and

distinct from the neck and cylindrical body. The dorsal body surface is predominantly green with numerous white vertebral dots. There is a white, red-edged ventrolateral stripe on males but it is only white in females. The ventral surface is a lighter shade of green. The head is green and there is a thin, faint white postocular stripe in males, but none in females. The prehensile tail is reddish brown. Prey includes frogs, small mammals, and lizards, which it captures from ambush. This snake is arboreal, often found in low bushes during day but forages for food on the ground during the day. It is a livebearer.

Range

Found in evergreen forests from 200 to 1200 m. This snake has been found in Chanthaburi, Nakhon Ratchasima, Prachin Buri, and Trat.

Extraterritorial

This snake is found in Cambodia, Laos, and Vietnam.

***Trimeresurus fucatus* (Siamese Peninsular Pitviper; Figure 26)**

This is a new species whose natural history and toxicity is not well known. A wild caught male juvenile remained healthy in captivity for eight years and 27 days at the snake farm of the Thai Red Cross Society.

Identification

The maximum recorded female length 868 mm and that of males is 834 mm. The head is distinct from the neck and the laterally compressed body. Both males and females are green with dark bands on the body; usually white vertebral dots are present, and the eyes are a shade of yellow. Males usually have a thin, irregular postocular streak, either entirely white or white below with an irregular, dark red or rusty brown streak above. This streak is absent in females but some white spots may be present. Males have a vivid bicolor ventrolateral stripe that is bright and deep orange or gold below and white above. Females have a thin, well-defined white stripe. The body has distinct dark crossbars and white vertebral dots. The tail is entirely rusty brown or reddish-brown or mottled. This new species is an arboreal and livebearer that preys on lizards and small rodents.

Range

Found in evergreen forests at 1100 m in southern Thailand.

Extraterritorial

This snake is found in Myanmar and West Malaysia.

***Trimeresurus wiroti* (Thai Palm Viper; Figure 27)**

A shy snake seemingly reluctant to bite. Nonetheless, it is venomous and should be considered dangerous.

**Identification**

Males grow up to 655 mm whereas females may only reach 410 mm in total length. The flat and triangular head is covered with small scales and the snout is upturned and spatula-shaped. The body is short and stout. The dorsal surface of the body is mottled brown, olive-brown, dark grayish-brown, or dark yellowish-gray, with 22 to 35 large dorsolateral

blotches with small gray or brown dots between them. The dorsal head surface is dark but the chin and throat are paler with black dots and pale brown markings. The ventral surface is darker than the dorsal. The prehensile tail is mostly reddish-brown. This snake is nocturnal and arboreal, with clutches of 7 to 14 eggs. Prey includes frogs, lizards, and small mammals.

**Range**

This snake inhabits forests at the elevations of 500 to 1196 m in southern Thailand.

**Extraterritorial**

This snake is found in West Malaysia.



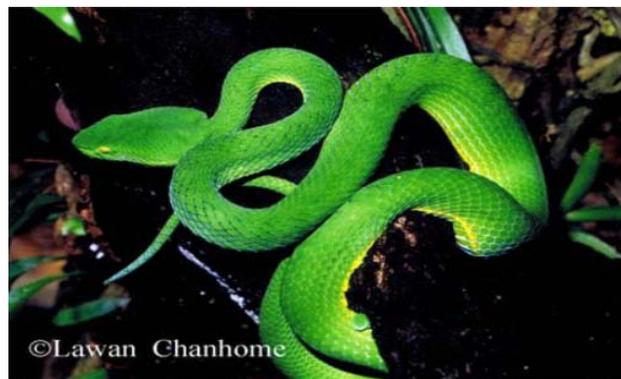
**Figure 22.** Beautiful Pitviper



**Figure 23.** Hagen's Pitviper



**Figure 24.** Pope's Bamboo Pitviper



**Figure 25.** Vogel's Green Pitviper



**Figure 26.** Siamese Peninsular Pitviper



**Figure 27.** Thai Palm Viper

***Tropidolaemus wagleri* (Wagler's Pitviper, Temple Viper; Figure 28)**

This venomous snake is docile but sluggish and slow to strike. A captive born specimen was kept for 20 months on a diet of *Hemidactylus* sp. and young mice.

Identification

The maximum total length is 522 mm in males and 920 mm in females. Although there are reports of unsexed specimens reaching a record length of 1300 mm, the average length is much smaller. Neonates are 200 to 250 mm. The heads of both males and females are triangular and distinct from the neck. The scales behind the eyes are heavily keeled. The bodies are compressed, slender in males, and stout in females. Adult males have a background color of green, a pattern of white spots, a white and red postocular stripe, and a uniform ventral surface. Adult females have a background color of black, a pattern of yellow crossbands encircling the body, and a black postocular stripe. Juvenile males have a background color of green, a pattern of white spots, a white and red postocular stripe, and a uniform ventral surface. Juvenile females have a background color of green, a pattern of white crossbands, a white and red postocular stripe, and a uniform ventral surface. The tail is prehensile. It is nocturnal and arboreal, rarely descends to the ground. This species is a livebearer with litters of 11 to 18. Prey includes small mammals, lizards, birds, and frogs.

Range

Found in lowland forests and mangrove areas up to 1300 m in the South.



**Figure 28.** Wagler's Pitviper, Temple Viper

Extraterritorial

This snake is found in Indonesia, East and West Malaysia, Singapore, and Vietnam.

***Ovophis monticola convictus* (Mountain Pit Viper; Figure 29)**

Bites by this snake are rare and painful but there are no known fatalities. Females are reported to guard their eggs. A male captured as an adult had a longevity of three years and 11 months.

Identification

The maximum length of this subspecies is 1150 mm. Hatchlings are 152 to 193 mm. The triangular head is distinct from the neck and stout body. The head is covered with small, smooth scales. The body scales are smooth. The body is predominantly dark brown with irregular short, black-edged crossbars or blotches along the vertebral ridge and smaller irregular dark blotches on the sides of the body and along the edges of the dorsal scales and ventrals. The ventral surface is light with a dusting of brown. The dorsal head surface is brown with a light line extending from the snout posteriorly above eyes to the base of the jaws. This subspecies is terrestrial and nocturnal, with clutches five to 18 eggs. It preys primarily upon small mammals.

Range

This snake is most often found under forest litter of highland forests from 610 to 1750 m in North, West, and South Thailand.

Extraterritorial

This snake is found in Cambodia, Indonesia, West Malaysia, and Vietnam.



**Figure 29.** Mountain Pitviper

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