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THE TAXONOMIC STATUS OF THE GREEN SNAKE, *OPHEODRYS MAJOR*, ON TAIWAN[1]

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ABSTRACT

The nasal shield on each specimen in my collection is entire, with its lower edge occasionally very narrow, and is not partly divided as stated by Maki (1931). Other scale characteristics, ventral and subcaudal counts and measurements, of both keeled and smooth specimens, well agree with the data obtained by other workers.

In keeled specimens, the numbers of keeled rows in both sexes are variable. Usually seven, five or three median scale rows are keeled anterior to the vent. One or two scale rows on either side of vertebral row are frequently keeled. The lengths of the keeled rows are variable. The outermost and more faint keeled rows are usually the shortest, and the scale rows with developed keels are the longest. Each keel, whether well developed or faint, is nearly as long as the scale on which it is located. It may become indistinct posteriorly.

The green snakes found on this island do not represent two subspecies as Maki suggested, but in reality belong to the highly variable population of *Opheodrys major*. Although keeled scale rows may be found in both sexes, most (94.7%) of the males in my collection are keeled and 60% of the females smooth. The keels in males are more strongly developed than those of females. Thus the local specimens show a definite sexual dimorphism.

The green snake is very common on Taiwan. The Japanese herpetologist Maki believed that on Taiwan this snake is actually represented by two subspecies and, in 1931 (1), described *Liopeltis major bicarinata* from Daibuzan, distinguishing it from the previously recognized *L. major major* (Günther) by the presence of keels on a few median scale rows. Fan in 1931(2) also noted such keels on a few median scale rows in most of his Lohsiang specimens, but found no other differences in a series of masurements and scale counts of keeled and smooth specimens. Pope (3) challenged Maki's classification and declared that these two subspecies actually belonged to one species *Eurypholis major*. Wang and Wang(4) and Chen(5) adopted Maki's classification in their writings. Again Kuntz (6) used the species name, *Liopeltis major* in his decription of the Taiwan green snake. Besides Pope informed me in June 1963(7) that Smith(8) reemployed the generic name *Opheodrys* for this snake, because the name *Eurypholis* had previously been given to a fish genus. These controversial opinions among various authors prompted me to collect

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Taiwan green snakes, examine and analyze them.

MATERIALS

A total of 68 specimens was collected during the period October 1959 to July 1963. Of these, 49 specimens were secured from the suburban districts of Taipei, including Tamsui, Peitou, Kuan Yin Shan, Tien Mu and Yang Ming Shan; five from I-Lan Hsien (northeastern Taiwan); one from Wufeng Hsiang (southern Taiwan); and 13 from Tsaotun (central Taiwan).

Most of the specimens were collected in low mountains except for the specimen from Wufeng Hsiang, which was found on Arishan at about 1600 meters above sea level.

SCALE CHARACTERISTICS

Scale characteristics of keeled specimens:

Upper labials eight, very rarely seven; usually fourth and fifth and very rarely third, entering the orbit; lower labials six, very rarely five or seven, usually anterior four, very rarely anterior three in contact with anterior chin-shields which are equal to or larger than posterior shields; nasal entire, with its lower edge occasionally narrow; one loreal; one preocular; usually tow postoculars, rarely one and very rarely three; temporals one plus two, very rarely one plus three or two plus two; parietals usually followed by two or three scales, very rarely four. These scales are not always enlarged, and occasionally are smaller than or equal to those on the nape; scale rows 15–15–15; anal divided.

Scale characteristics of smooth specimens:

The scale characteristics of smooth specimens are similar to those of keeled ones.

Ventral and subcaudal counts and measurements of specimens examined:

		Sex	No. of specimens	Extremes	Average
Ventrals	keeled specimens	♂	36	157–177	166.2
		♀	12	168–176	172.3
	smooth specimens	♂	2	166–167	166.5
		♀	18	165–178	172.6
Subcaudals	keeled specimens	♂	27	83–99	89.2
		♀	9	82–109	87.7
	smooth specimens	♂	1	——	90.0
		♀	17	80–96	86.8
Total length	keeled specimens	♂	27	62.1–104.4	86.5 cm
		♀	9	61.9–108.2	92.1 cm
	smooth specimens	♂	1	——	74.9 cm
		♀	17	75.5–107.9	90.0 cm
Tail/Total length	keeled specimens	♂	27	0.25–0.28	0.26
		♀	9	0.23–0.30	0.25
	smooth specimens	♂	1	——	0.26
		♀	17	0.22–0.26	0.24

Numbers of keeled rows and prominence of keels on scales of specimens examined:

Of the 68 specimens (38♂ and 30♀) mentioned previously, 48 are keeled (36♂ and 12♀), and 20 smooth (2♂ and 18♀). Percentages of the keeled and smooth specimens are 70.6% and 29.4% respectively. In 36 keeled male specimens, the keels of 23 are developed distinctly. Those of the other 13 are faint. In the 12 keeled female specimens, the keels of four are distinctly developed, and those of the other eight are faint. For illustration, the number of keeled rows, the points from which the keeled rows become smooth, and the status of development of the keels on scales are tabulated as TABLE I.

With both males and females keels on a scale may be nearly as long as the scale itself. In some examples only the posterior end of the keel is indistinct. In other specimens the keel becomes indistinct at the level of the posterior one third or posterior two thirds of the scale.

DISCUSSION

Of 68 specimens of the Taiwan green snakes examined by the writer, 70.6% possessed keeled scales. Of the 50 specimens Fan(2) examined, 31 were found with keeled scales, which indicated a similar percentage (62%).

A careful examination of the scale characteristics of keeled and smooth specimens reveals no other differences between these two series of snakes. In each series, scale characteristics well agree with the data published by previous authors, except that the nasal, which is entire, with its lower edge occasionally narrow, is not partly divided as stated by Maki (1) Further, the average numbers of ventrals and subcaudals and measurements approximate Fan's data(2).

The numbers of keeled rows are not a constant characteristic as Maki indicated, but vary. His opinion may have been influenced by lack of material for study.

My data concerning variation in number of keeled scale rows may be summarized as follows:

In keeled males: Three males possess seven median scale rows which are keeled anterior to the vent; 17 possess five keeled rows and one possesses three keeled rows. Five males possess two keeled rows on either side of the vertebral row as in Maki's specimen. Ten males possess one keeled scale row on either side of the vertebral row.

In keeled females: Seven females possess five median scale rows which are keeled anterior to the vent; three possess three median keeled rows. Two females possess two scale rows which are keeled anterior to the vent on either side of the vertebral row as in Maki's specimen.

The length of the keeled rows in male and in female specimens is variable. Usually the outermost and more faintly keeled rows become smooth a short distance anterior to the vent. The scale rows with well developed keels generally become smooth when reaching the anterior region of the body. The length of the keels is relatively stable. Each keel, whether well developed or faint, is nearly as long as the scale on which it is located. In some examples the posterior end of the keel is indistinct. In other examples the nature of the keel on the posterior one third or posterior two thirds of the scale is indistinct.

In the writer's collection, 94.7% of the males possess keeled scales, while only 40% of the females are keeled. The keels on the scales of male specimens are usually more strongly developed than those on females.

It may be concluded that the keeled and smooth specimens found on this island are not two subspecies as Maki suggested, but in reality belong to the highly variable population of *Opheodrys major*. Since most (94.7%) of the males are keeled and 60% of the females smooth, the local specimens show definite sexual dimorphism in this character.

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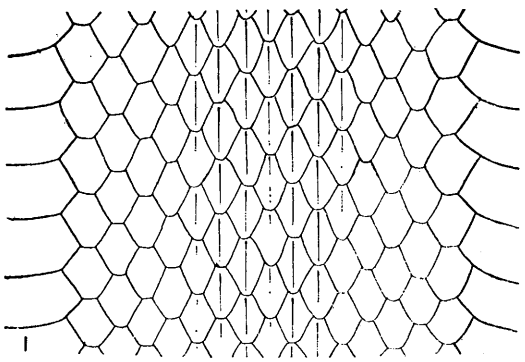
Fig. 1. No. 448, ♂, with seven median scale row keeled, one inch before vent.
Fig. 2. No. 429, ♂, with five median scale rows keeled, one inch before vent.
Fig. 3. No. 371, ♂, with three median scale rows keeled, one inch before vent.
Fig. 4. No. 280, ♂, with two scale rows on each side of vertebral row, one inch before vent.
Fig. 5. No. 364, ♂, with one scale row keeled on each side of vertebral row, one inch before vent.
Fig. 6. Photo of No. 280, ♂, showing the nature of the keeling.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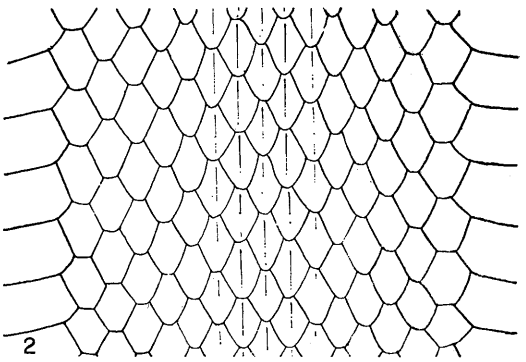
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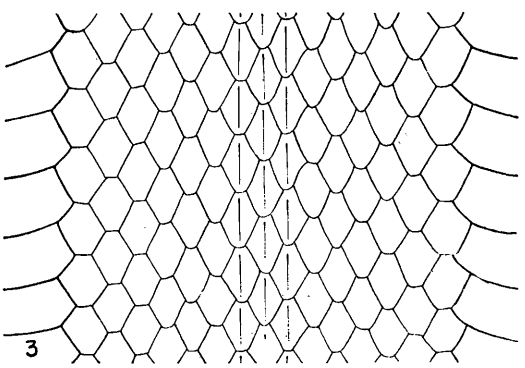
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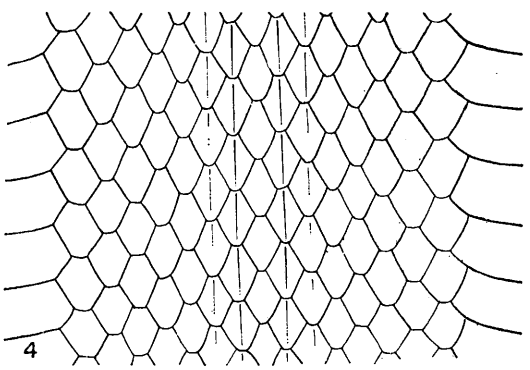
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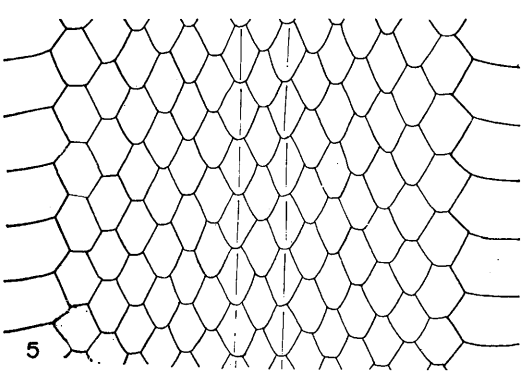
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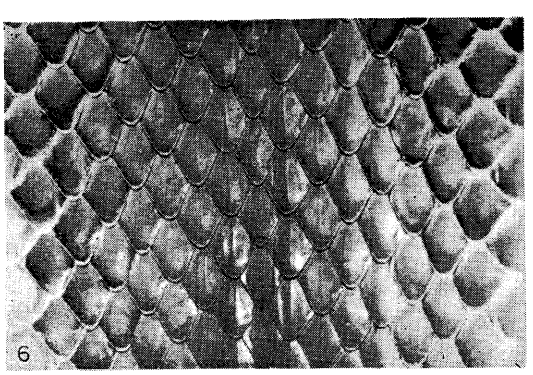
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TABLE I

Variation of the keeled rows and keels in ***Opheodrys major*** *from Taiwan*

Sex	No. of specimens	No. of scale rows keeled before vent	Points where 3rd (outermost) scale row on either side of vertebral scale row becoming smooth	Points where vertebral scale row and 2nd scale row on either side of which becoming smooth	Points where 1st scale row on either side of vertebral scale row becoming smooth	Points where three inner scale rows becoming smooth	Status of development of the keels on scales
♂	3	7 median	A short distance before vent	Mid-body; 1/3 of length of body from anterior end	3, 5 or 7 head-lengths from neck		Five inner scale rows with somewhat developed keels; outermost (3rd) scale row on either side with faint keels
♂	7	5 median		As above	1/3 of length of body from anterior end; 3, 4 or 5 head-lengths from neck		First scale row on either side of vertebral scale row with somewhat developed keels; vertebral and 2nd scale rows with faint keels
♂	6	5 median		A short distance before vent; 1/3 or 2/3 of length of body from anterior end; 5 head-lengths from neck (2nd scale row only)		3, 4 or 7 head-lengths from neck	Three inner scale rows with somewhat developed keels; 2nd scale row on either side with faint keels
♂	4	5 median		A short distance before vent; mid-body; 4 head-lengths from meck	Mid-body; 1/3 of length of body from anterior end; 3 or 5 head-lengths from neck		First scale row on either side of vertebral scale row with faint keels; vertebral and 2nd scale rows with more faint keels
♂	1	3 median		Mid-body (vertebral scale row only)	1/3 of length of body from anterior end		With somewhat developed keels
♂	5	2 on either side of vertebral scale row		A short distance before vent; mid-body (2nd scale row only)	Mid-body; 1/3 of length of body from anterior end; 5 head-lengths from neck		With somewhat developed keels
♂	10	1 on either side of vertebral scale row			A short distance before vent; mid-body; 1/3 of length of body from anterior end		Nine specimens with faint keels, one with developed keels
♀	1	5 median		Mid-body	1/3 of length of body from anterior end		First scale row on either side of vertebral scale row with somewhat developed keels; vertebral and 2nd scale rows with faint keels
♀	1	5 median		2/3 of length of body from anterior end	1/3 of length of body from anterior end		With faint keels
♀	2	5 median		A short distance before vent; mid-body (2nd scale row only)		1/3 of length of body from anterior end	Three inner scale rows with somewhat developed keels; 2nd scale row on either side with faint keels
♀	3	5 median		Mid-body (2nd scale row only)		As above	With faint keels
♀	3	3 median		Mid-body (vertebral scale row only)	1/3 of length of body from anterior end		With faint keels
♀	1	2 on either side of vertebral scale row		Mid-body (2nd scale row only)	As above		First scale row on either side of vertebral scale row with somewhat developed keels; 2nd scale row with faint keels
♀	1	2 on either side of vertebral scale row		A short distance before vent (2nd scale row only)	1/4 of length of body from anterior end		With faint keels.