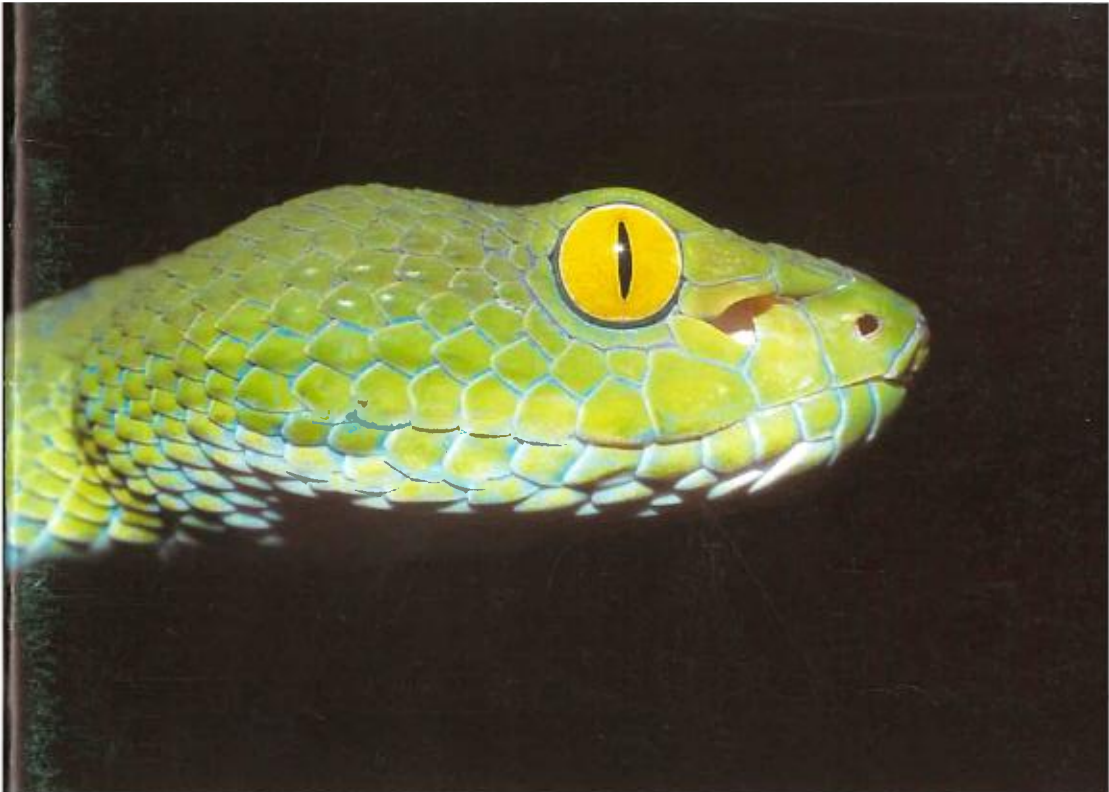


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COBRAS AND OTHER HERPS IN SOUTH-EAST ASIA WOLFGANG WÜSTER

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Outline of a talk of the same title given to the BHS on February 14th 1991.

South-east Asia has one of the world's most diverse herpetofaunas, but has received little attention from herpetologists, so that it is herpetologically less well known than almost any other part of the world. New taxa are still being described regularly, including venomous or large, conspicuous species, a recent example being a 2 metre long, brightly coloured species of *Boiga* (*B. saengsomi*) from the forests of southern Thailand. Many further, less conspicuous, taxa almost certainly still remain to be discovered. In view of the pace of environmental degradation, it is likely that many will become extinct without ever becoming known to science. Research into herpetofaunal diversity in this part of the world should therefore be a priority.

South-east Asia has a high rate of snakebite morbidity and mortality. The systematics of many groups of venomous snakes in this region are very poorly understood, which has hindered the development of effective treatment for snakebites. For the last five years, the work of our research group in Aberdeen has concentrated on the elucidation of the population systematics of some of the problematical groups, with the aim of providing taxonomic information which will allow the production of better, more specific, antivenoms for the treatment of snakebite victims in all parts of southern Asia.

Most of the fieldwork has been concentrated in agricultural areas, especially rice fields, where most of the medically important species occur. Despite the much lower species diversity in such habitats, compared with rainforests, a good selection of species can be seen in these man-made habitats, and their accessibility is better, so that they are super places for "herping". The following paragraphs will give a brief outline of some of the commonly seen herp species in such habitats.

In flooded rice fields, frogs are the most prominent herps to be seen, especially at night, when the choruses can be deafening. Common species include *Ooeidozyga lima*, *Rana limnocharis*, and *R. erythraea*, probably the most beautiful of the common frogs in the area. *Rana tigrina* is heavily predated by the local human population, and therefore less common. Other common anurans are found in villages, plantations and forests. The commonest of all is undoubtedly *Bufo melanostictus*, which is very similar to our *Bufo bufo*. *Kaloula pulchra* is a common microhylid in bushy or wooded areas and plantations, and all such areas have a complement of tree frogs, *Rhacophorus leucomystax* being the commonest.

No visitor to south-east Asia can fail to notice the commonest reptiles, the various house geckos, especially *Hemidactylus frenatus* and *Gehyra mutilata*, which seem to live on every single building in the region, often in large numbers. Their chattering calls in the evening, which have earned them the local names "chik-chak" in Malaysia and "jing-jok" in Thailand, are a reliable reminder that dinner-time for herpetologists is near. Another well known visitor to houses, with a call that inspired the name of the entire lizard family Gekkonidae, is the Tokay (*Gekko gecko*). Since this species is generally hated and killed on sight, it is usually confined to outbuildings; it is also commonly found on trees growing on the dikes of rice fields, and on roads at night.

Other common lizards include the skink *Mabuya multifasciata*, and various species of *Calotes*. In some areas, especially Penang, *Varanus salvator* is common. Their tracks may be seen in the sand on Penang's less frequented beaches, and sometimes large specimens are seen walking along village streets in broad daylight. They also frequent mangroves, where they dive into the sea when disturbed. In forested areas and parks, flying lizards (*Draco sp.*) are common, especially on large, smooth-barked trees, without much undergrowth between them. Their flight mechanism is a very effective anti-herpetologist strategy.

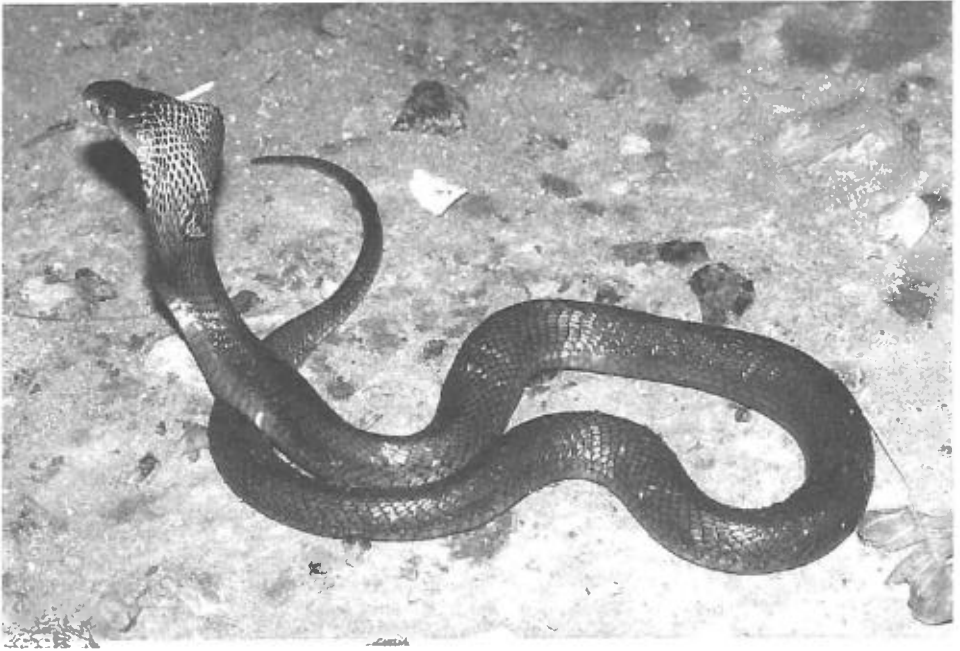


Fig. 1. Monocellate cobra, *Naja kaouthia*, from Lop Buri Province, central Thailand. This is the common cobra of wet lowlands in central and southern Thailand.



Fig. 2. *Naja cf. atra*, Indochinese spitting cobra. Black and white colour variety, from Amphoe Ta Khli, Nakhon Sawan Province, central Thailand. Despite very obvious differences in colour pattern, behaviour, and size, this species has until now been generally confused with *N. kaouthia*.

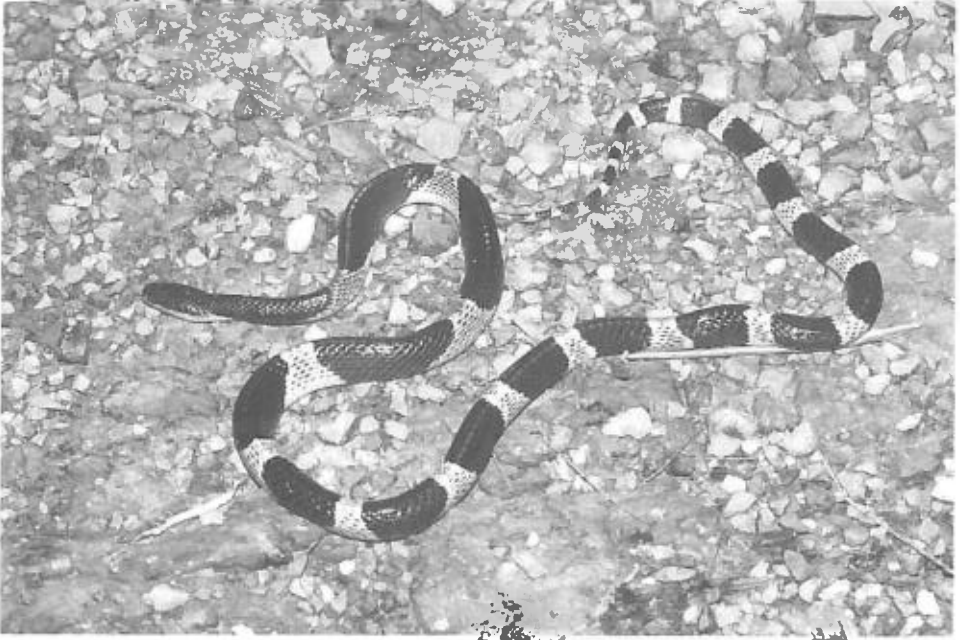


Fig. 3. Malayan krait, *Bungarus candidus*, from Nam Nao National Park, Phetchabun Province, north-eastern Thailand. This species is one of the main causes of snakebite death in Thailand, yet no antivenom is available to treat its bites.

Commonly seen harmless snakes include various colubrids, such as Bronzebacks (*Dendrelaphis pictus*) and Vine Snakes (*Ahaetulla nasuta*), usually found in bushes, various water snakes *Enhydryis* sp.), and Striped Keelbacks *Amphiesma stolata*). Some representatives of other snake families are also common, such as the Sunbeam Snake (*Xenopeltis unicolor*), referred to as the "gasoline snake" in NE. Thailand, because of the iridescence of its skin, and the Pipe Snake (*Cylindrophis rufus*).

Thailand and Malaysia have few large, good-natured, non-venomous snake species – most snakes capable of giving a good bite will do so with little provocation. Enthusiastic and commonly seen purveyors of scar tissue include the Indochinese Rat Snake (*Ptyas korros*), which is often found sleeping in trees at night, and the Copperhead Racer (*Elaphe radiata*), which has the particularly startling habit of striking high at the face of any perceived adversary, until exhausted, when it will save energy by playing dead. The main natricine bruiser is the ubiquitous Checkered Keelback (*Xenochrophis flavipunctata*).

In terms of physical injury inflicted, the Kukri Snakes (*Oligodon*) are in a class of their own. Legend has it that these are small, inoffensive snakes, which are reluctant to bite. This is certainly not the case in the two most common Thai species, *O. cyclurus* and *O. taeniatus*, which are all too eager to sink their teeth into anything alive. A 20 cm specimen of *O. taeniatus* drew appreciable amounts of blood, and "large" (= 60 cm) *Oligodon cyclurus* can produce slash-wounds which bleed for hours, and leave permanent scars. These wounds are inflicted with the posterior maxillary teeth, which are large, flattened and blade-like. The maxillae of these snakes are extraordinarily mobile, and the teeth can slash any finger attempting to hold the snake by the neck in the usual manner, rather like the African Mole "vipers", genus *Atractaspis*.

Of the 25 or 26 species of front-fanged, venomous, land snakes found in Thailand and Malaysia, fewer than 10 cause widespread medical problems. Due to good medical care, the case fatality rate in these countries is relatively low. Nevertheless, many people do die from snakebite, and many more suffer severe bites, often resulting in permanent disability due to tissue damage.



Fig. 4. Banded krait, *Bungarus fasciatus*, from near Mae Ramat, Tak Province, western Thailand. Although not uncommon in many areas, this snake is very seldom involved in snakebite accidents. Yet, the only Thai *Bungarus* antivenom covers this species, rather than the much more dangerous *B. candidus*.



Fig. 5. White-lipped pit viper, *Trimeresurus albolabris*, from Amphoe Bueng Bun, Sisaket Province, north-eastern Thailand.

One of the taxonomically confusing groups of venomous snakes is that of the Green Pit Vipers (genus *Trimeresurus*). These are the most common venomous snakes in Thailand, and occur even in the centre of Bangkok. The various species look very much alike, but their distributions and medical importance differ greatly. The three most common Thai species are *Trimeresurus albolabris*, *T. popeorum* and *T. macrops*. These have been frequently confused in the literature. Thus, *T. macrops*, a species which, though common even within Bangkok, was only described in 1977, is referred to as *T. popeorum* in much of the literature, whereas the true *T. popeorum* is often mis-labelled *T. erythrus*, a species not hitherto recorded from Thailand. *Trimeresurus popeorum* is a hill form, and is rarely involved in snakebite accidents. The most serious, though usually non-fatal, *Trimeresurus* bites in Thailand are inflicted by *T. albolabris*, whereas *T. macrops* seems to cause mostly trivial bites. However, the Thai green pit viper antivenom uses the venoms of both species, thus reducing its effectiveness against the more dangerous *T. albolabris*. Due to the confusion in the nomenclature of these forms, it is very difficult to interpret past medical or venom-related literature on these vipers.

Another pit viper causing many bites is the Malayan Pit Viper, *Calloselasma rhodostoma*. This snake is particularly common in rubber plantations. Due to its excellent camouflage, and its tendency to stay put when approached, it is responsible for a very large proportion of snakebite accidents within its range. Although the fatality rate is low, it is one of the principal causes of snakebite death in Thailand and Malaysia, due to the high number of bites. Survivors of bites may suffer severe necrosis in the bitten limb, sometimes requiring amputation. Our research group is currently working on a project on the biology of this species.

Russell's Viper is by far the most dangerous viperid found in this region, although it is fortunately restricted to a part of the central Thai plain and a few neighbouring areas. This species has a scattered relict distribution in south-eastern Asia, isolated populations inhabiting Burma, central Thailand, Taiwan, southern China, eastern Java, and a few smaller Indonesian islands.

It is a major source of snakebite death in most of these areas, particularly in Burma. There is considerable venom variation between different populations. For instance, the effects of a bite by this species in Burma show very different clinical symptoms than a bite sustained in Thailand. This species was until now subdivided into five conventional subspecies. Research by our group has shown that these are largely artificial, and therefore valueless (like most subspecies); there are in fact only two morphologically distinct taxa within Russell's viper, a western form from India and neighbouring areas, and an eastern form from Burma eastward.

Two genera of Elapid snakes are of medical importance in Thailand and Malaysia, the kraits (*Bungarus*), and the cobras (*Naja*). The other genera (*Ophiophagus*, *Maticora*, *Calliophis*) rarely cause snakebite accidents. It should be mentioned that, of the rarer Elapids, it is not just the King Cobra which is highly dangerous. *Maticora bivirgata* has killed human beings, and a bite by a 30 cm *Calliophis maclellandi* resulted in the death of a healthy adult man in 8 hours!

The two common species of *Bungarus* found in Thailand and Malaysia, *B. fasciatus* and *B. candidus*, further exemplify the problems posed by an insufficient understanding of the epidemiology of snakebites. In Thailand, an antivenom is produced only against the venom of the more conspicuous of the two species, *B. fasciatus*, which is common in the Bangkok area. There is no antivenom against *B. candidus*. Epidemiological research has shown that, whereas very few people are bitten by *B. fasciatus*, *B. candidus* is one of the principal sources of snakebite death in eastern and north-eastern Thailand. The *B. fasciatus* antivenom is useless against *B. candidus* venom, so that many people die due to bites by the latter species.

The main thrust of the research of our group has so far been directed at the resolution of the systematics of the Asiatic cobra species complex, which was until now particularly chaotic. In most classifications which have appeared in the western literature over the last few decades, all Asiatic *Naja* populations have been regarded as belonging to a single species, *Naja naja*, ten subspecies being recognised by most workers. This arrangement was widely felt to be unsatisfactory, but, until now, nothing has been done to resolve the problem.

Our understanding, or lack thereof, of the population systematics of these snakes has a number of important consequences for the treatment of snakebite patients. Most importantly, if all



Fig. 6. Pope's pit viper, *Trimeresurus popeorum*, from Ban Pala-U, Prachuap Khiri Khan Province, southern Thailand.



Fig. 7. Russell's viper, *Vipera russelli*, from central Thailand.

populations are subspecies of one species, one would by definition expect to find only one of these subspecies in any one locality; there would be no sympatry between different forms. Furthermore, where two such subspecies meet, one would expect some kind of hybrid zone between them, where one phenotype merges into an other. Where venom differences exist between supposed subspecies, one would expect the venom types to intergrade in such a zone.

Significant venom differences are known to exist between some cobra populations; for instance, it is known that antivenom against cobras from southern Malaysia (traditionally known as *N.n. sputatrix*) does not neutralize the venom of cobras from central Thailand (traditionally known as *N.n. kaouthia*). The conventional taxonomic arrangement would predict a hybrid zone somewhere along the Malayan Peninsula, where the venom types would intergrade.

Our work has shown that there are in fact eight or nine full species of Asiatic cobra, not ten subspecies of a single species. Many of the conventional subspecies were found to be entirely artificial, consisting of a random assemblage of populations which actually belong to two or three different species. In Thailand and Malaysia, there are three full species of cobra. The most common is the Monocellate Cobra (*Naja kaouthia*), a large (up to 220 cm) non-spitting species, which is common in central and southern Thailand, and northern Malaysia. In southern Thailand and northern Malaysia, *N. kaouthia* occurs sympatrically with *N. sumatrana*, the Equatorial Spitting Cobra. *Naja kaouthia* and *N. sumatrana* are the two species with different venoms mentioned earlier. However, rather than there being a gradual intergradation between venom types, as would be predicted by the conventional taxonomic arrangement, there is in fact a situation where, over several hundred kilometers of the Malayan Peninsula, two species, whose bites require different antivenoms, occur sympatrically. Since there is currently no polyvalent antivenom which covers both species, this is clearly of some relevance for the treatment of snakebite victims in the area.

In much of central Thailand, *N. kaouthia* occurs sympatrically with a highly variable group of small spitting cobras, which have been the subject of much taxonomic confusion. In a previous paper, we (Wüster & Thorpe, 1991) assigned these populations to *Naja atra*, but pointed out that more than one species may be involved. Current work suggests that the Thai spitters are indeed not conspecific with Chinese *N. atra*, so, until the affinities of this form are sorted out, I will refer to them here as *Naja* cf. *atra*. This is the only species to occur in northern and north-eastern Thailand, where it inflicts a good number of bites every year. In Thailand, only antivenom against *N. kaouthia* is currently available. There has so far been a conspicuous lack of comparative research into differences in venom composition between *N. kaouthia* and *Naja* cf. *atra*, so that nothing is known about the effectiveness of the Thai antivenom in the treatment of *Naja* cf. *atra* bites.

These examples show how taxonomic confusion can seriously hinder progress in the treatment of snakebite victims. In any biological problem, the principal precondition must be that one has to know what animals one is working with. Most of all, it must be emphasised that there are many other complexes of dangerously venomous snakes in urgent need of revision, using modern taxonomic methods, such as multivariate analysis of morphological characters, or molecular techniques. This is particularly the case when the species in question either all look the same (as in *Trimeresurus*), or when there is much superficial variation, which does not reflect systematic affinities, as in Asiatic cobras.

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