

The Reptiles and Amphibians of Korea

By FREDERICK A. SHANNON

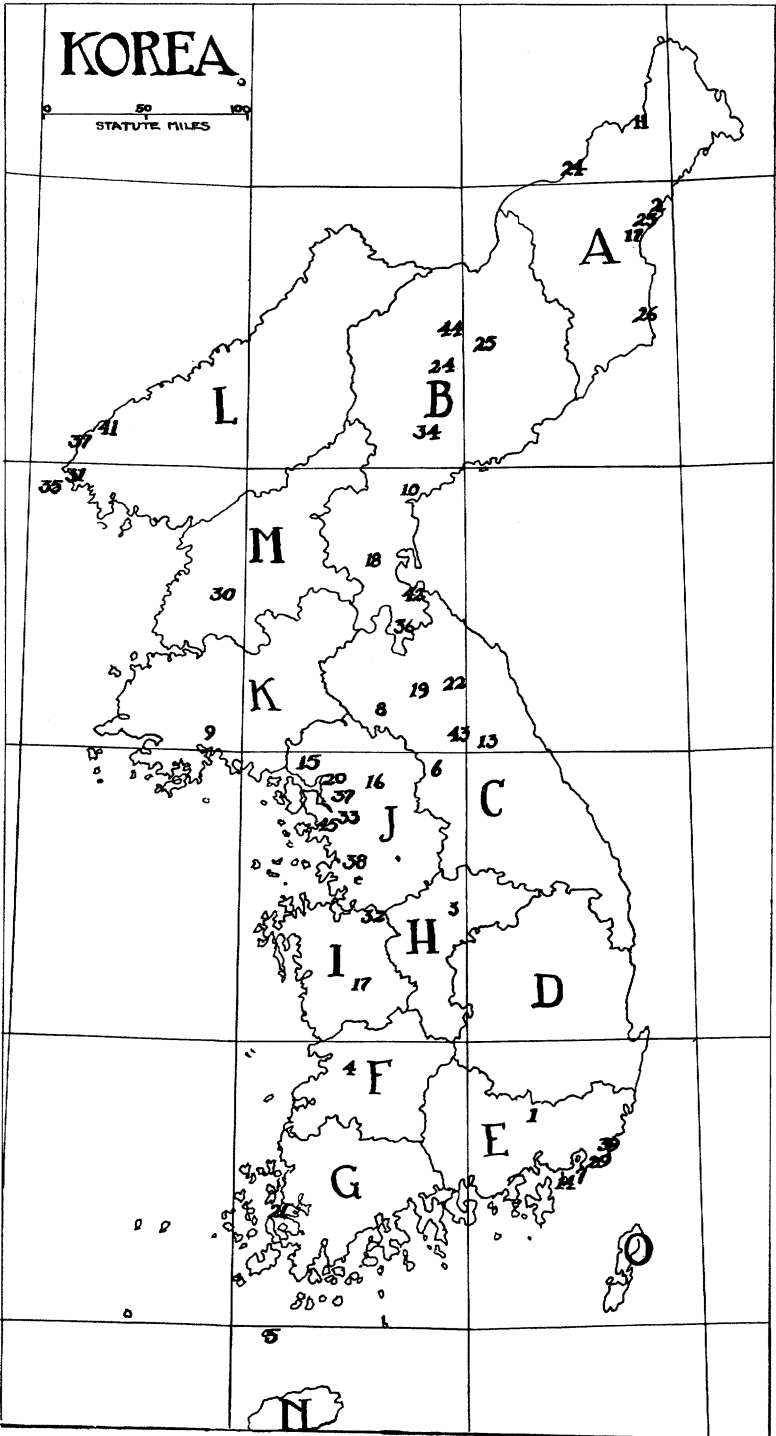
The author was stationed in Korea from August 10, 1951, to July 22, 1952, as surgeon for the 194th Engineer Combat Battalion. During this interval enough time was secured free from other duties to accumulate over 500 herpetological specimens representing 20 different species. Large numbers of undetected mines along the courses of mountain streams made collecting in these localities a rather foolish endeavor, so most of the material was secured from hillsides, plains, rice paddies, and the more frequented waterways where somewhat more careful mine-sweeping activities were practiced. In addition about 855 specimens of Korean reptiles and amphibians were examined from the collection of the California Academy of Sciences.

In this paper, thirty-seven species and subspecies of reptiles and amphibians are recognized, of which two are sea snakes and two are sea turtles. While a few may be later added or deleted, the above unimposing figure must not be far from the actual total.

A glance at a map of Asia will reveal Korea to be a rather small peninsula, leading one to expect that the herpetofauna would be nothing but an extension of Manchurian populations. This is largely true, as 25 of the 33 land species are found in both Korea and Manchuria. Two additional species are known only from their type localities, near Seoul, and may not be endemic. Of the remaining six species, two (*Rana*) are endemic, two (*Geoclemmys reevesi* and *Scincella reevesi*) are found both in China and Korea but are not definitely known from Manchuria, and two (*Gekko japonicus* and *Takydromus tachydromoides*) are doubtful invaders from Japan.

The mountains of northern and eastern Korea are extensions of the ranges in Manchuria and become progressively lower in altitude from north to south. The vegetation of the mountainous regions is similar to that of Manchuria and is classified by Berg (1950: 60, 322), as belonging to the Manchurian Broadleafed Forest, a branch of the Temperate Deciduous Forest. The characteristic cover of the lower and middle regions of the mountains is Korean pine (*Pinus koraiensis*), Amur linden (*Tilia amurensis*), Manchurian ash (*Fraxinus mandshurica*), Manchurian fir (*Abies holophylla*), Khingan fir (*Abies nephrolepis*), Mongolian oak (*Quercus mongolica*), mono maple (*Acer mono*), Scotch elm (*Ulmus montana heterophylla*) and others. Higher in the mountains the deciduous forest and Korean pine give away to fir and Yeddo spruce (*Picea jezoensis*). Flood-plain forest is similar to that described for the lower mountain slopes and contains Manchurian walnut (*Juglans mandshurica*) and Mongolian poplar (*Populus suaveolens*) as well. This forest is similar to European mixed forests and the deciduous forests of eastern United States, differing in closely related species.

In Manchuria, as in the Caucasus, southern Europe, and eastern United States, relict faunas and floras from Tertiary glaciation represent the more widespread pre-glaciation species. The Manchurian Broadleafed Forest was the successor to the East Asian Element of the Hardwood-Deciduous



Complex (Arcto-Tertiary) of Axelrod (1950: 7), the other elements being the East American and the Caucasian.

Okada (1931: 2) lists the northern part of Korea, Hokkaido, Sakhalin, and the Kuriles as being in the Siberian Subregion of the Palearctic Region. He lists the southwestern part of Korea and the rest of Japan as being parts of the Manchurian Subregion.

One of the most frustrating problems in the attempt to correctly allocate Korean specimens has been the liberal use in the literature of numerous synonymous names for almost every Korean locality. These names are in romanji, Japanese, in Korean (phonetically transliterated, of course, in an intriguing variety of manners), and in a number of other dialects of bastard origin beyond personal comprehension. The author has done little toward consistency in choice, but a map has been prepared with the localities mentioned in the paper recorded as numerals (See Text Fig 1). The provinces and two important islands are recorded as letters. The legend for the map also includes localities that could be traced only to province and a few that could not be allocated at all. Occasional localities have been determined with considerable hesitation. Thus Zae-zu-to was interpreted to refer to Ch'uja Do, off the coast of Cholla Namdo. This interpretation may be incorrect as to locality, although correct as to province. Slevin's paper (1925) on Korea refers to specimens collected by Thompson at "Sagawansa." Thompson was at "Sagawansa" on June 8, 1911, after collecting at Wonsan on June 7. He did no collecting on June 9 and could have done little with his time except to cross the peninsula to the southwest. From the speed with which this was done he must have used the railroad. On July 10 he was collecting at Ch'ongju (Ch'ungch'ong Pukto). The only likely locality along this hypothetical route which could be correlated with "Sagawansa" is Songhwon in southern Kyanggi Do. In some instances difficulties have been encountered in duplication or resemblance of names. There is a "Ch'ongju" in Ch'ungch'ong Pukto, another in P'yongan Pukto, and a Chonju in Cholla Pukto.

KOREAN PROVINCES

- A. Hamgyong Pukto (Kankyo Hokudo)
- B. Hamgyong Namdo (Kankyo Nando)
- C. Kangwon Do (Kogen Do)
- D. Kyongsang Pukto (Keisho Hokudo)
- E. Kyongsang Namdo (Keisho Nando)
- F. Cholla Pukto (Zenra Hokudo)
- G. Cholla Namdo (Zenra Nando)
- H. Ch'ungch'ong Pukto (Chusei Hokudo)
- I. Ch'ungch'ong Namdo (Chusei Nando)
- J. Kyonggi Do (Keiki Do)
- K. Hwanghae Do (Kokai Do)
- L. P'yongan Pukto (Heian Hokudo)
- M. P'yongan Namdo (Heian Nando)
- N. Quelpart Island
- O. Tsushima Island

Fig. 1. Map of Korea: lettered provinces and numbered collecting localities correspond to list in text.

KOREAN LOCALITIES

1. Ch'ongnyong (Chang-won)
2. Ch'ongjin (Seishin)
3. Ch'ongju (Seishu)
4. Chonju (Zun-Zu, Zan-Nu)
5. Ch'uja Do (Shushi to, Zae-zu-to)
6. Ch'unch'on (Shunsen)
7. Choryong-do
8. Ch'orwon (Tetsugen)
9. Haeju (Kaishu, Hae Zu, Hap-su)
10. Hamhung (Kanko, Sei-ko-shin)
11. Hoeryong (Kainei, Kwainei)
12. Inch'on
13. Inje
14. Kadok-to (Ka-tuk-to) Island north of Koje-do.
15. Kaesong (Songdo, Kaijo)
16. Kapyong
17. Konju (Koshu)
18. Kowan (Kangozan, also Kongo Peak at Kowan)
19. Kumhwa
20. Kyongsong (Kyojo, Kyung-sung)
21. Mokp'o (Moppo)
22. Mundung-ni
23. Munsan-ni
24. Musan Pass—on Yalu River
25. Nanam (La Nam, La Tlam)
26. Po'ha-dong (Pochondong, Hosando, Hozando)
27. Puksubaek-san (Buk-ke Su)
28. P'ungsan
29. Pusan (Fusan)
30. P'yongyang (Heijo)
31. Sampoto
32. Seikan
33. Seoul (Kyongsong, Keijo)
34. Shoko
35. Sin-do (Su-un-to, Suiunto, Shin-to)
36. Sin'gosan (Shinkozan)
37. Sinuiju (Shingishu, Shi-i-zu)
38. Suigen (Chicksan, Chickusan, Keidi, Yonggu, Yoshu, Suwon, Sung-Fan)
39. Tongnae (Torai)
40. Uijongbu (Uijonbu)
41. Uiju (Ujo)
42. Wonsan (Genzan, Gensan)
43. Yanggu
44. Yangp'yong-ni
45. Yongdung-Po (Eitoho)
46. Yongamp'o (Ryuganpo, Ryugampo). Locality too close to 31 to plot.

LOCALITIES IDENTIFIABLE ONLY TO PROVINCE

Kwang-nung: Kyonggi Do

Mt. Kwanak: Kyonggi Do

Mt. Zung-bang: Hwanghae Do

Paek-a: Kyonggi Do (Island)

Pu-Ryong: Hamgyong Namdo

Ra-Buk or La Buk: Hamgyong Pukto

Sagawansa: Probably Songhwon in southern Kyonggi Do.

LOCALITIES UNIDENTIFIABLE EVEN TO PROVINCE

Komazan

Rahoku

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KEY TO THE REPTILES AND AMPHIBIANS OF KOREA

(Adapted in part from Pope, 1935 and 1940)

Key to the Caudata (Hynobiidae)

- 1a. Lungs present; no claws; vomerine teeth in V-shaped series.....
 *Hynobius* (2).
 b. Lungs absent; claws always present in juveniles; teeth in nearly
 straight line..... *Onychodactylus fischeri*.
 2a. Five toes; pattern basically black mottled with light brown; no light
 dorsal stripe..... *Hynobius l. leechi*.
 b. Four toes; light dorsal band present..... *Hynobius keyserlingi**

Key to the genera and species of Salientia

- 1a. Abdomen vividly marbled with brick red and dark (may be yellow
 in preservative) *Bombina orientalis*.
 b. Abdomen may be varicolored, but not as above..... 2.
 2a. A large dermal gland (parotoid) present on each side of body be-
 hind head; skin warty and rough..... *Bufo bufo gargarizans*.
 b. Skin rough or smooth, but parotoid glands absent..... 3.
 3a. Form spherical; head minute, much narrower than (less than 1/3)
 body width..... *Kaloula borealis*.
 b. Form elongate or broadened, but not spherical in contour; head
 elongate, much wider than 1/3 body width..... 4.
 4a. Intercalary cartilage present in fingers; terminal discs considerably
 wider than phalanges..... *Hyla arborea japonica*.
 b. Intercalary cartilage absent; phalangeal tips not as wide as phalanges
 *Rana* (5).
 5a. Elongate dorsolateral ridges absent; dorsum extremely rough with
 rugosities consisting of short, elongate ridges..... *Rana rugosa*.
 b. Elongate dorsolateral ridges present; dorsum rough or rather
 smooth 6.
 6a. Heels not or barely overlapping; canthus rostralis indistinct..... 7.
 b. Heels broadly overlapping; canthus rostralis distinct..... 8.
 7a. Narrow dorsolateral fold; short elongate ridges between folds
 *Rana nigromaculata*.
 b. Extremely wide dorsolateral fold; pustules distinct or indistinct be-
 tween folds, but not elongate..... *Rana plancyi chosonica*.
 8a. A pair of paravertebral stripes (may be broken but always present);
 vocal ostia and vocal sacs absent in males; dorsolateral ridges nearly
 straight or flaring slightly behind head..... *Rana amurensis coreana*.
 b. Paravertebral stripes absent: vocal ostia and vocal sacs present in
 males; dorsolateral ridges usually with considerable flare in tym-
 panal region..... *Rana temporaria dybowskii*.

Key to the Turtles.

- 1a. Large, with anterior extremities modified into large, broad paddles;
 found in the sea..... 2.
 b. Small, with anterior extremities not modified into large, broad pad-
 dles; never found in the sea..... 3.
 2a. Limbs clawless; carapace with seven prominent longitudinal ridges
 *Dermochelys coriacea schlegeli*.

*No definite records from Korea, but probably present in the northern part of the country.

- b. Limbs with one or more claws; carapace without seven longitudinal ridges.....*Chelonia mydas japonica*.
- 3a. Shell covered with horny shields.....*Geoclemmys reevesi*.
- b. Shell covered with soft skin.....*Amyda sinensis*.

Key to the Lizards.

- 1a. No large, symmetrical shields on dorsum of head; eyelids immovable*Gekko japonicus*.
- b. Large, symmetrical shields on dorsum of head; eyelids movable.... 2.
- 2a. Ventral scales cycloid, resembling those of sides and back; femoral and inguinal pores absent..... 3.
- b. Ventral scales squarish, sharply differentiated from lateral; femoral or inguinal pores present..... 4.
- 3a. Lower eyelid opaque.....*Eumeces coreensis*.
- b. Lower eyelid with an undivided, transparent disc.....*Scincella reevesi*.
- 4a. Dorsal scales granular, not keeled.....*Eremias argus*.
- b. Dorsal scales strongly keeled, not granular.....*Takydromus* (5).
- 5a. Three pairs of chinshields.....*Takydromus auroralis*.
- b. Four pairs of chinshields..... 6.
- 6a. One femoral pore on each side.....*Takydromus wolteri*.
- b. More than one femoral pore on each side..... 7.
- 7a. Two (rarely three) femoral pores on each side, not more than six rows of dorsal scales.....*Takydromus tachydromoides*.
- b. Three or four femoral pores on each side, six or eight rows of enlarged dorsal scales..... 8.
- 8a. Three femoral pores on each side, eight rows of enlarged dorsal scales.....*Takydromus amurensis*.
- b. Four femoral pores on each side, six (occasionally seven) rows of enlarged dorsal scales.....*Takydromus kwangakensis*.

Key to the Snakes.

- 1a. Tail laterally compressed; marine.....*Hydrophiidae* (2).
- b. Tail round; not marine..... 3.
- 2a. Ventrals small but distinct throughout, not divided by a median suture.....*Hydrophis melanocephalus*.
- b. Ventrals much reduced in size or absent or divided by a median suture.....*Pelamis platurus*.
- 3a. Maxillary short, vertically erectile, bearing long perforated fangs.. 4.
- b. Maxillary horizontal, not erectile; fangs absent..... 5.
- 4a. Loreal pit present.....*Ancistrodon halys brevicaudus*.
- b. Loreal pit absent.....*Vipera berus sachalinensis*.
- 5a. Color black with red crossbands; loreal usually enters eye.....*Dinodon rufozonatum*.
- b. Color other than black with red crossbands; loreal separated from eye by preoculars..... 6.
- 6a. A conspicuous, black-edged, yellow, middorsal stripe extending from head throughout length of body; scales in 17 rows around middle of body.....*Zamenis spinalis*.
- b. No middorsal yellow stripe; scales in more than 17 rows around middle of body..... 7.
- 7a. Scales strongly keeled; scale rows 19..... 8.
- b. Scales weakly keeled or smooth; scale rows more than 19..... 9.

- 8a. Ground color essentially green with narrow red interspaces anteriorly; preoculars two.....*Natrix tigrina lateralis*.
 b. Ground color not green with red interspaces; one preocular.....*Natrix vibakari ruthveni*.
- 9a. Scales in 21 rows at midbody; scales smooth.....*Elaphe rufodorsata*.
 b. Scales in more than 21 rows at midbody; scales weakly keeled.....10.
- 10a. Tail with four black and four white longitudinal stripes.....*Elaphe taeniurus*.
 b. Tail without four black and four white longitudinal stripes.....11.
- 11a. Scales in 25 (rarely only 23) rows; ventrals usually less than 205; narrow crossbands on body.....*Elaphe dione*.
 b. Scales in 23 or 21 rows; ventrals usually 206 or more; blotches, if present, are wide.....12.
- 12a. Adults with dorsal blotches faint, or dorsum uniformly brown; postocular stripe indistinct or absent; ventral spotting reduced or absent.....*Elaphe schrenki anomala*.
 b. Adults with contrasting dark dorsal blotches; postocular stripe distinct; profuse ventral spotting (juveniles cannot be easily distinguished from 12a).....*Elaphe schrenki schrenki*

Family Hynobiidae

Hynobius leechi Boulenger.

1887. *Hynobius leechii* Boulenger, Ann. Mag. Nat. Hist., ser. 5, v. 19, p. 67. Type: Brit. Mus. 86.12.8.14. Type locality: "Gensan" (Wonsan), Korea.

One hundred forty-one specimens from Pusan were examined at the California Academy of Sciences. The basic pattern is black mottled with light brown dorsally. There is no sign of a caudal fin present in adults.

Stewart (1953: 148) has collected the salamanders from 5.8 miles SW of Inje, where they were taken from a stream pool. Other localities from the literature are Suigen, Kongju, and Wonsan.

It seems likely that *Hynobius keyserlingi* should be added to the fauna of Korea. Professor Cho of the University of Seoul states that this amphibian does penetrate Korea from Manchuria.

Onychodactylus fischeri (Boulenger).

No specimens of this species of clawed salamander were taken in the field. Four adults and 220 juveniles from Wonsan belonging to the California Academy of Sciences were examined by the author. Professor Cho (letter) states that the salamander has also been collected from Haeju.

Numerous juveniles in the CAS collection have a broad, cream-colored dorsal stripe. In a few the cream is longitudinally divided by a line of dark brown vertebral pigmentation. Claws, absent in all four adults, were invariably present in the juveniles.

Family Discoglossidae

Bombina orientalis (Boulenger).

1890. *Bombinator orientalis* Boulenger, Ann. Mag. Nat. Hist., (6) V, p. 143. Type locality: Seoul, Korea.

Over 100 specimens, largely from Seoul, from 50 miles NNE of Seoul, and from the vicinities of Kumhwa and Ch'orwon were taken in 1951 and 1952. The favorite location for these weak-bodied little am-

phibians was vegetation-choked marshes containing a few inches of water. They were common in rice paddies and could be found in the grass margining larger bodies of quiet water but were not found near running water. Stewart (1953: 146) found that they were common along the edges of streams near Inje. They were observed in amplexus in late April and early May and again in late August and early September. The copulating couples were floating in shallow water, although many found buoyant support in the thick vegetation or on the shallow bottom of their marsh or pond. In their habitat they were abundant and could be collected in unlimited numbers. Eggs and tadpoles were observed in late August.

An abundant milky secretion given off by secretory glands in the rough skin of these salamanders is extremely irritating to lips, nostrils, and eyes. It exerts a histaminic effect with a profuse consequent vasomotor rhinitis accompanied by lachrimation. Several *R. n. nigromaculata* carried in the same bag with the *Bombina* were found to be dead after the lapse of an hour.

The exact localities of 66 specimens of the above series are: 8 mi E Ch'orwon, FAS 4373-76; 16 mi S Ch'orwon, FAS 4312, 4316, 4319-4344, 4473; 9 mi E Kapyong, 4313-15, 4318, 4346-48, 4350-51, 4353-56, 4358-64, 4368-72; 4 mi E Kapyong, 4357; near Kapyong, 4317, 4344, 4349, 4352; 23 mi. SE Kumhwa, 4365-67. The toads were seen until the middle of October, 1951. The first to be collected in 1952 was on April 29. Other localities from which *Bombina* has been collected are: 5.8 mi SW Inje, 7 mi NNE Yanggu, Pusan, Hoeryong, Nanam, Musan, Ch'ongyong, Tongnae, Kadok-to, Chonju, Kaesong, Suigen, Ch'uja Do.

Family Bufonidae

Bufo bufo gargarizans Cantor.

1842. *Bufo gargarizans* Cantor, 1842, Ann. Mag. Nat. Hist., (1) 9: 483. Type locality: Chusan Island, China.

1869. *Bufo vulgaris* var. *asiatica* Steindacher, 1869, Novara Exped. Zool., 1, Amph., p. 39. Type locality: Shanghai, China.

Nine specimens (FAS 4303-11) were collected 8 miles south of Ch'orwon during May and June, 1952. Another (FAS 4377) from Seoul was presented by Professor Cho.

The toads, far from abundant, were taken hopping around the hills near camp. During a heavy rain they would occasionally enter the tents in an attempt to avoid the excessive moisture.

Schmidt (1927: 557) believes that *gargarizans* of Chusan Island is the same as the mainland population known as *asiatica*. This has been supported by numerous other authors, and it seems likely that *asiatica* should be regarded only as a junior synonym of *gargarizans*.

Okada (1931: 47) states that the toad is not native to Korea but has been widely introduced.

The toad has also been collected from P'yongyang, Tongnae, Munsan-ni, Wonsan, Kongju, and Pusan.

Family Hylidae

Hyla arborea japonica Guenther.

1858. *Hyla viridis* var. *japonica* Guenther, Cat. Batr. Sal. Brit. Mus., p. 81.
1858. *Hyla arborea* var. *japonica* Guenther, Cat. Batr. Sal. Brit. Mus., p. 109. Type locality: Japan.
1887. *Hyla arborea* var. *savignyi* Boulenger, Ann. Mag. Nat. Hist., (5), 19, p. 67 (part). From Gensan (Wonsan), Korea.
1887. *Hyla stephensi* Boulenger, Proc. Zool. Soc. London, p. 579, pl. 51, fig. 1. Type locality: Port Hamilton Island, Korea.
1888. *Hyla chinensis* var. *immaculata* Boettger, Ber. Senckenberg Naturf. Ges., Abh., p. 189. Type locality: Shanghai.
1918. *Hyla arborea ussuriensis* Nikolsky, Amphibia (in *Faune de la Russie et des Pays limitrophes*) 309 pp., pl. 1-4, 62 figs., Petrograd.
1931. *Hyla arborea stephensi* Okada, The tailless batrachians of the Japanese Empire, pp. 63-64, Seoul, Korea.
1940. *Hyla arborea immaculata* Pope and Boring, Peking Nat. Hist. Bull., v. 15, pt. 1, p. 35.

Over 50 of these little *Hyla* (37 of which are here reported) were taken from Seoul (FAS 4576-4582); from 41 mi NNE of Seoul (FAS 4557-4575); from the vicinity of the base camp 8 mi. S Ch'orwon (FAS 4556, 4583-92). Following a light rain on the night of May 18, 1952, a series of *Hyla* came from the green hills of the Ch'orwon camp and were trapped in foxholes between the hills and the stream below. The following passage is taken directly from field notes:

"Grass green above and white below, with blood-colored venter around posterior portion of abdomen and ventral surfaces of femur. Blotching above greyish-black, abundant to nearly absent. Brownish-black stripe from nose thru eye to mid-body, bordered above with white. Dark femur banding strong to nearly absent. Green ground color may be replaced by gray."

Between 8:30 and 10:00 P.M. on the night of June 29, 1952, *Hyla* were heard calling from a rice paddy near the Ch'orwon camp. The call consisted of a "rik-rik-rik-rik," repeated 7 or 8 times in a sharp treble and followed by a considerable rest. It was raining and had been raining for the preceding 36 hours. The amphibians were found clinging to the stems of grass or other low-growing vegetation in the shallow water or in damp matted vegetation just above the water.

Description (FAS No. 4574, adult male from 8 mi S Ch'orwon, collected June 29, 1952). Head broader than long; tympanum round, distinct, diameter slightly greater than $\frac{1}{2}$ that of eye, superior border buried beneath a distinct tympanal fold starting at posterior corner of eye to angulate behind tympanum, terminating slightly behind corner of mouth and above insertion of arm; canthus distinct; nostrils just beneath canthus, distinct, open dorsally; snout rounded. Tongue fleshy, rounded, attached in front, free to sides and rear, notched posteriorly; vocal ostia elongate, extending from side of tongue posteriorly to near angle of mouth; vomerine teeth in two patches angulating slightly posteriorly, closer to each other than choanae; choanae large, distinct, lying on each side of vomerine teeth.

Skin of dorsum loose, smooth, leathery; a few discrete, large pustules behind angle of mouth and above anus; anus transverse and dorsally placed. A slight but distinct fringe of web at base of all fingers; digital formula 3-4-2-1; thenar tubercle elongate, distinct; hypothernar and palmar tubercles indistinct, tending to be replaced by strongly developed pustules present over the whole palm; subarticular tubercles single, strongly developed; discs distinct but only slightly wider than toes. Legs separated by two millimeter gap when shanks are adpressed to thighs; extended tibiotarsal joint to middle of eye, tarsal fold strong, extending from medial metatarsal tubercle to ankle; medial metatarsal tubercle elongate, distinct; lateral metatarsal tubercle punctuate; sole strongly pustular; subarticular tubercles single, distinct; digital formula 4-3-5-2-1; toes slightly less than $2/3$ webbed; discs little wider than toes.

Ventral surfaces pebbly, especially on chest, abdomen, and femoral surfaces and beneath anus. Pebbly surfaces of chin give away to a slightly smoother, loose, prominent vocal pouch.

Measurements of specimen in millimeters. Snout-vent, 33; head width, 12.8; head length, 10.2; diameter of tympanum, 2.4; diameter of eye, 4.2; from eye to nostril, 3.4; internasal, 3.1; interorbital, 4.3; vocal ostia, 4.5; diameter of 3rd finger disc, 1.5; smallest diameter of 3rd finger, 1.1; femur, 15.7; tibia, 16.1; foot, 14.5; inner metatarsal tubercle length, 2.0; length of first toe, 3.8.

Color of specimen in alcohol. Dorsal ground color dark bluish-gray with large, roughly paired, darker, irregularly shaped dorsal blotches; dark spot beneath eye on upper labium; dark stripe bordered above with light from nostril to eye, and from eye to above tympanum, thence to side of body where it gradually tapers out before groin. Pigment on thighs confined to a dark, quite distinct, narrow band; thighs banded in the sense that the bands are confined to the width of the longitudinal femoral band; arms banded; tibial and tarsal surfaces banded. Ground color of venter and sides cream, with brown staining evident on chin and sides.

Variation in 33 other specimens from near Ch'orwon and from Seoul. Ten of these *Hyla* had an inner metatarsal tubercle in excess of 66% of the length of the first toe, the average tubercle length being 60% (43.5-75.0); outer metatarsal tubercle present in all; 5th toe from $1/3$ - $2/3$ webbed, average slightly over $1/2$; fingers webbed at base in all. There is a considerable variation in color pattern, but it should be remembered that specimens in formaldehyde may almost completely lose the dorsal spots which may be quite evident in living specimens. The dorsal spots may vary considerably in intensity on the same specimen, depending upon the amount of exposure to light. The above series varied from specimens having distinct spots with banding on the arms and legs and with lateral stripes to those lacking in all these characters. Pattern reduction was not necessarily consistent; some had arm and leg banding only, spots only, or lateral bands only, as well as every conceivable variation in pattern structure. The lateral band was usually present.

If the above remarks have been painfully elaborate, they will at least indicate why it has been found necessary to apply the same name to the Chinese, Japanese, and Korean populations. *Hyla stephensi* was described from Port Hamilton, just to the south of Korea, in 1887 as occurring with *Hyla a. japonica*. The only distinguishing characteristic of Boulen-

ger's (*op. cit.*) description was "inner metatarsal tubercle large and very prominent, oval, about two-thirds the length of the inner toe." As may be seen above, this character is useless in differentiating the Korean population. Boulenger later (1890) records two specimens from the Ussuri River as *stephensi*, stating that the species "is easily distinguished from *H. arborea* by the much larger and more prominent metatarsal tubercle." The length of the first toe is given as 4 mm. and that of the inner metatarsal tubercle as 2.5 mm. (FAS 4559 from 46 mi NE Seoul has a first toe length of 3.8 mm. and a tubercle length of 2.5 mm.) Unfortunately, the type of *H. stephensi* is so desiccated that it is useless. Pope and Boring (*loc. cit.*) state that *Hyla arborea immaculata* occurs in northern China as well as in the Shanghai Valley where it was originally described in 1888. They state that *immaculata* from "Anhui have a color pattern more closely resembling that of individuals from Germany than do Japanese specimens." Unfortunately, they do not state in what way it is different and *immaculata* may be far from immaculate, whereas specimens from both Korea and Japan may be quite lacking in dorsal pattern. Pope and Boring feel that *stephensi* cannot be differentiated from *immaculata* and, apparently due to a *lapsus* since *stephensi* was described first, throw *stephensi* into the synonymy of *immaculata*. They also synonymize Nikol'sky's (1918) *Hyla arborea ussuriensis* from the Russian Coast Province adjacent to Manchuria. It is doubtful if Boettger (1894) is correct in stating that *japonica* has toes $\frac{1}{2}$ and $\frac{1}{4}$ webbed, whereas *immaculata* has no finger webbing and toes $\frac{1}{4}$ webbed.

While good characters may exist which will serve to subspecifically differentiate these populations, I have no alternative to listing all as *H. a. japonica* until such characters have been adequately demonstrated.

These little tree toads have also been collected from Munsan-ni, Pusan, Wonsan, Kongju, Hamhung, Wonsan, P'yongyang, Rahoku, Hoeryong, Seoul, Tongnae, Suigen, Pyongyang, Nanam, and La-Buk.

Family Microhylidae

Kaloula borealis (Barbour).

- 1908. *Cacopoides borealis* Barbour, Bull. Mus. Comp. Zool., Harvard, 51, p. 321. Type locality: Antung, Manchuria.
- 1913. *Callula tornieri* Voigt, Sitzber. Ges. Natf. Fr. Berlin, p. 219. Type locality: Korea.
- 1934. *Kaloula borealis* Parker, A monograph of the frogs of the family Microhylidae, p. 82.

These microhylids were dug out of mammal burrows in the vicinity of Yongdung'po, Korea (FAS 4546) by Col. Robert Traub, on May 9, 1952. Eleven more (9 of which are FAS 4547-55) were collected by Sgt. Harman and myself from a rice paddy 8 mi S Ch'orwon on June 29, 1952. Although they had been hunted persistently above ground before this latter date, none had been seen. There had been a steady, 36-hour rain previous to the night of June 29, and the toads had been heard on the preceding evening. The collecting was done between 8:30 and 10:00 P.M. with the rain still steadily falling. The air and water temperatures were 70°F. and the calling males were scattered through the rice paddy. A few individuals called with a sound of "wreck-wreck," although the more common sound was "urrrh-urrrh-urrrh." The latter sound ended in an

explosive grunt pitched in a low bass and lasting about $\frac{1}{2}$ second, separated by a pause of $\frac{1}{2}$ second or less. Several calls were heard at a time, followed by a longer pause of several seconds. The toads were hard to find as they were sitting beneath broad-leaved plants in two or three inches of water. The call was pinpointed by triangulation with two flashlights. When picked up, the little toads would inhale large quantities of air, becoming extremely inflated.

The living specimens were dark olive-brown. Areas of yellow punctations appeared in the dorsal pattern (xanthochromes?) and these frequently turned brown. A copious light secretion given off by handled specimens would quickly assume the consistency and texture of rubber cement. The secretion was quite sticky, had a bitter taste, and quickly numbed the tip of the tongue.

This microhylid is reputed to occur only in the southwestern part of Korea. Other locality records are Seoul (FAS 4547) Suigen, Seikan, and Ch'uja Do.

Family Ranidae

Rana rugosa Schlegel.

About 60 specimens were collected by the author and by other members of the 194th Combat Battalion during the fall of 1951 and the spring of 1952. Most of the specimens were taken in the vicinity of Kumhwa or Ch'orwon. They appear in small numbers on the warmer days of March and are out in force by middle April, being found on the banks of running water. They are quite cautious and when approached will dive into the clear water where they sit crouched on the rocky bottom. If further disturbed they swim beneath rocks to hide. Their salt-and-pepper gray marking affords a high degree of protective coloration, and some difficulty may be experienced differentiating them from the rocks. Although the banks upon which they sit may be grassy, they seldom try to hide in the vegetation. They may be found until the end of November or the early part of December on warm days.

This frog is reported from most of Korea. It is reputed to be rare, but from our own observations it seems to be one of the most common amphibians in central Korea. Forty-three of the above series are recorded as follows: 4 mi E Kapyong, FAS 4481-82, 4484-86, 4488; 8 mi E Kapyong, FAS 4483; 9 mi E Kapyong, FAS 4487; 26 mi SSE Kumhwa, FAS 4489; 23 mi S Kumhwa, FAS 4490-4500, 4506-07, 4516-19; 4 mi N Ch'orwon, FAS 4503-4, 4514-15; 6 mi S Ch'orwon, FAS 4502; 8 mi S Ch'orwon, FAS 4505, 4513; 9 mi S Ch'orwon, FAS 4501; 10 mi S Ch'orwon (Hantan Ch'on River), FAS 4508-12, 4520-24. The frogs have also been collected from 5.8 mi SW Inje, Pusan, Kaesong, Nanam, Tongnae, and Ch'uja Do.

Rana nigromaculata Hallowell.

1860. *Rana nigromaculata* Hallowell, Proc. Phil. Acad. Sci., p. 500. Type No. 152, Tokyo Imp. Univ., from Ofuna, Kanagawa Prefecture, Japan.

Nearly 150 specimens (FAS Nos. 4380-4772, 4474-80, 4546 plus others) were secured from 50 mi ENE of Seoul, from Seoul, and from the vicinities of Kumhwa and Ch'orwon.

Between 1:00 and 4:00 P.M. on the afternoon of April 14, 1952,

several of these frogs were seen in a rice paddy and creek, 8 mi S Ch'orwon. The air temperature was 58-60° F. The high temperature of the shallow water at the edge of the rice paddy of 62-68° F. was probably due to decomposing vegetation. The temperature of the deep water and of the creek was about 56° F. The frogs were in the grass and in rice stumps, submerged except for their noses. The call was guttural to clucking, sometimes a little resonant: "urr-curr-curr-eh-keh-keh-uh-kuk-kuk-uh-kuk-kuk." The calls were of 1 to 3 seconds duration and were infrequent. The frogs were extremely wary and those surprised out of water would escape by writhing rapidly through the dense grass, with only occasional high jumps. The paddy was revisited at 8:00 P.M. At that time the air temperature was about 50° F. The frogs were calling from all parts of the paddy. Where the water temperature was 52° F. the frogs were more scarce and when surprised would only submerge to lie on the rice stumps. Where the water temperature was 54° F. the frogs would submerge, then dive under the stumps. Floating free in the water, the males would call "churruh-churruh-churruh," the call frequently lasting four to five seconds. On the night of April 24 (9-10:30 P.M.) the air temperature was 57° F. and the water 56-58° F. Captured frogs were either greenish-gold, usually with distinct pale green dorsal strips and a few posterodorsal spots, or they were vivid grass green with indistinct lighter stripes and distinct posterior black spots. A clutch of eggs was taken at 10:30 in a small pool which had been collected at 9:00 P.M. At the earlier time 12 frogs were there but the eggs were not. At that time none of the frogs were in amplexus although one evaded a jump from another. The eggs were about six inches beneath the surface and were attached in one large clump to rice stalks. The animal pole was perhaps slightly smaller than the vegetal although in a few eggs it was as large as or larger than the latter. No cleavage was present. The individual eggs were 2 mm. in diameter. Two envelopes appeared to be present, the outer about 3 to 3½ mm. in diameter. By 8:30 the following morning all eggs had the first cleavage plane in 60° F. water and about 1/3 had the second. By 9:00 the following morning they were entering the blastula stage. By 10:00 A.M. on the 28th the neural ridge was evident, and by that evening it was closed in many. The eggs were accidentally destroyed on the 30th. At that time early tail formation was evident.

The frogs were collected until early November of 1951. They reappeared by the middle of April of 1952.

There has been considerable debate as to the authenticity of Schmidt's (1927) division of the species into three Chinese subspecies. Pope and Boring (1940: 55) conclude that the division was not valid, and Liu (1950: 309) tentatively follows Pope and Boring. It is doubtful if the Korean population could be separated from the Chinese, unless it were on the plains of south Korea, as the species is only an insular extension from Manchuria.

Exact localities for the above mentioned specimens are: 4 mi N Ch'orwon, FAS Nos. 4391, 4397-98, 4470, 4475-77; 6 mi S Ch'orwon, 4382, 4428; 8 mi S Ch'orwon, 4380-81, 4387-89, 4392-93, 4401-2, 4404-08, 4411, 4413-15, 4417-23, 4429-30, 4432, 4440-53, 4459, 4461, 4463, 4465-69, 4472, 4474, 4479-80; 9.5 mi S Ch'orwon, 4394-95, 4416; 10 mi S Ch'orwon (Hantan Ch'on River), 4383, 4403, 4412, 4431, 4454-

58; 13 mi S Ch'orwon, 4396, 4462; 2 mi W Kapyong, 4385-86, 4424, 4426; 4 mi E Kapyong, 4384, 4399, 4433-35; Kumhwa, 4471; 5 mi S Kumhwa, 4478; 23 mi S Kumhwa, 4390, 4400, 4546; 21 mi SE Kumhwa, 4410; 23 mi SE Kumhwa, 4425, 4436-39; 51 mi NNE Seoul, 4409; Seoul, 4427, 4460; Yongdung'po, 4464. Other recorded localities are: 5.8 mi SW Inje; 4 mi E Yangp'yong-ni near Munsan-ni; Ch'ongjin; Pusan, Kongju, Hoeryong, Wonsan, Sagawansa, Hamhung.

Rana plancyi chosonica Okada new combination.

1931. *Rana nigromaculata chosonica* Okada, The tailless batrachians of Japan, p. 89, pl. 8, fig. 1. Type locality: Seoul, Korea.
1926. *Rana nigromaculata coreana* Okada, Annot. Zool. Japan, v. 11, no. 42, p. 100. (nec *Rana temporaria coreana* Okada, same paper, p. 97.)
1925. *Rana plancyi* Slevin, Proc. Cal. Acad. Sci., 4th ser., v. 14, no. 5, p. 92.

While only 11 specimens of the two subspecies of *R. plancyi* (7 from Korea and 4 from Shanghai, China) were examined, these specimens could invariably be differentiated on the basis of color. In addition, descriptions gleaned from the literature as well as published illustrations (Okada, 1941, pl. 8, figs. 1 and 2) bear out the differences of the material on hand.

Diagnosis. *R. p. chosonica* may be differentiated from *R. p. plancyi* by the presence in the former of a rather uniform green groundcolor (gray in preservative) on the posterior aspect of the thighs; similar area of *plancyi* is cream, mottled with dark. Morphological differences are minor. The web between the toes of the Korean subspecies is more incised and is not quite as extensive as that of the Chinese subspecies. This is most noticeable on the first toe of *chosonica*, where the web extends to the proximal 1/3 or 1/2 of the terminal phalanx whereas the first toe of Chinese *plancyi* is fully webbed. There is little doubt that examination of larger numbers of well-preserved specimens will reveal that there is a significant difference in the amount of dorsal pustulation, the Korean subspecies being quite pustular and the Chinese relatively smooth.

Variation. Occasional specimens of *chosonica* may have scattered dark spots on the posterior aspect of the thighs. While these specimens are superficially similar to *plancyi*, their dark spots are not on a cream background as they are in *plancyi* and the spotting does not assume the complex marbling present in *plancyi*, where the cream groundcolor may itself be broken into spots by reticulation of the darker color. Complex cream and dark reticulation on the lateral surfaces of the body of *plancyi* is greatly reduced or absent in *chosonica*. Both subspecies have a black band bordered by a light band on the posteroventral aspect of the thigh. The light border is much better developed in the Chinese population and extends onto the upper surfaces of the thigh, as the yellow groundcolor already discussed. The band may be greatly reduced in Korean specimens.

R. p. chosonica is confined to southern Korea and occurs over the same general range as *R. a. coreana*. It may be found in lesser numbers in the same rice paddies and ponds as *R. n. nigromaculata*, with which species it has often been confused.

One specimen (FAS No. 4379) was collected by Colonel Robert

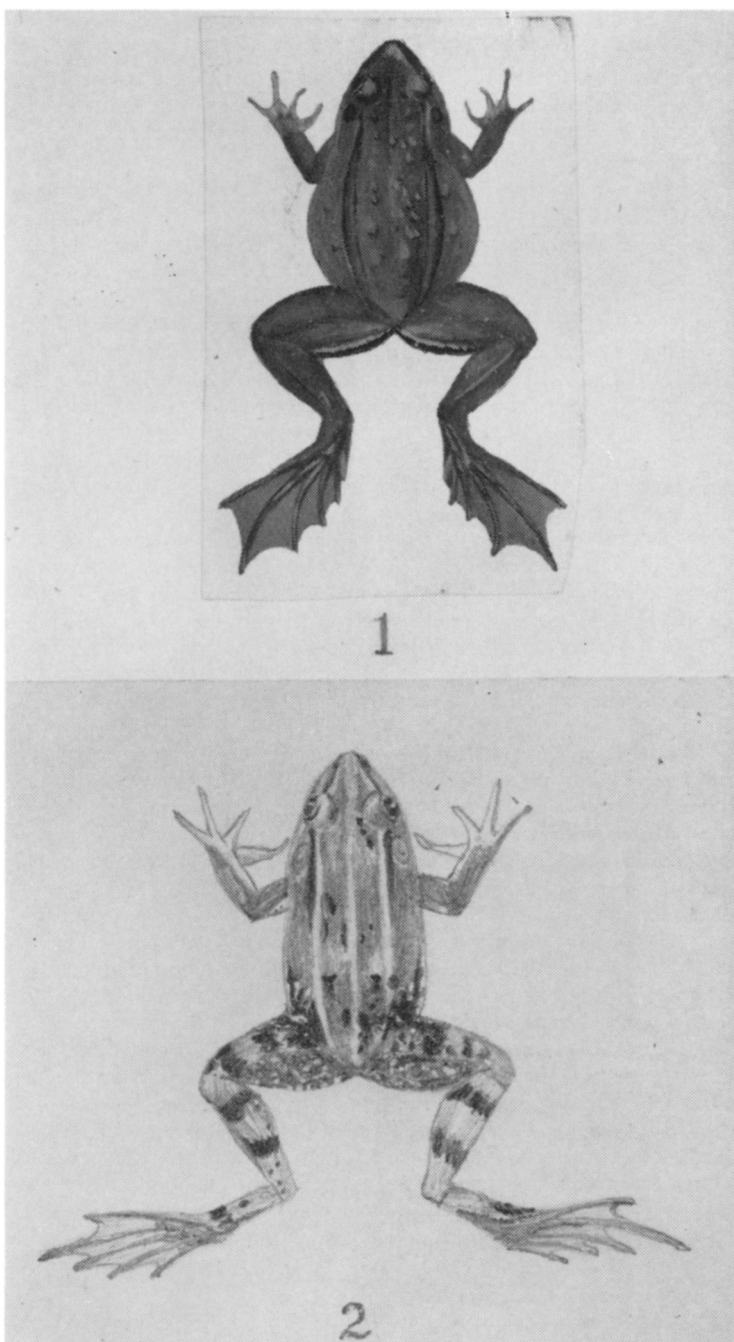


Plate I. Fig. 1. *Rana plancyi chosenica* Okada. Dorsal side ♂ X 1/3 (Drawing by Professor Cho after Okada, 1931.) Fig. 2. *Rana plancyi plancyi* Lataste. Dorsal side ♀ X 2/3. (Adapted from Okada, 1931.)

Traub. on May 9, 1952, at Yongdung'po. Other localities from which the frogs have been collected are Pusan, Kongju, Suigen, Seikan, Seoul, and the vicinity of Munsan-ni.

Rana amurensis coreana Okada new combination.

1926. *Rana temporaria coreana* Okada, Annot. Zool. Japan, v. 11, n. 42, p. 97.
 1907. *Rana japonica* Stejneger, Bull. U. S. Nat. Mus., v. 58, p. 111 (part).

Rana amurensis coreana may be easily distinguished from *Rana temporaria dybowskii* by the presence of nearly straight dorsolateral folds, by a more slender general body configuration and a smaller size, and, more specifically, by a lack of vocal sacs and ostia in the males. The species differs from Japanese specimens of *Rana japonica* in several ways. Specimens of *R. a. coreana* all have a pair of paravertebral dark stripes extending from the posterior portion of the head for the full length of the body. These stripes may be broken or undulant, but they are always identifiable as stripes. Dark markings may be present in specimens of *R. japonica*, but they are more like cryptograms and are never in the form of stripes. The toes of *coreana* are not as fully webbed as those of *japonica*, the distal two phalanges of the first, second, and fifth (distal $2\frac{1}{2}$ of third toe and 3 of fourth) being free of web. An outer metatarsal tubercle was present and distinct in all of 40 specimens of *coreana* examined for such a character. The tubercle is only indifferently present in Japanese specimens of *japonica*.

Boulenger described *Rana amurensis* (1886: 4) from the Amur Province of southeast Russia. Boulenger's description included the facts that his new species had no vocal sacs and had short hind legs. No subspecies of *Rana temporaria* lacks vocal sacs in the male. In a forthcoming paper on the biogeographics of the woodfrogs, I shall further elaborate on the reasons for resurrecting Boulenger's *amurensis* and for delegating *coreana* as the southern subspecies of *amurensis*.

R. a. coreana replaces *R. t. dybowskii* on the broad plains of southern Korea. The ranges of the two species are largely allopatric but with a fairly large area of overlap in central Korea. It may be noted that neither *R. a. amurensis* nor *R. a. coreana* are mountain populations, the former occurring in the low lands around Vladivostok.

Professor Cho states that large numbers of *R. a. coreana* may be taken on the campus of the University of Seoul following a rain. They are usually not far from water. One specimen (FAS No. 4526) was taken on the bank of a small creek 2 miles north of Ch'orwon; FAS Nos. 4527-28 from Yongdung-po; FAS Nos. 4529-45 from Seoul. The species has also been collected at Kongju, Hamhung, Inch'on, Suigen, and Seikan.

Rana temporaria dybowskii Guenther.

1876. *Rana dybowskii* Guenther, Ann. Mag. Nat. Hist., (4), 17, p. 387. Type locality: Abrek Bay, near Vladivostok. Type in British Museum.
 1940. *Rana temporaria chensinensis* Pope and Boring, Peking Nat. Hist. Bull., v. 15, pt. 1, p. 57 (part).
 1931. *Rana temporaria ornativentris* Okada, Tailless batrachians of the Japanese Empire, p. 111 (part). Werner's type locality is Yumoto, Nikko (Honshu Island, Japan).

A single large adult female (FAS No. 4525) bloated to the bursting point with eggs was taken at 9:00 P.M. from a rice paddy 8 miles south of Ch'orwon, on April 14, 1952. The frog was seen sitting half submerged in the shallow water in the middle of a chorus of *Rana nigromaculata*. The air temperature was 50° F. and the water temperature 54° F. Further diligent searching on that and subsequent nights failed to produce other individuals. The frog had an orange venter, grading into a more yellowish color posteriorly. The ventral surfaces of the legs were blood red.

Pope and Boring (1940: 51) feel that *R. amurensis* and *R. asiatica* are synonyms of *R. t. chensinensis*. Liu (1950: 279) thinks that *amurensis* is a valid subspecies of *temporaria* occurring in the three eastern provinces of China, "larger in size than other Chinese woodfrogs and with very narrow dorsolateral glandular folds." He states that "the capacity of the oviduct to absorb water is a remarkable specific character of this form." All the females in his collection and in the collection of Yen-ching University "have their abdomens fully expanded and in some cases the abdominal wall is ruptured near the pelvic region, where the jelly-like substance of the enlarged oviduct can be seen." Liu has not found this to be true of other closely related woodfrogs, although all were preserved in 5% formalin. The observation is true of the above listed female from near Ch'orwon. Other differences separating *chensinensis* from *dybowski* will be presented in a future paper, as will reasons for confining the name *ornativentris* to frogs from the mainland of Japan, where the population was described from Honshu.

Other localities for *R. t. dybowski* are: Pu-Ryong, Hoeryong, Musan Pass, Wonsan, Ch'ongjin, Seoul (doubtful), Rahoku, Komazan, Po'ha-dong.

Family Dermochelidae

Dermochelys coriacea schlegeli (Garman).

The turtle has been reported from near Mokp'o, Korea, by Hironobu Doi (1936: 109).

Family Cheloniidae

Chelonia mydas japonica (Thornberg).

This turtle has been reported from the ocean off Paek-a by Hironobu Doi (1936: 110).

Family Testudinidae

Geoclemys reevesi (Gray).

A single example was seen by Sergeant Harmon on the north bank of the Hantan-chon River, about 10 miles south of Ch'orwon. The turtle was plodding along a grassy bank and, upon being disturbed, partially withdrew into its shell. Other known Korean localities are Seoul, Inch'on, Ch'ongju, and Haeju.

Family Trionychidae

Amyda sinensis Wiegmann.

1925. *Amyda maackii* Slevin, Proc. Cal. Acad. Sci., v. 14 (5), p. 100.

Three of these turtles (FAS 4704 is the only one tagged) were collected from the Hantanchón River about 10 miles south of Ch'orwon

during May of 1952. They have also been collected from Kongju and from P'yongyang.

If the subspecies *maacki* is valid, the name should be applied to the population from the southern tributaries of the Amur River and from Korea. According to Pope (1935: 60), it is likely that the names *schlegeli*, *sinensis*, and *maacki* apply to nothing but ontogenetic stages of the same species, with *sinensis* being the senior synonym.

Family Gekkonidae

Gekko japonicus (Duméril and Bibron).

That this little species has at least a toe hold in Korea is indicated by Stejneger (1907: 166) who reports upon three specimens collected by Jouy from Pusan. Okada (1936: 251) states that Doi collected one specimen from Pusan but that he has never since collected the species in Korea. The lizards are frequently found in northern Honshu and on Tsushima Island.

The recording of *Hemidactylus frenatus* may be noted here. Stejneger (1907: 174) mentioned a specimen collected by a Sir E. Belchur from an unnamed locality in Korea. The record is mentioned again by Okada (1936: 267). The presence of the lizard in Korea is about as impressive as that of the notorious boa constrictor from Iowa.

Family Lacertidae

Takydromus amurensis Peters.

One specimen (FAS No. 4705) was collected by Sgt. McGowan, at the base of a hill 4 mi. SW Kumhwa, March 18, 1952. The terrain was rocky with scattered pine trees. The following CAS specimens collected by Dr. J. C. Thompson during May and June, 1911, were examined by the author: CAS 31685-31719, Wonsan; CAS 31824-31828, Pu-Ryong; CAS 31837-31839, Shoko; CAS 31812, Suigen. Other localities mentioned by Slevin (1925: 94) are Kongju, Musan Pass, Ch'ongjin, and Hoeryong.

Enlarged dorsal scales vary from 7 to 11 (usually 8), a central row or two of which may be somewhat reduced; ground-color olive brown; black dorsolateral stripe located just below keeled rows, bordered below by a white, thin band extending from snout to groin. The white border may be broken by black blotches, or may be reduced or absent. Occasional specimens are practically without pattern.

Takydromus auroralis Doi.

1929. *Takydromus auroralis* Doi, Korean Biol. Assoc., v. 9, pp. 1-3.

The species, recorded from the vicinity of Seoul, is characterized by three pairs of chinshields, six rows of enlarged dorsal scales, and three femoral pores on each side.

Takydromus kwangakuensis Doi.

1928. *Takydromus kwangakuensis* Doi, Chosen Iho, pp. 70-75.

The lizard is known only from the type locality of Mt. Kwanak, near Seoul. The presence of four femoral pores on each side combined with six rows of enlarged dorsal scales and absence of a lateral white line lend strong support to the probability that the population constitutes a valid species.

Takydromus tachydromoides (Schlegel).

This Japanese lizard is rather doubtfully included in the fauna of Korea on the basis of a report by Okada (1933: 145).

Takydromus wolteri Fischer.

1885. *Takydromus wolteri* Fischer, Jahrb. Wiss. Anst. Hamburg, v. 2, p. 82. Type locality: Chemulpo (Inch'on), Korea.

The lizard is reported in the literature from Pusan, Seoul, Suigen, Wonsan, and Inch'on. One specimen (FAS No. 4706) was collected by the author 8 mi S of Ch'orwon, May 5, 1952, on the grassy slopes of a hill with a scattered cover of pine. A number of specimens from the California Academy of Sciences were examined as follows: CAS 35945-35954, 31546-31864, Pusan; 31813-31817, 31807-11, Chikan (Suigen); 31734-31735, Wonsan. As reported by Slevin (1925: 94), all specimens have a single femoral pore on each side. A dark dorsal stripe is present, measuring about three scales wide; a distinct, white, ventro-lateral band one scale wide extends from tip of nose to groin.

Eremias argus Peters.

Twenty specimens are cataloged as follows: FAS No. 4695, 5 mi W Ch'orwon; FAS 4697, 4 mi S. Kumhwa; 4698, 4701-03, 8 mi S. Ch'orwon; 4699, 3 mi S Ch'orwon; 4700, 13 mi S Ch'orwon, and 4696, 19 mi S Ch'orwon, collected between March 30 and July 26, 1952. Nineteen of Prof. Cho's specimens from Seoul were examined at the University of Seoul.

Stejneger (1907: 248) has a good description of *E. argus* based upon a specimen from Seoul. A few individuals have the prefrontal zygous scale broken into one or two additional scales. Femoral pores are usually 10-10 or 11-11, but may vary from 9-13.

Other published records for the species are Konju, Suigen, and Inch'on.

Family Scincidae

Scincella reevesi (Gray).

Okada (1939: 202) rejects attempts to distinguish the oriental population, *Leiolopisma reevesi*, from the North American, *L. laterale*. He apparently does so, with considerable justification, on the basis that distinguishing characteristics are not constant. Schmidt (1927: 424) feels that the two populations should be specifically differentiated on the criteria that the prefrontals of *reevesi* are usually in broad contact, that the scales are in 30-33 rows (26 specimens) (less than 30 in *laterale*), and that *reevesi* has much more yellow in its coloration, the lateral dark bar being broken by light spots or vermiculations. Schmidt states that the scales around the body ranged from 26 to 30 in 28 specimens of *L. laterale*, with only one specimen having 30 rows. Smith (1946: 338) states that these rows vary from 26 to 32, usually 28 or 30.

Schmidt (1927: 425) describes the Tsushima population as *Leiolopisma vandenburghi* on the basis of having only 12 subdigital lamellae as compared to 16-19 in *reevesi*.

Korean specimens are recorded from Seoul. Professor Cho stated (letter) that the lizards are found on Mt. Diamond, near Seoul. No specimens are available for examination, so the relationship of the Korean population to that of *vandenburghi* on Tsushima remains problematical. *Eumeces coreensis* Okada.

1937. *Eumeces coreensis* Doi and Komita, Zoological Mag., v. 49 (6), pp. 211-215, text figs. 1-4.

According to Okada (1939: 187), the species differs from *E. chinensis* and "*E. pekinensis*" (= *xanthi*) in the following characters: only one postmental, prefrontals in contact with each other, six upper and lower labials; *E. coreensis* differs from *E. c. chinensis* in having two upper labials in contact with posterior loreal and from *E. xanthi* in having no postnasal. Taylor (1935: 243) states that *E. xanthi* varies in that one specimen shows only six upper labials. According to his Fig. 33, the prefrontals are in contact. *E. xanthi* usually has 22 rows about the middle of the body, one in nine having 24. Both known specimens of *coreensis* have 24. Like *xanthi*, *coreensis* has four narrow, dark dorsal bands, but Okada states that these are situated on the four median dorsal rows whereas those of *E. xanthi* are located on the two median dorsal rows and on the third scale row. Both species have a broad, dark lateral band.

There is little reasonable doubt that the name *E. coreensis* is applied to a valid population, but the species is indubitably closely related to *xanthi* of northeastern China and western Manchuria.

Eumeces coreensis was described from a female and a male from Sampoto near Yongamp'o and one male from Sin-do Island, Korea. It is suggested that the type locality be restricted to Sampoto.

Family Colubridae

Natrix tigrina lateralis (Berthold).

Forty-two specimens were collected, 40 of which are reported upon as follows: FAS Nos. 4594-95, 4599-4606, 4611-12, 4615, 4618, 8 mi S Ch'orwon; 4597, 4 mi E Ch'orwon; 4598, 4607, 4609, 5 mi E Ch'orwon, 4593, 20 mi N Seoul; 4610, 4622, 4626, 4629, 4 mi E. Kapyong; 4624, 3 mi E Kapyong; 4596, 6 mi E Kapyong; 4621, 12 mi E Kapyong; 4613, 54 mi NNE Seoul; 4628, 55 mi NNE Seoul; 4623, 51 mi NE Seoul; 4608, Seoul; 4614, near Wonchon; 4620, 3 mi W Chunchon; 4616-17, 25 mi SE Kumhwa; 4639, 23 mi S Kumhwa; 4630, 20 mi SE Kumhwa; 4619, 18 mi S Kumhwa; 4625, 4627, 4638, 3.5 mi S Kumhwa.

The species was collected until October 23 of 1951 and was first taken in 1952 on May 3.

Ventral counts on the males averaged 160 (153-165); females, 165.2 (161-174); male caudals, 68.5 (62-74) female, 61.4 (55-72); male, % tail of total length, 21.7 (20.4-24.2), female, 18.6 (17.3-20.3). Cross bands on body varied from 41-56 with from 7 to 23 anterior interspaces containing some evidence of red coloration. No sexual dimorphism was apparent in the pattern.

A tendency for a clinal increase in ventral count in the southern China-Manchuria-Korea sector invalidates Stejneger's (1907: 278) conclusion that *N. t. tigrina* of Japan could be differentiated from *lateralis* on the basis of having a ventral plus caudal count of 227-248 (236.1) for *tigrina* and 206-224 (215.2) for *lateralis*. The Korean population samples vary from 220-238 and average 227.4. On this basis the Korean sample would perhaps appear to be closer to *tigrina* of Japan, but the caudal counts reveal the difference. Fifteen males from Japan vary from 68-83 and average 78. Twenty-three females vary from 66-80 and average 72. No significant variation in scale count is noted from north to south Korea.

The snakes were most frequently taken in the lower hills of the bivouac area or in the grass bordering the clear streams. They were only occasionally taken in the swampy ground of the rice paddies. None were observed in water.

One stomach yielded a large *Rana nigromaculata* which had been swallowed rear end first. Pope (1935: 138) records Chinese specimens as consuming tadpoles, frogs, and toads.

Other locality records for the species are Pusan, Kongju, Wonsan, Suigen, Uiju, 5.8 mi SW Inje, 3 mi SW Mundung-ni, 8 mi N Yanggu, and the vicinity of Munsan-ni.

Natrix vibakari ruthveni Van Denburgh.

1923. *Natrix vibakari ruthveni* Van Denburgh, Proc. Cal. Acad. Sci., ser. 4, v. 13 (2), p. 3. Type: CAS No. 31486, adult male. Type locality, Pusan.

Although no representatives of this subspecies were collected in Korea, the holotype was examined at the California Academy of Sciences.

The following counts of Korean specimens were gleaned from the literature: Ventrals of four males, 146-153; caudals of three males, 56-64; ventrals of four females, 142-150; caudals of four females, 58-65.

Van Denburgh (*op. cit.*) described the subspecies largely upon the basis of a lower caudal count of 55-65 compared with a caudal range of 62-83 in *N. v. vibakari* of Japan.

The population appears to be found from one end of Korea to the other. It is recorded from Quelpart Island, Pusan, Sinuiju, and Possiet Bay (on the Korean frontier) to Vladivostok and Khabarovka at the junction of the Ussuri.

Dinodon rufozonatum (Cantor).

Ten specimens were collected. Nine are reported as follows: FAS Nos. 4683, 4685-87, 4689, 21 mi S Kumhwa; 4688, 17 mi S Kumhwa; 4681, 5 mi S Kumhwa; 4682, 7 mi E Kapyong; 4684, 9 mi S Ch'orwon. The Ch'orwon individual was taken May 28, 1952, the rest from August until the end of October, 1951.

Five males had ventrals varying from 200-204; caudals, 64-78; % tail of total, 17.5-18.7. Four females had ventral counts of 197-209; caudals, 64-75; % tail of total, 14.4-18.1. A slight sexual dimorphism may exist, but it is difficult to define on the basis of such a small series. Dorsal bands varied from 61-75 on body and 17-24 on tail. The position of the loreal was quite variable, failing to enter the eye on one side of five specimens. In one instance the separating obstacle was the fourth supralabial and in the rest, the third; supralabials usually 8, frequently 7 on one side; infralabials 9-9, 10-10, or 9-10; scales in 17-17-15 rows. The largest specimen, a male, was 1077 mm. in total length, next in size being a 1053 mm. female. Both specimens are considerably longer than those reported by Pope (1935: 202).

These snakes were usually collected during the warmer part of the day on the lower slopes of the hills or in the swampy ground both adjacent to and part of the rice paddies. Captives were somewhat treacherous in habit, with inclinations toward running their heads over the restraining hand, then suddenly sinking their teeth into a tender portion.

A *Rana nigromaculata* was taken by a captive specimen. Pope (1935: 20) records Chinese specimens as consuming lizards, frogs, toads, fish, and even a guinea pig.

I have followed Pope (1935: 202), Maslin (1950: 442), and others in relegating other subspecies to *rufozonatum*.

Other localities from which *D. rufozonatum* has been secured are Seoul, Pusan, and the vicinity of Munsan-ni.

Zamenis spiralis (Peters).

Six of these snakes were collected. Five of them are recorded as follows: FAS No. 4690, 7 mi NE Seoul; 4691-4692, 4 mi E Kapyong; 4693, 23 mi S Kumhwa; 4694, 7 mi S Kumhwa. October 23 was the last date of collection for 1951, and April 1 the first for 1952.

From the literature and from the above collection, four males were found to have ventral counts varying from 185-191; caudals, 88-102 (86, 88, 88, 102); % tail of total length in two males, 25 and 27.1. Ten females had ventral counts of 194-205; caudal counts, 81-96; % tail of total length in six females, 24.6-27.1. Sexual dimorphism is apparent only in the ventral counts. The largest male was 745 mm. in total length, the largest female, 904.

Short transverse black bars are evident on the anterior dorsal scales bordering the vertebral stripe of one adult female. They are absent or poorly developed in the rest. Alternating dark and light lateral stripes are evident only on the posterior half of the body and on the tail.

Although Pope (1935: 226) mentions the food of Chinese individuals as being lizards, a mouse was found in the stomach of the 904 mm. female from 4 mi E Kapyong.

The snakes were all taken on hillsides or in high, dry valleys, where they would try to escape into grass or low shrubs upon being surprised. They had the alert reflexes expected of racers and moved with considerable speed. Their temperament was nasty, and they struck repeatedly upon being captured.

There are at least as many differences separating these snakes from *Coluber* and *Masticophis* as there are separating the latter two genera, and I do not feel that they should be combined with either.

The snake has been taken at the following additional localities: Suigen, near Munsan-ni, Inch'on, P'yongyang, and Hoeryong.

Elaphe dione (Pallas).

Five specimens were collected: FAS No. 4671, 3 mi S Ch'orwon; 4670, 6 mi S Ch'orwon; 4666, 18 mi S Ch'orwon; 4672, 18 mi S Kumhwa; 4669, 25 mi S Kumhwa. The last specimen collected in 1951 was taken on September 28 and the first in 1952 on May 2.

The following data (11 males and 10 females) were gleaned from the above specimens as well as from literature records: male ventrals, 181-204 (188.2), female ventrals, 193-205 (199.5); male caudals, 60-73 (69), female caudals, 56-71 (62.8); male % tail of total, 17.6-23.3 (20.5) and female % tail of total, 15.6-18.7 (17.6).

A complete description of a Korean specimen is provided by Stejneger (1907: 316).

Pope (1935: 243) records the food of Chinese individuals as birds and small mammals. Somewhat to my surprise, a captive Korean example ate a *Rana nigromaculata*.

All specimens were collected on roads or grassy hillsides. Stewart (1954: 66) found one of the snakes in a tangle of roots and rocks on the summit of a mountain.

Other recorded localities are Kongju, Seoul, Suigen, Pu-Ryong, Ch'ongjin, 6.4 mi ESE Mundung-ni, and vicinity of Munsan-ni.

Elaphe rufodorsata (Cantor).

Twenty-nine of these snakes were collected. Twenty-eight are recorded as follows: FAS No. 4657, 3.5 mi S Ch'orwon; 4640-43, 4647-49, 4652-53, 4655-56, 4663-64, 4668, 8 mi S Ch'orwon; 4650, 10 mi S Ch'orwon; 4646, 12 mi SE Ch'orwon; 4659, 18 mi S Ch'orwon; 4665, 21 mi SW Ch'orwon; 4654, 23 mi S Ch'orwon; 4644, 4658, 4660-61, 4 mi E Kapyong; 4662, 55 mi NNE Seoul; 4645, 10 mi S Kumhwa; 4667, 21 mi S Kumhwa; 4651, Yongdung-po. The species was collected until November 3 of 1951 and was first collected on April 30 of 1952. The snakes were commonly seen by early May.

The male ventral average was 167.5 (161-175), female ventral average, 177.4 (168-183); male caudal average 60.8 (57-67), female caudal average 50.9 (47-56); male % tail of total average 20 (18.8-20.7), female 16.5 (15.5-17.1). Strong sexual dimorphism is thus apparent.

The largest female in the series measured 785 mm. in total length, the longest male, 631 mm.

The lateral stripe is usually on the third and fourth scale rows anteriorly and on the third and fourth or second and third scale rows posteriorly; dorsolateral stripe usually on sixth and seventh scale rows.

A favorite habitat for the snakes was the rocky border of a large stream 4 mi E Kapyong. The water at this spot was four or five inches deep and grass was profuse. The snakes would prowl through the grass and shallow water in search of young *Rana nigromaculata* and could also be found in the rice paddies or at a considerable elevation on the lower hillsides of the bivouac area. A fish was taken from the stomach of one specimen. Stewart (1954: 67) found a *Bombina orientalis* in the stomach of one snake. The animal was apparently not deterred by the irritating secretion of the toad.

Other localities for the species are Seoul, 5.8 mi SW Inje, Pusan, Wonsan, Suigen, and Pu-Ryong. It has also been collected at Vladivostok, near the Korean border.

Elaphe schrencki anomala (Boulenger).

Eight of these snakes were collected: FAS No. 4673, 8 mi S Ch'orwon; 4674, 4 mi N Uijongbu; 4675, 7 mi ENE Seoul; 4676, 18 mi ENE Seoul; 4677, 50 mi NNE Seoul; 4678, 18 mi S Kumhwa; 4679-80, 23 mi S Kumhwa. None of these snakes was found in a damp habitat.

The last snake of 1951 was collected on September 22, and the first of 1952 on May 4. In the fall of 1951 these snakes were probably abroad until at least the middle of October.

The following records of 14 males and 8 females are from the literature and from the above collection: male ventrals varied from 212-227 (217), female, 218-230 (225.4); male caudals, 62-76 (70.7), female, 65-72 (68.1); male % tail of total, 16.3-20.3 (17.9), only one intact female available, 15%.

Pope (1935: 266) resurrects the name *anomala* for the population "from Shansi, Shantung, Hopei, Jehol and part of Korea." He records *E. s. schrencki* as a northeastern population "found in Manchuria and the region eastward to the sea." He has examined material from Seoul and believes it to be "perfectly typical" of *anomala*. He states that juvenile individuals of both subspecies are nearly identical, with a spotted venter, a postocular dark bar, and black-bordered dorsal blotches. Adult individuals of *anomala* have "a varying but usually very small remnant of the postocular stripe;" lose the dorsal blotches except for "the black edges of the dorsal bands which are, however, generally only evident posteriorly and even there quite weak and indistinct;" and have only "a faint trace of the ventral spotting (often entirely absent)."

FAS No. 4675, an adult female (1452 mm. in total length) from 7 mi NE Seoul may be considered a representative example of *anomala*. It has the dorsal blotches obscured almost absent; ventral markings absent, except on tail. FAS No. 4674, an adult male 1339 mm. in total length, from 4 mi N Uijongbu (about 22 mi directly north of Seoul) is fairly typical of *anomala* with obscure marbling extending the length of the venter. FAS No. 4673, a 1542 mm. male from 8 mi S Ch'orwon, has evident, although faint, dorsal blotches; no postocular stripe; and ventral markings evident except on tail. FAS No. 4676, a 1630 mm. male, has plainly marked dorsal blotches ("29 rich chocolate bands on body and 14 on tail"); obscurely but obviously marked venter; distinct postocular stripe. It may be noted that this locality is in the hills bordering the plains surrounding Korea. FAS No. 4677, a 1690 mm. male (largest specimen) has 19 blotches on body and 17 on tail; little trace of ventral mottling except on most anterior portion of belly; postocular stripe is distinct. FAS No. 4678, a 1476 mm. female, has 35 obscure dorsal blotches; ventral marbling faint but evident for length of venter; postocular band evident but indistinct.

The above specimens are apparently intergrades with the exception of the two from Uijongbu and from near Seoul which should be allocated to *anomala*.

California Academy of Sciences specimens from Suigen (Chiksan) and Pusan lack bands and ventral spotting. The postocular bar is present although in CAS No. 31519 (from Suigen) it is faded. The Wonsan specimen (CAS No. 31497) is strongly banded with a prominent postocular bar and ventral spotting and is thus typical of *E. s. schrencki*.

While interpretation of the Korean range of *anomala* may be open to question, it seems likely that the population is restricted to the coastal areas of P'yongan Pukto, P'yongan Namdo, the western half of Hwanghae Do, the coastal area of Kyonggi-Do, then expanding its range to cover the whole of South Korea exclusive of Kangwon Do. The range of *E. s. schrencki* would then be represented by the mountainous areas of northern and eastern Korea with gene exchange to the west and south.

Elaphe schrencki schrencki Strauch.

CAS No. 31497 from Wonsan.

Possible intergrades are reported under the discussion of *E. s. anomala*. *Elaphe taeniurus* Cope.

The only record for Korea is one of indeterminate locality collected

by Dr. N. M. Ferebee, illustrated and described in some detail by Stejneger (1907: 320). According to Pope (1935: 274) the only records for Asia northeast of Peiping are the Korean record, one for Possiet Bay, and one for the Yalu River Valley. Pope feels that *taeniurus* was carried into northern China by man.

Family Hydrophiidae

Hydrophis melanocephalus Gray.

The only known Korean locality is Choryong-do (Cho, correspondence).

Pelamis platurus (Linnaeus).

The species is recorded from Possiet Bay (near the Korean border) by Maki (1931: 194). Professor Cho (correspondence) states that these snakes have been taken from the Korean coast town of Choryong-do.

Family Crotalidae

Ancistrodon halys brevicaudus Stejneger.

1907. *Agkistrodon blomhofii brevicaudus* Stejneger, Bull. U. S. N. M., No. 58, p. 463. Type locality: Pusan.

Seven specimens of this little pit viper are reported as follows: FAS No. 4632, 54 mi NE Seoul; 4633, 40 mi NE Seoul; 4634, 23 mi S. Kumhwa; 4635, 4 mi E Kapyong; 4637, Kapyong; 4636, 8 mi S Ch'orwon. They were collected from August through October of 1951 and in June of 1952. Five additional specimens from Suigen, Wonsan, and Pu-Ryong were examined from the California Academy of Sciences collection, and data on nine more from the vicinity of Munsan-Ni were kindly furnished by Mr. James Dixon.

These diurnal snakes prefer the low, marshy environment provided by rice paddies or meandering streams. They may at times be found on the lower slopes of the hills but seldom penetrate to any considerable altitude. Koba (1938: 247) states that individuals from Syoryuzan Island, Kwangtung, and South Manchuria subsist largely on birds; Pope (1935: 394) lists mice, rats, lizards, and a frog (*Rana nigromaculata*) from the stomachs of Korean specimens. The snakes are usually mild in disposition, seeking to escape even when annoyed. Many Koreans have an exaggerated fear of them but collect them for sale for medicinal use.

The use of subspecific names for *Ancistrodon halys* has led to little but confusion. Thompson (1916: chart) summarized the data on ventrals and caudals of the different subspecies and came to the conclusion that they could not be differentiated on that basis, and certainly not upon the basis of color. His chart might have been more useful had he separated the sexes. Pope (1935: 396) has followed Thompson since "ventral, subcaudal, upper labial and scale row counts intermediate between those of central Asia and those of the Yangtze Valley" are present. Stejneger's (*loc. cit.*) color differences of his type description of *brevicaudus* do not appear to be valid. A computation of the standard error for ventral and caudal counts of 39 specimens from Korea and 39 from Japan shows a highly significant *t* value for the two populations, thus the decision to retain the name *brevicaudus* for the Korean population. The sexes are lumped, as in most cases they were unknown. The fact does not, of course

enhance the value of the data. No attempt is made to justify subspecific names for other populations. Other localities from which the snakes have been collected are: Wonsan, Suigen, Pu-Ryong, Shoko, Musan Pass, Munsan-ni, Seoul, Keijo, Hoeryong, Kowan, Haeju, Puksubaek-san, Kaesong, and Sinuiju.

	<i>Korea</i>	<i>Japan</i>	<i>t</i>	<i>P</i>
Ventrals	147.0 ± 0.60 (139-154)	140.3 ± 0.52 (132-146)	8.5/.001	
Caudals	41.5 ± 0.76 (31-52)	48.2 ± 0.82 (32-58)	6.0/.001	

Family Viperidae

Vipera berus sachalinensis Carewskij.

Reports of the species from northern Korea by Maki (1931: 196) are confirmed by Professor Cho (letter) who states that the snakes have been collected at Sinuiju.

The Korean specimen described by Maki has a total length of 635 mm.; tail length, 67 mm.; ventrals, 156, and caudals, 34. The sex is unknown.

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