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NOTES ON THE BIOLOGY, KEEPING AND BREEDING OF *ELAPHE HELENA HELENA* (Daudin, 1802)

PAUL M. KORNACKER

Locher Str. 18, D-53359 Rheinbach, Germany

INTRODUCTION

The Indian Trinket Snake (*Elaphe helena*) is one of the numerous *Elaphe*-species found on the Asian continent and was first mentioned by Russell in 1796 (quote from Smith, 1943). In the German literature this snake was described for the first time by Schetty (1950). So this species has been well-known for almost 200 years, and has been given various names by the native population. The Sinhalese use the name "*Mudu Karavala*" or "*Kalu Kateya*"; "*Kattu pambu*" is the name used by the Tamils.

DESCRIPTION

Two subspecies of *Elaphe helena* are known, differing in colour pattern and different ventral count (Schulz, 1992).

Elaphe helena helena (Daudin, 1802)

The ground colour of the body is dark to light brown; young snakes appear to be more of an ochre colour.

They have two black dorsal stripes starting just behind the head, which gradually fade as they stretch towards the centre of the body and then change into spots which gradually fade over into unclear, shadowy markings (Front Cover). On each side of the head, there are two dorsolateral stripes which also change into black spots stretching right down to the Ventralia. Directly behind the eyes, there is a thin, downward-pointing diagonal stripe which, on some snakes, reaches right back to the Infralabialia. The heads of young and sub-adult snakes are often light olive in colour. On fully-grown snakes, there may also be a black stripe between the Parietalia.

The dorsal scales have white edges and are evenly spaced. And so a pattern emerges which, especially on the young ones, can take the form of a zig-zag band. The rear of the body has no pattern but changes into a brown colour ending in a darker tone at the sides (Plate 1). The ventral side is creamy-white with no markings. Gohil (1983) reported the discovery of an albino in India.

The pholidose ratio is as follows:

2 Praefrontalia; 10 or 11 Supralabialia, of which either the 5th and 6th or the 5th to 7th touch the edge of the eye. The Dorsalia show in the middle of the body a strong reduction from 27 to 23 rows. On the front part of the body, the dorsal scales are slightly keel-shaped. Ventralia: male 210-234, female 226-244; Subcaudalia: 79 to 100. The anal shield has no parting.

Figure 1 shows the head-pholidosis of the female, which was caught in 1974 by the author in Sri Lanka.

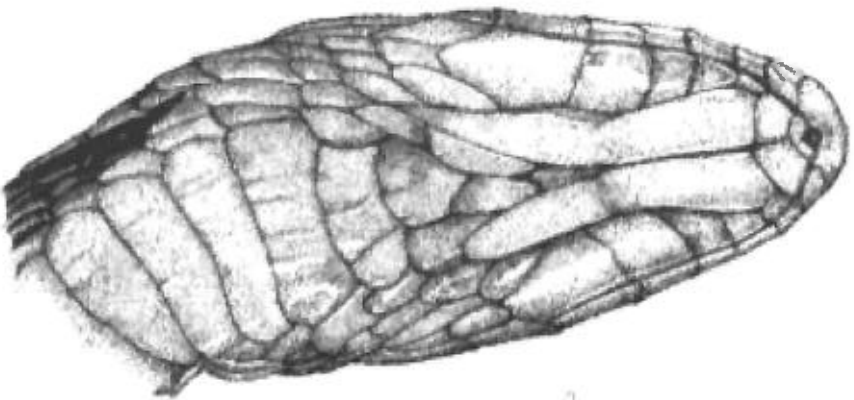
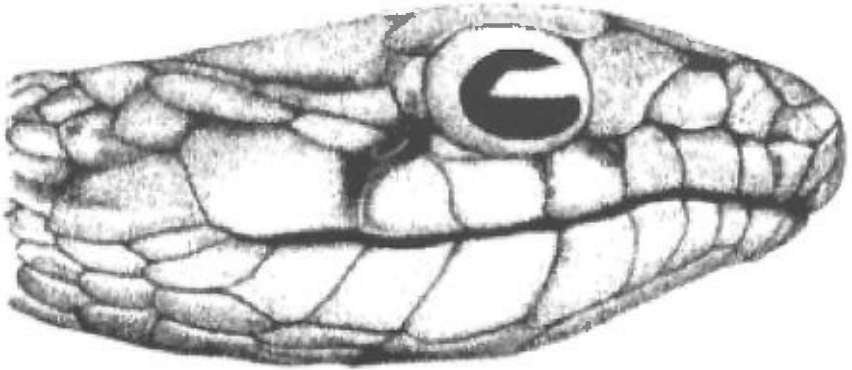
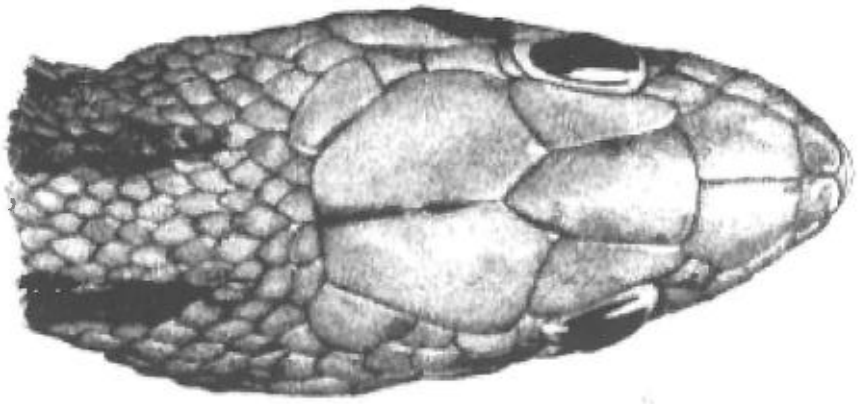


Fig. 1 - Head pholidosis and pattern of *Elaphe helena*, drawn by Uschi Euler

Elaphe helena monticollaris (Schulz, 1992)

According to Smith (1943), the ringed variety has no longitudinal black stripes. Its characteristic mark is a black-edged white collar. Murthy & Chandrasekhar (1989) described snakes collected from the hills in Tamil Nadu, South India and give some remarks about the colour pattern of this subspecies. In the publications by Niehaus & Schulz (1987), one finds a very good colour chart from Wall (1913) on which one can clearly see the back markings. In Figure 4, a courtesy from Schulz (Schulz, 1992) the different colour patterns are easily seen. They consist of yellow or white ocelli with black edges, which are evenly spaced out across the longitudinal axis in chain-forming belts. The number of these small cross-bands vary between 21 and 23. Another distinctive character compared to the nominate form is the higher number of ventral scales.

The pholidose ratio is as follows:

2 Praefrontalia; 9, seldom 8, Supralabialia, of which the 5th and 6th touch the edge of the eye. The Dorsalia show in the middle of the body a mostly constant number of 25 rows, sometimes a reduction to 24 or 23. Ventralia: male 216-242, female 247-260; Subcaudalia: 75 to 101. The anal shield has no parting.

E. helena has a slim body, a slightly pointed head and a pointed tail. The tongue has a black septum and sometimes the mouth has a black mucous membrane.

The sex of adult animals, can easily be determined because of their marked sexual dimorphism. The female Indian Trinket Snake can grow up to 130 cm in length, whereas the male, which is much slighter, grows to less than 100 cm. The sexes also differ in the number of ventral scales.

DISTRIBUTION

E. helena is found in an area reaching from the Himalayas in the north, throughout the whole Indian Subcontinent down to Sri Lanka (Fig. 5). In India it is mostly found in the provinces of Assam, Kashmir, Sikkim and Madras. The nominate form is restricted to the plains and hilly country between sea-level and 900 m above sea-level. Only in Nepal does it reach altitudes of 1500 m (Schulz, 1992). *Elaphe h. monticollaris* lives in the hills mainly in the Western Ghats along the southwestern coast of India, between 600 and 2000 m above sea-level.

According to De Silva (1980) and A. De Silva (1990) *E. helena* is found all over the island of Sri Lanka. From the dry north (Jaffna), down to the humid south (Ratnapura) and from the east coast (Trincomalee) to the west coast (Colombo), living at altitudes ranging from sea-level to over 1500 m. In Sri Lanka they are mostly found at altitudes of about 500 m. The snake was observed by the author in Deltota, Gampola and Peradeniya (Central Province) as well as in Ruwanwella (Western Province), all of which are between 400 and 500 m above sea-level (Kornacker, 1988).

ECOLOGY AND BIOLOGY

All specimens found by the author were in a hot and humid lowland area differing in climate from all the other regions of the island by its yearly precipitation of over 2000 mm and an average temperature of 20°C. The results of some sporadic temperature measurements showed 21°C in the morning and 28°C in the late afternoon. The humidity fluctuated between 85% and 75%.



Fig. 2 - The distribution of *Elaphe helena*

E. helena is an eurytope series, which means it colonises various biotopes. *E. helena* was mostly observed at the edge of the tropical rainforest, but also in a meadow clearing, in a rice field and close to a village. Its most active time is at dawn and during the night. During the day, it usually hides on the ground under stones, branches or bark or curled up in compact tree growth or bushes. As a semiarboricole species, the Indian Trinket Snake often climbs into bushes or low-lying branches. One specimen was found in a rubber plantation curled up in a latex-catching jar. The only young snake, found by chance, was observed on a dam in the middle of a rice field, from where it immediately escaped into the water. This also proves the oral communication from De Silva, who could only observe young snakes in the vicinity of standing water. Therefore, it is possible that the different *Rana*- and *Rhacophorus*-species are eaten for food. According to A. De Silva (oral communication), *E. helena* also hunts lizards, especially the young of *Calotes versicolor*, *Otocryptis wiegmanni* and *Mabuya carinata lanakae*. However, the main diet is small mammals.

Up to now, ophiophagy as described by Smith (1943), Deoras (1965) and other authors, could not be observed.

A vast selection of other snakes could be found in the same habitat, including *Ptyas mucosus*, *Lycodon aulicus*, *Dendrelaphis tristis*, *Vipera russelli* and *Naja naja*, which are all classed as eurytope species like *E. helena*.

Of the endemic Ophidiofauna (39 of the 92 species are endemic), only *Xenochrophis asperrimus* and *Bungarus ceylonicus* could be found.

Even though *E. helena* is a very calm and sociable species, its behaviour can suddenly change, if threatened with danger. If the distressed snake sees no way of escape, it will display a defensive behaviour similar to that of *Elaphe radiata* (Kornacker, 1986, 1988 and Schulz, 1986). The front of the body is raised to stand erect and bent back in an >S< shape (Fig. 6). The sides of the neck flatten out and the mouth opens slightly. When it strikes, the snake attacks forward and bites hard.

Very little is known about the reproduction cycle of *E. helena* in the field. It is known that many factors play a role.

Knowledge of the exogenous parameters such as temperature, humidity, photoperiod, population density and behaviour can be very valuable for later keeping and successful breeding in the terrarium. *E. helena* appears to be capable of breeding at any time of the year. A. De Silva captured a pregnant female in September and found clusters of eggs in January, March and December, whilst H. De Silva reported eggs from March, June and September. All these dates were given by oral communication. Whitaker (1978) noticed the laying of eggs in the Snake Park in Madras (India) in February, August and December. As shown in Table 1, reproduction in a terrarium can happen over the whole year.

MAINTENANCE

The author has kept the subspecies *E. h. helena* since 1974, but a suitable pair first started breeding in 1981. In the following four years the snakes were separated, according to sex, into two terraria, similar in size and interior. They were only allowed to mix for a short period of time when breeding. Later, all the snakes were put into one terrarium where they are kept today. The terrarium [size 100 x 70 x 90 cm (length/width/height)] is laid out with a root, several different sized branches and various bromeliads, ferns and climbing plants (for example *Cissus discolor* or *Scindapsus pictus*). The soil, 10 cm deep, consists of a mixture of sand, earth and peat in a ratio of 1 : 1 : 1. *Ficus diversifolia*, *Pellionia repens* or *Pilea cardiere* are soil plants, which cover the bottom and give the snakes a good shelter. A three litre plastic bowl is used as a water basin. The simulation of day and night is achieved by using two lamps, each of 38 watts, and an automatic timer on a 12-hour cycle. 300 Lux are projected onto the soil and 2200 Lux onto the tops of the branches. No further heating is needed, as the room in which the terrarium is situated has a temperature of 26°C-28°C. At night the temperature drops to about 20°C and could be dropped to about 16°C without causing any harm. Despite the relatively low humidity of 50%-70%, skin-shedding problems are very rare.

Feeding is done exclusively with laboratory mice. The bodysize of the mice has to be carefully controlled as the male snakes only dare to attack half-grown mice and flee from larger animals. The fully grown females, on the other hand, will eat mice of any size. The mice are killed in the *Elaphe* manner of constriction. Every 8 weeks they are given a multivitamin preparation which has been fed to their prey.

One specimen suffering from a lung infection was restored to health by using Tetra-Tablinen, a preparation manufactured by the firma Sanorania, Germany. Treatment took place over a period of 10 continuous days. The dose given on the first day was 100 mg/kg body weight and from the second to tenth day, 50 mg/kg. One side effect was the shedding of its skin 11 times that year! The snake was isolated in an almost sterile tank for several months. An infra-red lamp was used at the first signs of lung infection before starting the antibiotic treatment. A few drops of eucalyptus oil were added to the soil in the terrarium to help relieve the snake's breathing (Kornacker, 1988).

BREEDING

The breeding results from 1981 to 1991 are listed in Table 1 and 2. As already mentioned, the snakes were separated according to sex from 1981 to 1984. So it is even more surprising that the four copulations (the fourth taking place unobserved at the end of December 1983) resulted in 8 clutches. Obviously this was the result of the phenomenally delayed impregnation (sperm storage, *Amphigonia retardata*), already practised by many different kinds of reptiles. This special way of biological reproduction in snakes was first described in 1938 by Kopstein (quote from Petzold, 1982), and consists of conserving the sperm in the female genital tract over a period of time (up to several years). This seems to be the first observation in an Asian *Elaphe*-species.

A few days before mating, the total length and weight of the snakes was 118 cm and 305g for the female and 85 cm and 125 g for the male. Before copulation they often chased each other until the male, trembling heavily, tried to climb onto the back of the female. A mating bite, a habit which lots of snakes demonstrate, could not be observed. The snakes did copulate several times per day, and each time could last up to four hours. The female continued to eat normally right up until she was ready to lay her eggs. Then she searched for a suitable place, which was usually a densely planted flowerpot. One important factor when she is about to lay her eggs is that there should be a moist area in the terrarium, well protected from external disturbance. The heavily pregnant female is quite helpless at this stage and requires absolute peace.

The deposition of the eggs, which was observed both during the day and night, can take up to several hours. The eggs, some of which were stuck together, were carefully separated, numbered with a pencil, weighed and measured and then immediately put into an incubator. Instead of a proper incubator, a drying cabinet was used, where the exact temperature could be set - in this case 27°C. The necessary humidity of 85%-95% was achieved by standing a number of waterbowls inside. A mixture of peat and soil, which was kept moist, was used as a nesting substrate. (A suitable alternative would be Vermiculite).

Eggs with a mycosis infection were powdered with charcoal and on several occasions healthy young snakes were hatched. Only heavily infected or malformed-eggs had to be removed. During the incubation period, it could be seen how the eggs grew in size and weight but they were not measured.

In the FI Generation (Tab.1), 39 snakes hatched out of a total of 51 eggs, a hatching rate of 76%. The average incubation time was 65 days. After first splitting the shell, they stayed inside the eggs for several hours until finally emerging (Fig. 7). The hatchlings were of an average length of 305 mm, and an average weight of 8.5 g. After a few days they shed their skins for the first time. Shortly afterwards, they were fed with newly born mice. The rearing of the young snakes followed without any problems although some had to be specially fed during the first four weeks. In these cases mice were not used as food but chopped up pieces of heart from cattle, given the odour of mice. When fed regularly, snakes reach mating size within about 18 months. The female has then reached a size of about 110 cm and the male nearly 70 cm.

Table 1.
Breeding data of the F1-Generation

Date of mating	Date eggs laid	Number of eggs	Average length (mm) and weight (g) of eggs	Incubation time (days)	Number of hatchlings	Average length (cm) and weight (g) of hatchlings
05.11.81	02.01.82	7	39.4/ 9.6	67-68	5	30.4/ 8.2
	15.03.82	8	43.6/10.8	65-69	8	31.9/ 9.2
30.03.82	29.05.82	6	43.7/10.5	65	4	31.1/ 8.8
	22.09.82	8	42.5/10.1	61	3	31.0/ 9.1
25.02.83	27.04.83	8	43.6/11.2	63-65	8	32.3/10.4
	20.08.83	4	41.1/ 9.5	64	1	29.1/ 7.5
?	02.03.84	3	38.9/ 8.0	61-67	3	27.8/ 6.9
	16.08.84	7	40.2/ 8.9	63-69	7	30.1/ 8.2

In 1986 a pair was chosen, which had hatched in August 1984, in order to try and breed an F2 Generation. Between 1986 and 1991 43 eggs were laid and 37 snakes hatched, a hatching rate of 86%. The incubation time was usually 67 days. The breeding results can be seen in Table 2. As in the F1 Generation, the remaining eggs were unfertilised.

The breeding results of the F1 and F2 Generation are compared in Table 3.

Table 2.
Breeding data of the F2-Generation

Date of mating	Date eggs laid	Number of eggs	Average length (mm) and weight (g) of eggs	Incubation time (days)	Number of hatchlings	Average length (cm) and weight (g) of hatchlings
	19.05.86	5	41.6/ 9.1	66-71	5	30.4/ 8.2
	17.08.87	4	39.2/ 8.6	67	1	29.4/ 7.6
16.03.88	23.05.86	4	42.8/10.8	68	4	31.2/ 9.6
	07.09.88 ¹	Two unfertilized, deformed eggs - 68.5 and 71.2 mm in length				
26.01.89	31.03.89	7	39.7/ 8.9	62-65	7	30.8/ 9.4
	02.08.89	4	41.2/10.2	66-68	3	29.8/ 8.7
21.02.90	28.04.90	8	38.4/ 8.5	69-71	8 ²	29.2/ 8.5
	19.07.90	4	40.8/ 9.7	65-66	3	30.5/ 8.9
	08.04.91	3	41.2/10.1	69	4	31.8/10.1
25.06.91	27.08.91	4	40.1/ 8.9	62-64	3	30.2/ 9.3

1) Egg-clutch disregarded in statistic.

2) One animal with deformed vertebral column, an other born with an open ventral side.



Plate 1 - Young "helenas" show a very clear pattern



Plate 2 - The subspecies *Elaphe helena monticollaris*



Plate 3 - The typical defensive behaviour of *Elaphe helena*



Plate 4 - Hatchlings in an incubator

Table 3.
Comparison between F1- and F2-Generation

	Summary of clutches	Number of eggs	Average of eggs/clutch	Average length (mm) and weight (g) of eggs	Average incubation time	Summary of hatchlings	Average length (cm) and weight (g) of hatchlings
F1-Generation	8	51	6.4 eggs/clutch	41.6/ 9.8	64.8	39 = 76%	30.5/ 8.5
F-2 Generation	9	43	4.8 eggs/clutch	40.6/ 9.4	66.8	37 = 86%	30.4/ 8.9

ADDENDA

In May 1988, after 14 years in the terrarium, the female used for the whole F1 Generation finally died. She was 121 cm in length and had been captured by the author in 1974 in Gampola, at the time measuring 116 cm in length.

When kept in proper conditions, the Indian Trinket Snake has proved to be easily adaptable to life in a terrarium, which means it is a good species for terrarium beginners. Due to the vast amount of breeding in the last couple of years by terrarium keepers, one should only keep those bred in captivity, thereby protecting the environment and the different species.

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