



Naja atra. Foto/Photo: N. Orlov

Venomous Snakes of Southern China



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The diversity of herpetological fauna in the forests of eastern and southeastern Asia is comparable only with that of Neotropical forests. Especially rich and extraordinary in reptile and amphibian species is an area covering the eastern Himalayas, southern China, and northern Indochina. This includes territories of Assam, India; northern and north-central Myanmar (Burma); southern Xizang (Tibet), southern Sichuan, Yunnan, Guangxi, Guangdong, Hainan, and Taiwan provinces of China; northern Laos; and northern Vietnam.

Especially interesting in China is the South Yunnan Mountainous Subregion of the South China zoogeographical region (ZHAO and ADLER, 1993). This is the western part of the Tonkin region, comprising the Hoang Lien range and the parallel Ailao Shan range, which transect Yunnan Province from northwest to southeast. Primary monsoon and rain forests once covered this territory, but today remain only in the high mountains and along steep slopes. These tropical montane forests support a unique and diverse herpetofauna, and are of increasing interest to zoologists, botanists, and ethnographers.



Naja atra. Photo: N. Orlov



Hemibungarus macclellandi. Photo: N. Orlov

In cooperation with Chinese scientists, we were able to study the herpetofauna of southern China, with a special focus on the venomous snakes. More than 30 species of terrestrial venomous snakes of the families Elapidae and Viperidae are found in China (ZHAO and ADLER, 1993; ZHAO et al., 1998; ZHAO et al., 2000), and most of them (except the genera *Gloydius*, *Vipera*, and *Ermia*) are found in southern China.

The family Elapidae is represented in southern China by members of the subfamily Bungarinae: *Naja atra* Cantor, 1842; *Naja kaouthia* Lesson, 1831; *Ophiophagus hannah* (Cantor, 1836); *Bungarus fasciatus* (Schneider, 1801); *Bungarus multicinctus* Blyth, 1860 — and members of the subfamily Elapinae: *Hemibungarus macclellandi* (Peters, 1862); *Hemibungarus kelloggi* Pope, 1928; *Hemibungarus sauteri* (Steindachner, 1913).

The family Viperidae is represented in southern China by the single member of the subfamily Azemiopinae: *Azemiops feae* Boulenger, 1888 — one member of the subfamily Viperinae: *Daboia russelli* (Shaw and Nodder, 1797) — and many members of the subfamily Crotalinae: *Deinagkistrodon acutus* (Günther, 1888); *Ovophis gracilis* (Oshima, 1920); *Ovophis monticola* (Günther, 1864); *Ovophis zayuensis* (Jiang, 1977); *Protobothrops jerdoni*

(Günther, 1875); *Protobothrops mucrosquamatus* (Cantor, 1839); *Protobothrops xiangchengensis* (Zhao, Jiang, and Huang, 1978); *Trimeresurus albolabris* (Gray, 1842); *Trimeresurus medoensis* Zhao, 1977; *Trimeresurus tibetanus* Huang, 1982; *Trimeresurus stejnegeri* Schmidt, 1925; and *Trimeresurus yunnanensis* Schmidt, 1925 (ORLOV et al., 2002, 2002a).

In this article, we will present data on the distribution and biology of some of these venomous snakes, based partly on our own field observations, and on captive-maintenance and breeding experience at Tula Exotarium (Breeding Center of Asian snakes).

Family Elapidae

Subfamily Bungarinae

Ophiophagus Günther, 1864, is a monotypic genus distributed in Asia.

Ophiophagus hannah (Cantor, 1836), the king cobra or hamadryad, was originally classified as the genus *Hamadrias* from the Sundarbans region and near Calcutta, India. This is one of the most fascinating venomous snakes in the world. It is the largest venomous snake of the Old World, with a maximum total length of 5.5 meters. Most are smaller than this, but king cobras of 4–4.5 meters are not rare in southern and southeastern Asia.



Mountain stream on Hainan Island, China. Photo: N. Orlov



Mountainous terrain in southern Yunnan, China. Photo: N. Orlov

Ophiophagus hannah is widely distributed, from India to Vietnam and from southern China through Indochina, the Philippines and Indonesia. In southern China it occurs from Hong Kong and Hainan westward to Yunnan, southwestern Sichuan, and southeastern Xizang (GOLAY et al., 1993; ZHAO and ADLER, 1993; MANTHEY and GROSSMAN, 1997; ZHAO et al., 2000).

We have observed *Ophiophagus hannah* in different types of mountain forests from foothills to elevations of up to 2,000 meters above sea level. This species has been recorded in anthropogenic landscapes (vegetation influenced by human activities) and often inhabits relatively open and sunlit woodland. In thick rain and monsoon forests it prefers clearings and riverbanks where the canopy cover is not fully closed.

The genus name *Ophiophagus* means “snake-eating,” and the king cobra diet indeed consists largely of other snakes, as well as other types of reptiles. In specimens with body lengths of 3–3.2 meters we found prey species of snakes: the Indian rat snake, *Ptyas korros*; the Asiatic water snake, *Sinonatrix trianguligera*; the yellowbelly water snake, *Enhydryis plumbea*; the banded krait, *Bungarus fasciatus*; and others — and large lizards: the East Indian brown mabuya, *Mabuya*

multifasciata; and the green prickle-nape, *Acanthosaura capra*. In captivity, cannibalism was seen.

A gravid female was recorded on 22 April in the southern part of the Annam mountain range. More than 30 large females examined at zoos in northern Vietnam in September and October did not have enlarged follicles; they were either barren, or had already laid eggs. In October and November, large king cobras were seen basking during the

daytime. In May and June this species is crepuscular and nocturnal.

Bungarus Daudin, 1803, is a genus of 13 species inhabiting southern and southeastern Asia.

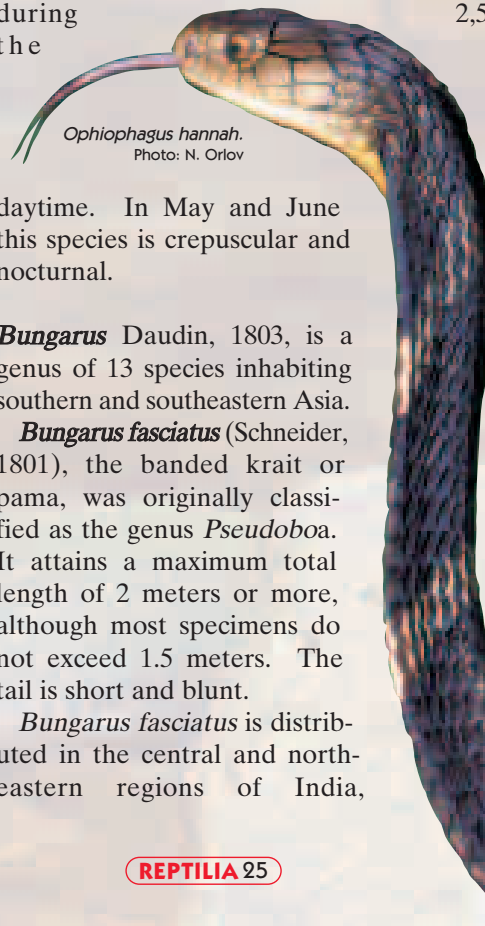
Bungarus fasciatus (Schneider, 1801), the banded krait or pama, was originally classified as the genus *Pseudoboa*. It attains a maximum total length of 2 meters or more, although most specimens do not exceed 1.5 meters. The tail is short and blunt.

Bungarus fasciatus is distributed in the central and north-eastern regions of India,

Myanmar, Thailand, Laos, Cambodia, Vietnam, southern China including Hong Kong and Hainan, and islands of Indonesia (Sumatra, Java, and Borneo) (GOLAY et al., 1993; ZHAO and ADLER, 1993; DAVID and INEICH, 1999).

Bungarus fasciatus is one of the most common and abundant venomous snakes. It lives in a variety of habitats, including dense jungle, primary stratified forest, secondary bamboo forest at elevations of up to 2,500 meters, agricultural land, the vicinity of human settlements, and even city parks. It does not avoid steep forest slopes or the rocky canyons of mountain streams.

Being strongly nocturnal, this snake hides during the day in a variety of shelters, and emerges as darkness falls. A very active hunter, it is a good swimmer and often found in forest streams at night. Prey items recorded include the buff-striped keelback, *Amphiesma stolata*; the big-tooth snake, *Dinodon flavozonatus*; the Malayan banded wolf snake, *Lycodon subcinctus*; and an Asiatic water snake, *Sinonatrix* sp. We also observed a 1-meter female that had eaten two adult spadefoot toads, *Megophrys lateralis*.



Ophiophagus hannah.
Photo: N. Orlov



Ophiophagus hannah basking. Photo: N. Orlov

We saw gravid females from the middle of May to the middle of July. Clutches consist of 3–12 eggs.

Bungarus multicinctus Blyth, 1860, the many-banded krait, is distributed in the southern mainland and Taiwan Province of China, Laos, Myanmar, and northern Vietnam (GOLAY et al., 1993; ZHAO and ADLER, 1993; DAVID and INEICH, 1999; McDIARMID et al., 1999; ORLOV, 1998a; ZHAO et al., 2000).

This species is found near water in plains and hills, especially near rice paddies. It is nocturnal and eats rats, lizards, other snakes, frogs, fishes (mainly loaches), and eels. In June, the female lays 3–12 eggs, which hatch in about 48 days.

Bungarus multicinctus has highly neurotoxic venom, which is used in traditional medicine, as are the gall bladder, and dried embryos. The meat of this species is also eaten.

Naja Laurenti, 1768, is an Afro-Asian genus including more than 10 species of large, extremely venomous snakes.

Naja atra Cantor, 1842, the Chinese cobra, is distributed in southern and southeastern China including the islands of Hainan and Taiwan, northern Vietnam, and Laos (GOLAY et al., 1993; ZHAO and ADLER, 1993; ORLOV, 1998a; DAVID and INEICH, 1999).

Naja atra occurs in a wide variety of habitats, from rice paddies in maritime lowlands to various types of mountain forests. It can live at elevations of more than 2,000 meters above sea level. It avoids dark forest with closed canopy. In primary monsoon and rain forests *Naja atra* inhabits clearings and riverbanks. Higher population density is



Hemibungarus kelloggi. Photo: N. Orlov

observed in the vicinity of human settlements, in secondary forests, and in rice paddies adjacent to forest.

Naja atra is diurnal and crepuscular. We saw hunting cobras during all daylight periods and as late as 2–3 hours after sunset from March to October, with ambient temperatures of 20–32°C (68–90°F).

The diet of *Naja atra* is highly variable. It preys on any vertebrates from fishes to mammals. Juveniles eat mostly amphibians, whereas adults usually prefer reptiles and mammals — during amphibian breeding periods, however, adult cobras eat mostly frogs: e.g., the paddy frog, *Fejervarya limnocharis*; the Java whipping frog, *Polypedates leucomystax*; and the black-spined toad, *Bufo melanostictus*.

Mating and egg-laying periods are very extended. We observed cobras mating in the mountains of the western Tonkin region, at elevations of 400–2,000 meters, in March through May; gravid females with 6–23 eggs were recorded from May to the end of July.

Bungarus fasciatus. Photo: N. Orlov



Subfamily Elapinae

Hemibungarus Peters, 1862, is a genus of four species distributed in India, Nepal, Indochina, southern China including the islands of Hainan and Taiwan, the Ryukyu Islands of Japan, and the Philippines.

Hemibungarus maclellandi (Reinhardt, 1844), the oriental coral snake, was originally classified as the genus *Elaps*, from Assam, India. It can grow to a total length of up to 69 centimeters.

The oriental coral snake is distributed in the states of Assam and Sikkim in India, Myanmar, Thailand, Vietnam, Laos, and southern China including Taiwan (GOLAY et al., 1993; ZHAO and ADLER, 1993;

ORLOV, 1998a; DAVID and INEICH, 1999).

This species inhabits its mountain slopes (sometimes very steep) of monsoon and rain forests. We have observed it at elevations from 400 to 2,500 meters. In the mountains of the western Tonkin region it prefers areas of karst covered with well-drained, layered forests (tree species of differing heights and sunlight requirements).

Hemibungarus maclellandi is crepuscular and nocturnal, being especially active at night. It emerges on rainy nights in the beginning of March, at temperatures as low as 14°C (57°F). Gravid females were recorded in May and June at elevations of 800–1,000 meters. Clutches consist of 7–12 eggs. Recorded prey items included the dwarf snake *Calamaria pavementata*; a worm snake, *Typhlops* sp.; and a ground skink, *Scincella* sp.

Hemibungarus kelloggi Pope, 1928, Kellogg's coral snake, is distributed in northern Laos, northern Vietnam, and the provinces of Sichuan, Guizhou, Zhejiang, Jiangxi, Fujian, Hainan, and Guangxi in China (GOLAY et al., 1993; ZHAO and ADLER, 1993; ORLOV, 1998a; DAVID and INEICH, 1999).

This nocturnal species is found in mountain forests. We have observed it at elevations from 600 to 1,500 meters. It preys on other species of snakes. In May, females lay 5–8 elongate eggs.

Family Viperidae

Subfamily Azemiopinae

Azemiops Boulenger, 1888, is a monotypic genus.

Azemiops feae Boulenger, 1888, Fea's viper, is one of the most mysterious viperid snakes. Until the last decade, only a few specimens were known. The species was named in honor of prominent Italian naturalist Leonardo Fea of the Natural History Museum in Genoa. During a 4-year field study (1885–1889) in Burma (now Myanmar) he collected insects and other invertebrates, amphibians, reptiles, and birds (HALLERMAN et al., 2002). He found *Azemiops feae* in the Kakhien (=Kakhyen) Hills, several kilometers from Bhamo, on the border with Yunnan, China (ORLOV and RYABOV, 2002).

Azemiops feae is distributed in northern Myanmar; the provinces of southeast Xizang, Yunnan, Guangxi, Guizhou, Sichuan, Fujian, Zhejiang, Jiangxi, and Shaanxi in China; and the provinces of Vinh-phu, Bac-thai, Cao-bang, and Lang-son of northern Vietnam (GOLAY et al., 1993; ZHAO and ADLER, 1993; ORLOV, 1995, 1997, 1998b; ZHAO et al., 1998; DAVID



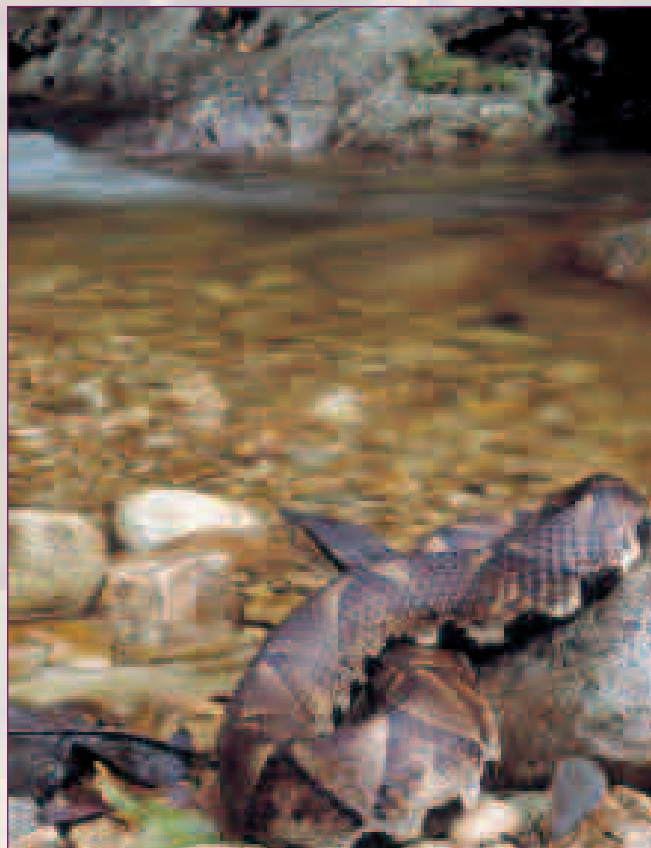
Azemiops feae. Photo: N. Orlov

and INEICH, 1999; McDIARMID et al., 1999; ORLOV et al., 2002; ORLOV and RYABOV, 2002).

We observed this cryptozoic species in the mountains of northern Vietnam and southern China at elevations from 600 to 1,100

meters. POPE (1935) reported the species at elevations of 600–1,500 meters in China. In addition to our own observations, we used a questionnaire and color photographs to survey the local people, especially hunters and foresters. Virtually everyone working regularly in the forest recognized this snake and said it was very rarely seen on forested mountain slopes. Sightings are probably so rare partly because of the extremely secretive lifestyle of the species. It is interesting to note that most recorded sightings are of subadult specimens.

Our observations and data received from the local people indicate that in northern Vietnam *Azemiops feae* occurs in habitats characterized by the presence of bamboo and tree-fern thickets interspersed with sunlit open areas, a thick layer of leaf litter and decomposing tree ferns, and karst outcrops, well-drained by numerous surface and underground streams. The snake probably



Deinagkistrodon acutus at the edge of a mountain stream. Photo: N. Orlov

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spends most of its life in the crevices and galleries of the karst fields, where it can find prey without appearing above ground. Limited data on feeding in nature show that the diet of *Azemiops feae* includes rodents and shrews (GREEN, 1992) associated with the karst outcrops cut by swift mountain streams.

We recorded *Azemiops feae* in mid May and early June from 3–4 a.m. Activity was observed during light rainfall, with air temperatures of 18–20°C (64–68°F) near the soil surface. The snakes moved slowly, sometimes appearing on the surface entirely, and sometimes disappearing in the forest litter. The juvenile specimens found in October and November were active on the surface at air temperatures of 16–19°C (61–66°F) in the evening, from just after dark at 7 p.m. until 10–11 p.m. Their appearance on the surface was always during light rainfall.

We also have long-term experience with *Azemiops feae* in captivity. It has been found that this viper cannot tolerate dry conditions. Even with relative air humidity approaching 100 percent, the substrate must be kept very wet (but loose). Otherwise, the snake will lose mobility and its skin will quickly become dry and wrinkled. During the active period (February through November), daytime temperature should be kept at 23–27°C (73–81°F); nighttime temperature, at 17–19°C (63–66°F). This snake feeds at temperatures as low as 16–17°C (61–63°F), and is able to digest food at temperatures as low as 19–20°C (66–68°F). In the loose wet substrate of the terrarium, captive vipers quickly burrow a network of underground tunnels and chambers.

During the active period, shedding in captive specimens occurred about once every 6 weeks. Over a period of 6 years in a terrarium, one female grew from 32 centimeters to 98 centimeters in total length. Over the same time period, a male grew from 30 centimeters to 92 centimeters. Specimens of such a large size have not been recorded in the wild.

Hibernation in captivity was set up in very moist substrate at temperatures of 13–14°C (55–57°F) for 60 days from the end of December until the end of February.

During the active period, *Fea*'s vipers ate once every 8–12 days. They were fed mice, newborn rats, lizards (*Hemidactylus* sp.), and pieces of chicken prepared with the scent of rat or mouse.

Unlike many other terrestrial vipers, *Azemiops feae* is relatively sluggish and unaggressive. When mating, the male aligns himself parallel with a female, twitches against her, and turns his tail and cloaca under hers. The female then lifts her tail, the cloacas are drawn together, and copulation takes place, lasting for about 10 minutes. Copulation may be repeated several times over a period of 10–12 days (ORLOV and RYABOV, 2002).

The female is gravid for about 90 days before laying eggs. We have observed two clutches of 5 eggs each laid by this species.

Subfamily Crotalinae

Deinagkistrodon Gloyd, 1979, is a monotypic genus.

Deinagkistrodon acutus (Günther, 1888), the Chinese copperhead, was first classified as the genus *Halys*, from the mountains north of Kinkiang (=Jinjiang Shi), Jiangxi Province, China.

Deinagkistrodon acutus is distributed in Taiwan and central mainland China from Zhejiang and Fujian westward to Guizhou and southeastern Sichuan, and southward to northern Vietnam, and possibly Laos (GOLAY et al., 1993; ZHAO and ADLER, 1993; DAVID and INEICH, 1999; McDIARMID et al., 1999; ZHAO et al., 2000; ORLOV et al., 2002).

This species lives in forested areas of mountains. It is often found on rocks in mountain streams, from lower hills and mountains to elevations up to 2,000 meters. It is very active in the evenings and on rainy or cloudy days. It feeds on frogs, lizards, birds, and rats. On the mountain Fan Si Pan (Sa Pa District,



Deinagkistrodon acutus in the forest. Photo: N. Orlov

Lao Cai Province) it has been seen feeding on bamboo rats (genus *Rhizomys*). Local people indicate that the adult snakes live in association with bamboo rat colonies, using the rat tunnels for shelter and ambush. Snake hunters visit these colonies at the proper time, and locate snakes by listening for the peeping sound emitted by rats being attacked in their underground nest chambers. The hunters then dig up the tunnels and catch the snakes.

Deinagkistrodon acutus is used in Vietnam and China for food and in traditional medicine.

A female measuring about 1 meter in total length was captured at the end of June in Mau Son (Lang Son Province), at an elevation of 600 meters. In captivity, this snake feeds on frogs, small rats, and other rodents. After eating, it often remains immobile for up to 19 days and 8 hours.

This species is oviparous. Copulation takes place in May, and again in September and October. Clutches of 15–35 eggs are laid between July and September (sperm from the autumn copulations is stored until the following year). Eggs measure 45–55 x 25–30 millimeters, weigh

about 15 grams, and already contain developed embryos at the time of laying. The female guards and incubates the eggs. Newly hatched young measure 21.5–24 centimeters in total length. The female abandons her young about 24–30 days after they hatch. The young snakes eat mostly frogs, but shift to mice as they grow. ■



Bungarus multicinctus.
Photo: N. Orlov

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