

## OBSERVATIONS ON THE PIT VIPER *TRIMERESURUS* *GRACILIS* OSHIMA, 1920<sup>1</sup>

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### ABSTRACT

This paper is a review of information concerning the pit viper *Trimeresurus gracilis* Oshima, 1920. This snake, which has been collected only in the mountains of central Taiwan, had previously been known from only six specimens. Two of these cannot now be located and are believed to have been lost or destroyed during World War II. The remaining four previously described specimens, plus three recently collected and until now undescribed examples, were examined and extent of variation in scutellation, coloration and measurements is here reported. *T. gracilis* is unique in that first infralabials are divided to form an extra pair of chin shields. In addition, the second supralabials do not form the anterior margin of the loreal pit, but are separated from this pit by a prefoveal shield. All specimens examined had 19 scale rows at mid-body and 17 rows anterior to the vent. Ventrals numbered 143-150. The anal is undivided. Subcaudals are divided and numbered from 42-61 in specimens examined. The tail terminates in a short spine. There are five to eight scales in a line between the supraoculars. There are seven to eight supralabials and 9-11 infralabials.

Until now the pit viper, *Trimeresurus gracilis* Oshima, 1920, (1, 2) has been known from only six specimens, all collected at fairly high altitudes in the mountains of central Taiwan. The type specimen, sex not specified, was collected on Mt. Noko (Neng-kao-shan 能高山) in October 1918 by Yonetaro Kikuchi. This specimen was deposited in the collections of the Institute of Science of the Government of Taiwan, but is no longer in those collections and is believed to have been lost or destroyed during World War II.

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An additional specimen, also of unspecified sex, collected on Mt. Niitaka, (Yüshan 玉山) was described by Takahashi in 1930 (3). This specimen too has been lost. Two specimens, one male and one female, both collected at Hattsukan (Pa-tung-kuan 八通關) (Mt. Niitaka), were described by Maki in 1931 (4), and were deposited in the collections of the College of Science of Kyoto University. Finally, Wang and Wang in 1956 (5) described one male and one female taken from Makazayazaya (Ma-chia-hsian 瑪家鄉) and Ari-shan (阿里山) respectively. These were deposited in the collection of National Taiwan University.

It is the purpose of this paper to describe variations in scutellation, color pattern, and other aspects of morphology

of *T. gracilis* determined through examination of Maki's specimens from Kyoto University; Wang and Wang's material from Taiwan University; two female specimens collected by Dr. S. Ueno, one on Mt. Hsin-kao-ch'ien (Yüshan-Chienshan 玉山前山) and the other on Mt. Shinbajin, during 1961; and a single sub-adult male collected by one of us (HLK) on Arishan in October 1963.

Collection data and related information concerning extant specimens of *Trimeresurus gracilis* are given in TABLE I. Further pertinent data concerning these specimens are presented in TABLE II.

#### DIAGNOSIS

A short, moderately stout *Trimeresurus*

with a dorsal series of dark, light-edged, confluent blotches forming an irregular, zig-zag pattern; with two series of smaller dark blotches laterally. Venter mostly dark. A broad, dark, temporal band bordered dorsally and ventrally by narrow, white or yellow stripes. Seven to eight supralabials. The second supralabial does not form the anterior margin of the loreal pit, but is in contact with a prefoveal shield. Nine to 11 infralabials. Those of the first pair are divided to form an extra pair of chin shields. Five to eight scales on a line between the supraoculars. Scale rows at mid-body 19, just anterior to tail 17. Scale rows on the neck vary in number from 21-25. Scales on posterior half or third of head faintly keeled. Number

TABLE I  
*Extant specimens of Trimeresurus gracilis*

No.	Sex	Locality	Collector	Date	Present location	Original reference
1	Male	Hattsukan, Taiwan	M. Maki	July, 1925	Zoological Institute, College of Science, Kyoto University, Kyoto, Japan	Maki (1931)
2	Femal	Hattsukan, Taiwan	M. Maki	July, 1925	Zoological Institute, College of Science, Kyoto University, Kyoto, Japan	Maki (1931)
3	Male*	Makazayazaya, Taiwan	Takahashi	Oct., 1924	Dept. of Zoology, National Taiwan University, Taipei, Republic of China	Wang and Wang (1956)
4	Male	Arishan, Taiwan	Takahashi	(Not given)	Dept. of Zoology, National Taiwan University, Taipei, Republic of China	Wang and Wang (1956)
5	Female (Sub-adult)	Mt. Hsin-kao-ch'ien, Hsin-kao Mts., Chia-I Hsien, Taiwan	S. Ueno	1 July, 1961	Tokyo Natural History Museum, Tokyo, Japan	This paper
6	Female	Mt. Shinbajin near Kirittoi, 2,500 meters alt., N. W. of Mt. Nan-hu-ta, I-lan Hsien, Taiwan	S. Ueno	16 June, 1961	Tokyo Natural History Museum, Tokyo, Japan	This paper
7	Male (Sub-adult)	Arishan 2,500 meter alt.	H. L. Keegan	9 Oct., 1963	United States National Museum, Washington, D. C.	This paper

\* Listed as a female by Wang and Wang (1956)

TABLE II  
Some pertinent data concerning extant specimens of *Trimeresurus gracilis*

	Specimen nos.						
	1*	2**	3	4	5	6	7
Total length	465 mm	456 mm	230 mm	438 mm	244 mm	479 mm	312 mm
Length-snout to vent	394 mm	389 mm	197 mm	363 mm	203 mm	395 mm	251 mm
Tail length	71 mm	67 mm	33 mm	75 mm	41 mm	84 mm	61 mm
Ventrals	146	145	148	144	147	143	150
Anal	1	1	1	1	1	1	1
Subcaudals	45	37	42	48	52	46	61
Scale rows	24-21-19-17	23-21-19-17	22-19-7	23-19-17	23-21-19-17	23-19-17	25-21-19-17
Preoculars	2	3	2	2	2	2	2
Postoculars	4	3	3	4-3	3	2-3	3
Suboculars	2	2	2	2	2	1-2	1
Supralabials	7	8	7-8	8	8	7	7
Infralabials	9	9-10	9	9-10	9	9-11	9-10
Scales between supraoculars	7	5	8	7	5	7	6
Small scales in contact with rostrals above	2	2	2	2	2	2	2

\* Skull missing—now in collections of U. S. National Museum.

\*\* Part of tail, missing.

Note: Specimen numbers are taken from TABLE I.

of keeled scale rows at mid-body varies from 11-17. Ventrals 143-150. Anal undivided. Subcaudals divided, 42-61 in number. Tail terminates in a spine.

Dorsal, ventral and lateral views of a male specimen collected on Arishan on 9 October 1963 are shown in *Figs. 1-4*. Details of scutellation of the head of the specimen are shown in *Figs. 5a-5c*.

#### DESCRIPTION

##### *Based on Examination of Seven Extant Specimens*

Rostral slightly wider than high. Canthus rostralis sharp. Six specimens examined had two preoculars. The remaining specimen had three. Postoculars varied in number from two to four. One specimen had 2-3, one 4-3, four had three, and one had four. One specimen had only one subocular, one had 1-2, and the remaining five specimens each had two. Three specimens had seven supralabials

on either side of the head, three had eight, and one had 7-8. Three specimens had nine infralabials, three specimens had 9-10, and one had 9-11. Numbers of scales on a line between the supraoculars varied from five to eight. Three specimens had seven, two had five, one had six, and one had eight. Two small scales in contact with the rostral above. Nasal undivided. Scales on anterior half or two thirds of dorsum of head smooth, scales on posterior portion of head faintly keeled. First pair of infralabials divided to form an extra pair of chin shields. Anterior pair of chin shields large, in contact with first and second infralabials, and showing considerable variation in relative size and shape. These variations are illustrated in *Figs. 6a-6d*. Suboculars crescentic. One or two rows of scales between suboculars and supralabials. Loreal rectangular, longer than wide. Nasal undivided, square, in contact with prenasals, rostral,

first upper labial, and prefoveal. Prefoveal shield, mentioned by Oshima, apparently is formed by the divided second upper labial. This shield is nearly square and is in contact with loreal, first and second supralabials, and lower preocular and subfoveal. On all but one specimen at least those temporals between the eye and the angle of the jaw are smooth. Each specimen examined had a different number of ventrals. These range from 143-150. Only the number 149 is not represented. The average number is 146.1. Subcaudals divided and varying in number from 42-61. The average number is 49. The anal is undivided in all specimens. Number of scale rows at mid-body on all specimens is 19. All specimens have 17 scale rows two head lengths anterior to the vent. In the neck region, two head lengths behind the head, numbers of rows were difficult to determine and counts from 21 to 25 were obtained. These data are shown in TABLE II. Keeled scale rows vary in number and in distinctness of keels. There is no apparent correlation with sex. Rows with smooth scales only are invariably those immediately dorsal to the ventral scutes along the side of the body. When counts were made at mid-body, it was found that three have 17 keeled and 2 smooth rows, three have 15 keeled and 4 smooth rows, and one specimen has 11 keeled rows and 8 smooth rows. Apical scale pits are lacking. Percent of total length represented by the tail varies from 15.27% to 19.3%. There is no apparent correlation with sex.

The ground color of the dorsum is grayish-brown. The dorsal pattern superficially resembles that of *T. elegans* and *T. mucrosquamatus* in that it consists of a series of confluent blotches, which may in places be saddle-shaped and together give the appearance of a wide irregular, zig-zag band which extends the entire length of the body. Although occasional blotches may be separate, this is unusual and, because of this, it is impossible to count them accurately. This longitudinal

series of markings is dorsally brown, laterally blackish, and is narrowly edged with white or yellowish green. Below each lateral "arm" of the dorsal series is a single or double black, white-edged spot. In some instances these may be confluent with lateral extensions of the dorsal marking. Alternating with these, and extending dorsally only on the outermost two or three scale rows, is a series of blackish spots which extend ventrally to the margins of the ventral scutes. These spots too are edged with white or yellowish green.

The ventral surface is black laterally, grayish medially with indistinct white or yellowish markings.

The dorsal surface of the head is brown with small, irregular, yellowish markings. The most distinctive feature of the lateral aspect of the head is a broad, black band which extends from the eye posteriorly to the neck. This band is edged dorsally with a bright yellowish-orange stripe, and ventrally with a similar white stripe. Both of these extend posteriorly onto the neck. Coloration of the supralabials is variable. Ventral portions of the third and fourth supralabials are black; upper portions of these scales are yellow or white. The posterior supralabials are included in both the wide lateral head band and its light ventral edging. Infralabials are black with yellow or white lateral markings. Extent of variation in head markings is shown in *Figs. 7a-7c*. The undersurface of the head is black with small, irregular, lighter markings.

In the only living specimen available for study, the width of the head, at its widest point, was almost exactly two-thirds of the length. While similar measurements were obtained from preserved specimens, some of these may have been slightly distorted, and in one the skull was missing.

#### DISTINGUISHING CHARACTERISTICS

*Trimeresurus gracilis* is unique among East Asian species of the genus in that

the first infralabials are divided to form an extra pair of chin shields. In addition, it may be distinguished from *T. monticola*, probably its most closely associated species in nature, by its dorsal pattern, lower scale row counts, keeled scales on the head and neck, and lack of apical scale pits. It may be separated from *T. mucrosquamatus*, the only other Taiwan snake with which it might be confused, by the condition of the second snpralabials. In *gracilis* this does not form the anterior border of the loreal pit. In *mucrosquamatus*, and as a matter of fact in all other *Trimeresurus* of Taiwan and the Ryukyu Islands, except *monticola* the second supralabial forms the anterior border of this facial pit.

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#### LITERATURE CITED

1. OSHIMA, M. 1920. Notes on the Venomous Snakes from the Islands of Formosa and Riu Kiu. *Ann. Rept. Inst. of Sc., Government of Formosa*. 8: 10-11 (in English), and 178-179 (in Japanese).
2. OSHIMA, M. 1943. *The Venomous Snakes of the Far East*. Hokuryukan, Publ. Tokyo. pp 252-256. (in Japanese).
3. TAKAHASHI, S. 1930. *Terrestrial Snakes in Japan*. Sunyodo, Publ. Tokyo. Sp. No. 54. figure 54, plate 50 (in Japanese).
4. MAKI, M. 1931. *A Monograph of the Snakes of Japan*. Dai-Ichi Shobo, Publ. Tokyo. pp 218-220, figures 146-147.
5. WANG, C. and Y. H. M. WANG. 1956. The Reptiles of Taiwan. *Quart. J. Taiwan Museum*. 9: 79-80.

Figures 1-5 all of a male specimen of *Trimeresurus gracilis* collected on Arishan on 9 October 1963 by H. L. Keegan.

Figure 1. Dorso-lateral view of living specimen.

Figure 2. Dorsal view.

Figure 3. Ventral view.

Figure 4. Lateral view of head.

Figure 5. Scutellation of head of *T. gracilis*.

a. Dorsal view.

b. Lateral view.

c. Ventral view.

Figure 6. Chin shield variation in *T. gracilis*.

a. Male from Mt. Niitaka (Yüshan) collected by M. Maki.

b. Female from Mt. Hsin-kao-chi'en collected by Takahashi.

c. Male from Makazayazaya collected by Takahashi.

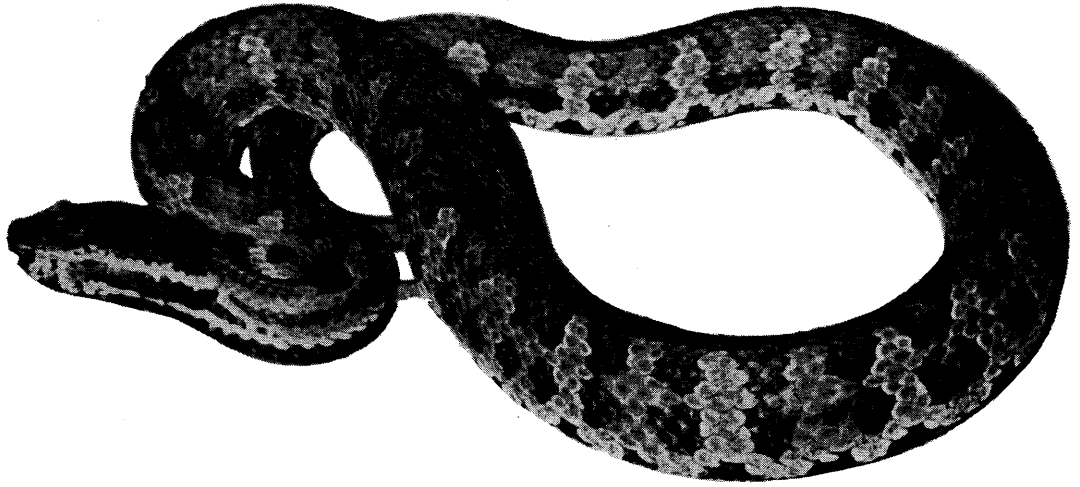
d. Male from Arishan collected by Takahashi.

Figure 7. Variation in lateral head and neck markings in *T. gracilis*.

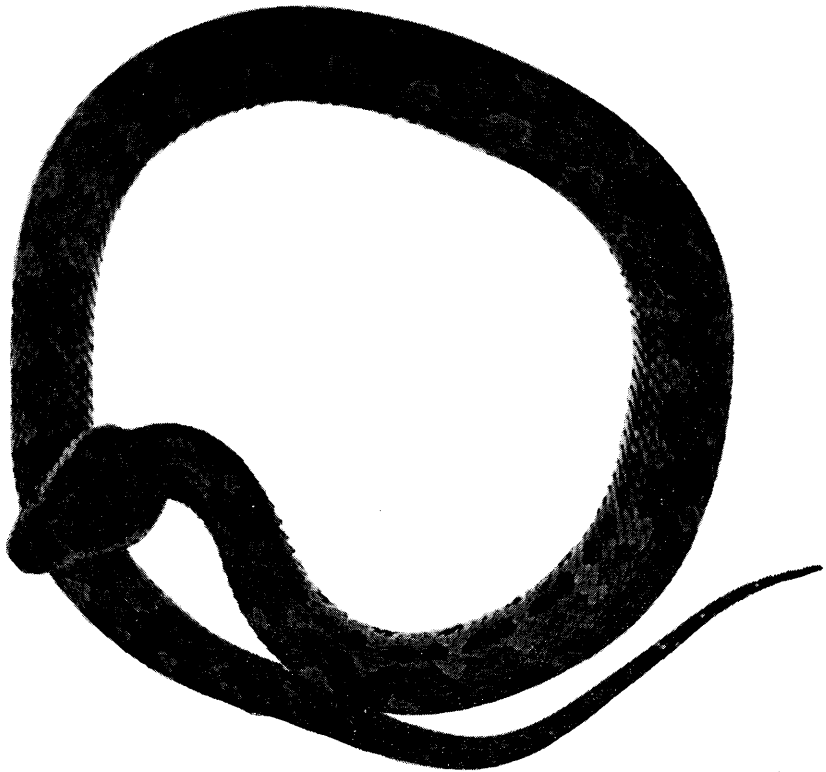
a. Male from Arishan collected by Takahashi.

b. Male from Arishan collected by H. L. Keegan.

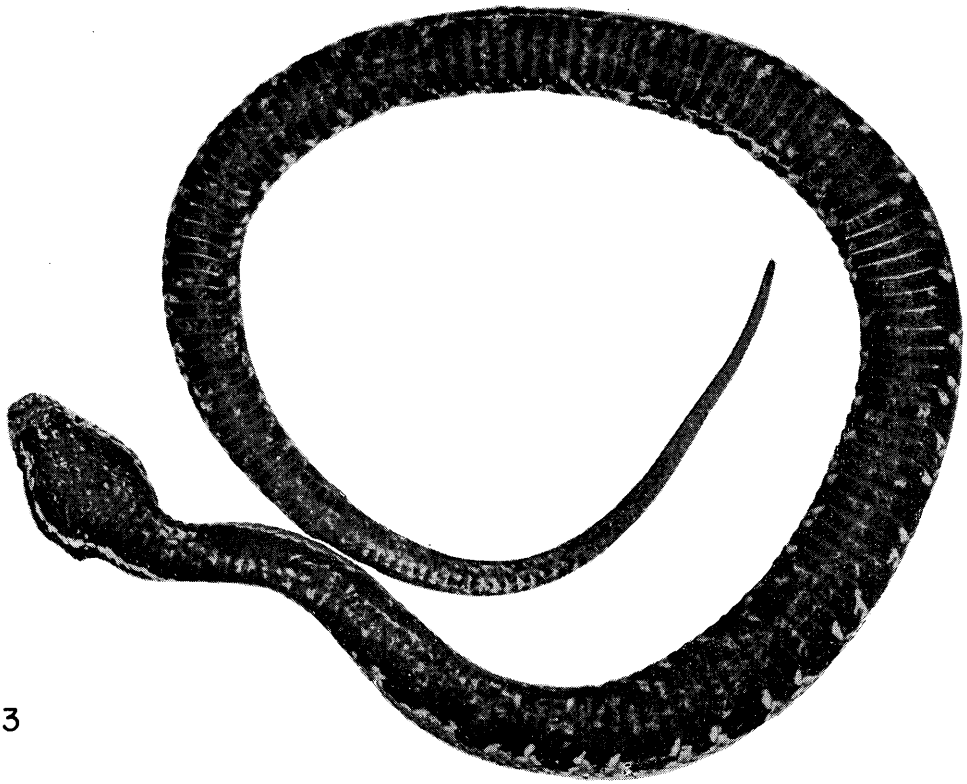
c. Female from Mt. Hsin-kao-chi'en collected by S. Ueno.



1



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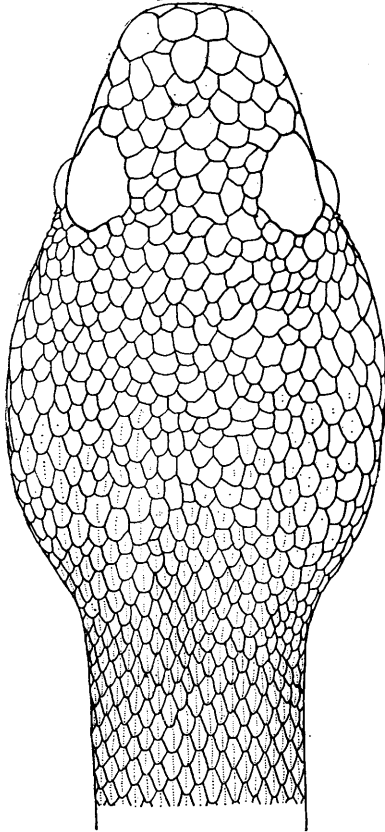


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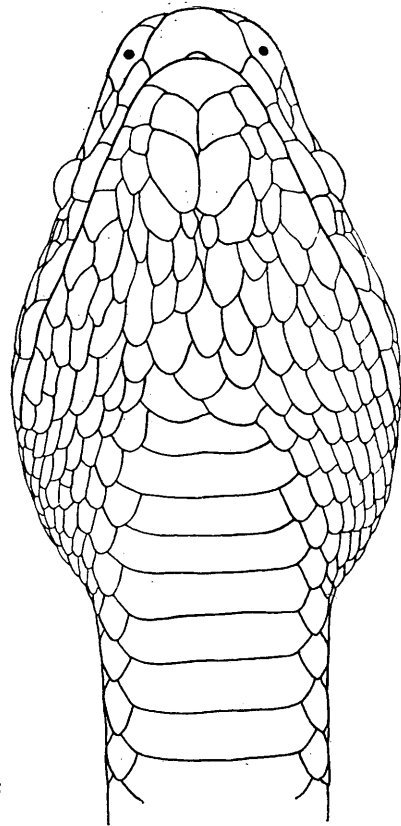


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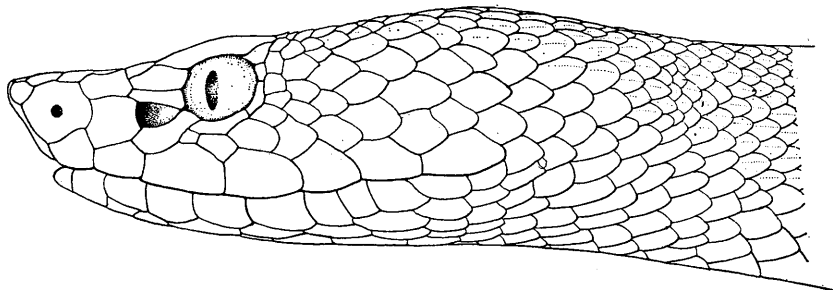




5a



5c



5b

