THE GREEN PIT VIPER, TRIMERESURUS GRAMINEUS, IN CHINA

By LEONHARD STEJNEGER Head Curator of Biology, United States National Museum

INTRODUCTION

The green bamboo pit viper, as a comprehensive species, extends over a vast area of southeastern Asia, from the Himalayas through India (not in Ceylon), Burma, Siam, Tonkin, Annam, Southern China, and Formosa, south through the Malay Peninsula to the Malay Archipelago. Various attempts have been made to subdivide the species, but on account of the great variability of the characters available for the discrimination of the geographic forms, none of these attempts has been generally accepted. In addition an erroneous nomenclature and absence of geographic correlation has caused great confusion.

Lack of sufficient data and material prevents a thorough investigation of the whole question in this connection, but enough is on hand to indicate the status of the species in China and adjacent territory.

Before examining into the question of the various forms occurring in China and the value of the characters by which they may be recognized, it seems best to review briefly and chronologically the previous efforts in the same direction.

Gray, who recorded the species under the name *Trimesurus viridis*, was the first (1842) to separate the South China specimens collected by Reeves as *T. albolabris* on the strength of a narrowness of the supraocular. In 1853 he made another addition by calling one of the specimens obtained by Hooker in Sikkim *T. elegans*, while referring the other to typical *T. viridis* (=gramineus). The distinction was again drawn from the "superciliary shield" (that is, supraocular), it being "large" in the latter, while "very small, rudimentary, linear" in the former in addition to smoother scales and certain color differences, namely, the narrowness of the lateral streak and the absence of the reddish-brown streak beneath it.

No. 2715.-PROCEEDINGS U. S. NATIONAL MUSEUM, VOL. 72, ART. 19. 59356-27 1

These distinctions, based as they were on a few specimens only, and on characters easily shown to be too variable, did not recommend themselves to contemporary herpetologists.

A second attempt at subdivision was made by Guenther who called attention to the existence of at least two forms. In fact, in his Reptiles of British India (1864) he treated them as two distinct species and gave figures to illustrate one of their structural differ-This according to him consisted in the presence of one or more ences. small scales between the supranasals in the form he called Trimeresurus gramineus, while in the other, T. erythrurus, the supranasals are in immediate contact with each other. In addition he mentioned slight differences in coloration, underside pale greenish in the former, greenish-white combined with whitish upper lip in the latter. Unfortunately, as he was unable to appreciate any correlation between the specimens thus separated and their geographical distribution, he applied two names, the types of which undoubtedly belong to the same form. As a consequence Boulenger refused to recognize any distinction, and united them again.

Stoliczka, who collected both species and wrote four years after Guenther, recognized the distinctness of the two forms and accepted his nomenclature, but had apparently a better appreciation of their geographic relations, as he refers the Burmese and Malay Peninsula specimens to the so-called *T. erythrurus* and restricts the other form to the Khasi Hills and Assam. At the same time he casts doubt upon its being found in the interior of the northwestern Himalayas and especially the alleged occurrence in Ladak.

Accepting the above, including Guenther's erroneous nomenclature, Anderson¹ discussed the question of the distinction between the two forms in still greater detail. He recorded as *T. gramineus* several specimens from Ponsee, western Yunnan, one of which had 23 scale rows, while he listed the so-called *T. erythrwrus* as from Upper Burma. In describing the distinguishing characters, however, he came to the conclusion that they are subject to considerable variation, but that the majority of the specimens conform to the accepted diagnoses.

Doctor Mell² also had an opportunity to study both forms in the field and observed certain differences in structure and coloration between specimens from the northern mountainous region of Kwantung and those from the southern lower regions of the same Province. Unfortunately, he also adhered to Guenther's application of the name gramineus to the northern subspecies. His choice of name for the southern form, which he calls *Lachesis gramineus albolabris* (Gray,

¹ Zool. Res. Exped. West Yunnan, 1879, pp. 828-832.

² Arch. Naturg., vol. 88, sec. A, pt. 10, 1922, pp. 126-128.

1842) in preference to erythrurus, given by Cantor three years earlier, is not explained.

Werner³ likewise recognized the difference between specimens from Indo-China and Sumba Island (one of the lesser Sunda Islands) on the one hand and the traditional T. gramineus on the other, but relied for their distinction chiefly on the separation of the first supralabial from the nasal. However, he names this form Lachesis fasciatus (Boulenger), apparently because the latter was described from the island of Jompea [Djampea], one of the small islands between Celebes and Flores, assuming it to be identical with the Sumba form. Miss De Rooij,⁴ however, who examined the type specimens from Djampea as well as specimens from Sumba [Soemba], regards the former as distinct and the Sumba specimens as conspecific with the typical T. gramineus. Therefore, if the Djampea form is distinct, the name fasciatus becomes inapplicable to the Sumba and Indo-Chinese form. But even if it is not separable, the name is inapplicable, because in that case it is synonymous with the typical T. gramineus.

The above review disposes of all the differential names given to the green bamboo pit viper up to 1924, with the exception of Gray's Trimesurus elegans 5 from Sikkim, which, however, is unavailable irrespective of the form to which it belongs, as his Craspedocephalus elegans of 1849 is a true Trimeresurus.6

In 1925 Karl P. Schmidt diagnosed briefly two Chinese Trimeresurus as T. stejnegeri and T. yunnanensis, respectively.⁷ The former is plainly Guenther's and later authors' restricted, northern and mountain T. gramineus, but the use of this name is, of course, inadmissible as it is based solely on a specimen from Vizagapatam, on the coast of eastern continental India (Province Madras). Since all the other names belong to this same form, it follows that the one given by Schmidt is the only valid name for this form.

Trimeresurus yunnanensis is described as being distinguished by having only 19 rows of scales at mid-body. Thus far the recorded specimens from East Central Yunnan all seem to agree with this statement, but the number of specimens reported on is too small to assign a final status to this form. The specimens from the extreme western Yunnan do not belong to it as shown by Anderson's account.

The characters ascribed to the various forms, apart from possible color differences and the difference in the number of scale rows, are chiefly the following four:

1. Size of internasals and their contact or separation by intervening scales.

³ Sitz. Ber. Akad. Wiss. Wien, Math. Nat. Kl., sec. 1, vol. 133, 1924, pp. 47-48.

⁴ Rept. Indo-Austral. Arch., Ophid., 1917, pp. 284-285. ⁵ Ann. Mag. Nat. Hist., ser. 2, vol. 12, 1853, p. 391.

⁶ See Herpet. Japan, 1907, p. 470. ⁷ Amer. Mus. Novit., No. 157, Feb. 13, 1925, p. 4.

VOL. 72

2. Fusion of the nasal shield with the first supralabial or their separation by a suture.

3. Presence or absence of one or more scales between the nasal and the shield bordering the pit anteriorly.

4. The size and arrangement of the gular scales whether in regular pairs bordering the mental groove or as less differentiated and irregularly placed scales.

It should be noted that the following discussion is based chiefly on Siamese, East China, and Formosan specimens as there are no specimens from India proper and the Himalayan region in the United States National Museum. The few records I have from that region I owe to the kindness of Dr. H. W. Parker, who kindly examined a number of specimens in the British Museum, which are of special interest in the present case. An examination of a much greater material is necessary to settle the status of the western forms.

1. SIZE OF INTERNASALS AND THEIR CONTACT OR SEPARATION BY INTERVENING SCALES

The internasals, or, as they are also often called, the supranasals, vary considerably in size. When relatively large they are usually broadly in contact along the median line; when small they are widely separated by several minute scales.

All the specimens from Formosa and Eastern China from Chekiang north and in the mountains farther south of which I have records— 17 altogether—have the internasals thus separated, the usual number (in 11 specimens) being 2, exceptionally 1, 3, 4, or even 5. Four specimens from central Yunnan show the same condition, 2 in three cases, 3 in one. All the specimens from the Himalayan region which Doctor Parker examined for me (11) except one also have the supranasals separated by one (7) or two (3) scales. In one specimen from Darjeeling, which also differs in other respects from the other five from the same locality, the supranasals are in contact. In one from the Tack Plateau, Tenasserim, and another from the Lao Mountains, Cochin-China, they are also separated by one scale. Therefore in 33 specimens out of 34 from the north and from the higher mountain regions the supranasals are separated by one or more scales.

Of southern and lowland specimens I have examined a fine series of 22 specimens from Siam collected by Dr. W. L. Abbott and Dr. H. M. Smith; one from Cambodia, one from southern Fukien, one from Tenasserim, and one from Java. In addition Doctor Parker has furnished me data pertaining to two specimens from China (cotypes of *T. albolabris*), two from Hong Kong and one from the Langbian Plateau, Annam, all in the British Museum; altogether 31 ART. 19

specimens. In these the internasals are in contact in all but 5 specimens, 4 from Siam and 1 from Tenasserim. In these, one small scale is intercalated between the internasals. These, however, are in every instance relatively very large, so much larger than in the series of the northern form that a confusion with the latter in this particular is out of the question.

We thus find that the available material of 65 specimens falls into two groups according to the size of the internasals and their contact or separation by intervening scales, inasmuch as about 97 per cent of the northern and highland form have small internasals separated by intervening scales, while in the southern and lowland form 80 per cent have the large internasals broadly in contact and 20 per cent have them narrowly separated by a single small scale.

2. FUSION OF THE NASAL SHIELD WITH THE FIRST SUPRALABIAL OR THEIR SEPARATION BY SUTURE

The fusion of the nasal with the first supralabial is a rather exceptional condition in snakes. It is therefore, perhaps, not surprising that in the same series of 34 northern and highland specimens, including those from central Yunnan mentioned under the first heading, we find only one exception to the rule that the nasal and the first supralabial form distinct shields separated by a suture. This exception is the same specimen from Darjeeling, in the Himalayas, which was also exceptional in having the internasals in contact.

The southern and lowland series, on the other hand, is not so uniform. Of the 32 specimens recorded, 26 specimens have the nasal and the first supralabial fused (in 1, from Cambodia, only partly so) while in 6 they are entirely separated by a suture.

Consequently, the 66 specimens again fall into two groups with relation to the fusion of the nasal with the first supralabial, inasmuch as about 97 per cent of the northern and highland form have the two shields separate, while in 77 per cent of the southern and lowland form the two shields are fused into one.

3. PRESENCE OR ABSENCE OF ONE OR MORE SCALES BETWEEN THE NASAL AND THE SHIELD BORDERING THE PIT ANTERIORLY

In the genus *Trimeresurus* the shield bordering the pit anteriorly is usually fused with the second supralabial into one shield. This shield may be in direct and broad contact with the nasal without any scale between them, or they may be wholly or partly separated by one or two small narrow scales, of which the upper is usually the larger when two are present. Sometimes they are reduced in size to mere granules. In the northern and highland series of 34 specimens (including those from central Yunnan) such intercalated scales are present in all except 1, namely, the same Darjeeling specimen in the British Museum which has been shown above to be an exception in the two previous characters.

In the southern and lowland series of 32 specimens, scales are present on both sides in only 8 specimens, while in 1 specimen, from Cambodia, a small granule is present on one side. In 2 of the 8 the intercalation is only indicated by a minute granule on both sides.

Expressed in percentages we thus find that in 97 per cent of the northern and highland form there is present one or two intercalated scales between the two shields, while in the southern and lowland form the two shields are adjacent the whole length without any intercalated scales or granules in 67 per cent of the series.

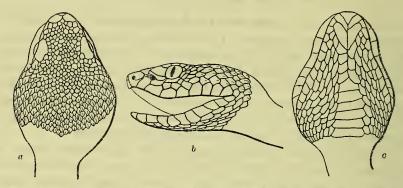


FIG. 1.—TRIMERESURUS GRAMINEUS GRAMINEUS, NAT. SIZE. *a*, TOP OF HEAD; *b*. SIDE OF HEAD; *c*. UNDERSIDE OF HEAD. No. 70342, U.S.N.M. FROM NONG MONG, KRABIN, EASTERN SIAM, COLLECTED BY DR. HUGH M. SMITH.

4. SIZE AND ARRANGEMENT OF GULAR SCALES

In these snakes we find only the anterior pair of chin shields (genials) developed, while the posterior part of the mental groove is bordered by smaller scales. In some cases these scales are of the usual elongate shape of gulars, in others the scales forming the border of the groove are more or less modified into larger, broader, and more rounded scales arranged in more or less regular pairs. The typical arrangement of these two styles is well shown in the accompanying illustrations. (Figs. 1 and 2.) Most of the specimens in the two forms agree plainly with one or the other of the two styles thus figured. But there are many individuals in both groups which show intermediate features.

6

While in the southern and lowland form the paired style is recognized in all the 32 specimens, the pairs are recorded as "irregular" in 4, among them one of the types of *T. albolabris*.

In the northern and highland form, including specimens from central Yunnan, the special modification of the scales bordering the groove and their paired arrangement is the exception. Often some of the scales show a tendency toward such modification, especially posteriorly, and various specimens present intermediate stages between the two typical patterns. However, out of 32 specimens, 19 are unmistakably of the Formosan type figured (fig. 2), while 9 are clearly of the paired type and 4 more or less irregular. It is rather singular that all the six specimens from Darjeeling as well as one from Sikkim in the British Museum, according to Parker, have the gulars in pairs.

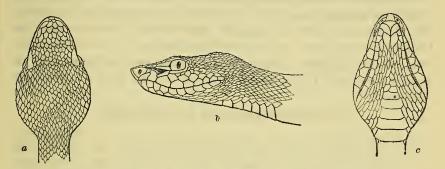


FIG. 2.—TRIMERESURUS GRAMINEUS STEJNEGERI, $1\frac{1}{3} \times \text{NAT. SIZE.}$ *a*, TOP OF HEAD; *b*, SIDE OF HEAD; *c*, UNDERSIDE OF HEAD. NO. 2^a Sci. Coll. Tokyo from Taipa, Formosa, collected by T. Tada

The pronounced typical style of the northern and highland form is therefore present in more than 59 per cent of the specimens, while of the southern and lowland form about 88 per cent show the paired modification.

SUMMARY

It will thus be seen that the four characters alluded to do not trenchantly and in all cases separate the two forms. There is a considerable amount of overlapping. Nor are the characters of equal value, the gular arrangement being the least reliable. Nevertheless in nearly every instance it is possible to refer a specimen to its proper geographical series by a combination of the characters. The conspicuous exception is the Darjeeling specimen in the British Museum, repeatedly referred to above.

Under these circumstances it is hardly advisable to treat the two forms nomenclatorially as distinct species, and a trinominal appellation is therefore here adopted. The three forms may then be distinguished as follows:

a.¹ Internasals large and usually broadly in contact; nasal and first labial usually fused into one shield; nasal and anterior pit shield in contact, usually without any intercalated scales; gular scales bordering groove usually large, rather rounded, and arranged in pairs,

T. gramineus gramineus.

- a.² Internasals small and separated by one or more scales; nasal and first labial nearly always separated by suture; usually one or two small scales between the nasal and the anterior pit shield; gulars, including those bordering groove, small and unmodified, scalelike in a majority of specimens.
 - b.1 Scale rows around middle of body 21, rarely 23,

 T. gramineus stejnegeri.

 b.² Scale rows 19______

 T. gramineus yunnanensis.

It remains to point out the possibility that further investigations of Indian material may reveal characters or combination of characters which can serve to diagnose other forms. In that case the Chinese lowland form may have to be known as T. gramineus albolabris, but not till then. Similarly the Himalayan specimens may require a new name if they should turn out to differ from T. gramineus steinegeri.

TRIMERESURUS GRAMINEUS GRAMINEUS (Shaw)

- 1802. Coluber gramineus SHAW, Gen. Zool., vol. 3, pt. 2, p. 420 (type locality, Vizagapatam, India; based on Russell's Ind. Serp., vol. 1, pl. 9).—Trimercsurus gramineus GUENTHER, Rept. Brit. India, 1864, p. 385 (part: Pinang; Mergui).—Boulenger, Fauna Brit. India, Rept. 1890, p. 429.—BOETTGER, Ber. Senckenberg. Nat. Ges., 1894, p. 135 (Hainan).—STANLEY, Journ. N. China Asiat. Soc., vol. 46, 1915, p. xiii (part: Swatow); vol. 47, 1916, p. xiv (Hoihow; Foochow).—MALC. SMITH, Journ. Nat. Hist. Soc. Siam, vol. 6, 1923, p. 205 (Hainan).—Lachesis gramineus Boulenger, Cat. Snakes Brit. Mus., vol. 3, 1896, p. 554 (part: India, Burma, Siam, Hongkong, Sumatra, Java, Timor).—WALL, Proc. Zool. Soc. London, 1903, p. 99 (part: Hongkong).
- 1802. Coluber viridis BECHSTEIN, Lacépède's Naturg. Amph., vol. 4, p. 252, pl. 39, fig. 1 (type locality, Vizagapatam, India; based on Russell's Ind. Serp., vol. 1, pl. 9) (not of Meuschen, 1778).—Trimeresurus viridis LACÉPÈDE, Ann. Mus. Paris, vol. 4, 1804, p. 209.—Bothrophis viridis FITZINGER, Sitz. Ber. Akad. Wiss. Wien, Math. Nat. Kl., vol. 42, 1861, p. 411 (Hongkong).—Trimesurus viridis GRAY, Cat. Snakes Brit. Mus., 1849, p. 7 (India).
- 1839. Trigonocephalus erythurus CANTOR, Proc. Zool. Soc. London, 1839, p. 31 (type locality, Ganges Delta, India, type in British Museum; Cantor, collector).—Trimeresurus erythrurus GUENTHEE, Rept. Brit. India, 1864, 386 (India, Siam, south China, Java).—STEINDACHNEE, Reise Novara, Rept. 1867, p. 86 (Hongkong, Cochin China, Java).—StoLiczka, Journ. Asiat. Soc. Bengal, vol. 39, pt. 2, 1870, p. 207 (Moulmein, Upper Burma, Penang, Wellesley Prov., Java).—ANDERSON, Zool. Res. Exped. West Yunnan, 1879, p. 830 (Upper Burma).—Boetriger, Offenbach. Ver. Naturk., 24–25 Ber., 1885, p. 157 (Kwangtung).

1842. Trimesurus albolabris GRAY, Zool. Misc., p. 48 (type locality. China^{*}; types in British Museum, Reeves, collector).

1870. Trimeresurus mutabilis STOLICZKA, JOURN. Asiat. Soc. Bengal, vol. 39, pt. 2, p. 219, pl. 12, figs. 5–5e (type locality, Andaman and Nicobar Islands).

1922. Lachesis gramineus albolabris MELL, Arch. Naturg., vol. 88, sec. A. pt. 10, p. 126 (Southern Kwantung).

1924. Lachesis fasciatus WERNER, Sitz. Ber. Akad. Wiss. Wien, Math. Nat. Kl., sec. 1, vol. 133, 1924, p. 47 (Annam, Hainan) (not of Boulenger).

A typical specimen (U.S.N.M. No. 67601) of the barred form from Kuling, Fukien, was collected by Sowerby (No. 565). The first supralabial is fused with the nasal; the internasals are rather large but separated from each other by a very small scale. The postgenials are regular and large, forming a symmetrical series of five pairs. In these characters it agrees with southern specimens of the species and differs from those of northern localities and higher altitudes. The type of one of the names applicable to the latter subspecies is also from the Province of Fukien, having been collected at Shaowu, scarcely more than 140 miles away to the northwest, but presumably at a much greater altitude.

TRIMERESURUS GRAMINEUS STEJNEGERI (Schmidt)

- 1853. Trimesurus elegans GRAY, Ann. Mag. Nat. Hist., ser. 2, vol. 12, p. 391 (type locality, Sikkim; type in British Museum; Hooker, collector); (not Craspedocephalus elegans Gray. 1849=Trimeresurus elegans Gray).
- 1864. Trimeresurus gramineus GUENTHER, Rept. Brit. India, p. 385 (part: Khasya, Ladak[?], Sikkim, Ningpo; not of Shaw)-Stoliczka, Journ. Asiat. Soc. Bengal, vol. 39, pt. 2, 1870, p. 216 (Khasi Hills and Assam.)--ANDERSON, Zool. Res. Exped. West Yunnan, 1879, p. 828 (Ponsee, Yunnan) .--- BOETTGER, Offenbach Ver. Naturk., 24-25 Ber., 1885, p. 157 Ningpo); Ber. Senckenberg. Naturf. Ges., 1888, Abh. p. 188 (South Formosa).-STEJNEGER, Herp. Japan, Bull. U. S. Nat. Mus., No. 58, 1907. p. 480, figs. 370-372 (Formosa); Proc. U. S. Nat. Mus., vol. 38, 1910, p. 113 (Formosa); vol. 66, art. 25, 1925, p. 101, (Moh-Kan-Shan, Chekiang).-BARBOUR, Proc. New England Zool. Club, vol. 4, 1909, p. 76 (Bankoro, Formosa).-OSHIMA, Annot. Zool. Japon., vol. 7, pt. 3, March, 1910, p. 207 (Formosa); Ann. Rep. Inst. Sci. Formosa, vol. 8, No. 2, 1920, p. 11, pl. 16.-STANLEY, Journ. N. China Asiat. Soc., vol. 45, 1914, p. 31 (part: Chekiang) .- TAKAHASHI Japanese Ven. Snakes, 1923, pl. 3 (Formosa) .- Lachesis gramineus Boulenger. Cat. Snakes Brit. Mus., vol. 3, 1896, p. 554 (part: Ladak, Darjeeling, Sikkim, Khasi Hills, Ningpo, Formosa).-WALL, Proc. Zool. Soc. London, 1903, p. 99 (part: Formosa) .--- Vogt, Arch. Naturg., vol. 88, 1922, sec. A, pt. 10, p. 143 (part: [Northern] Kwangtung) .-- WERNER, Sitz. Ber. Akad. Wiss. Wien. Math. Nat. Kl., sec. 1, vol. 133, 1924, p. 48, Formosa .--Lachesis graminea BOETTGER, Kat. Schlang. Mus. Senckenberg., 1898, p. 139 (part: South Formosa).-Lachesis (Trimeresurus) gramineus STEIDNACHER, Denkschr. Akad. Wiss. Wein, Math. Nat. Kl., vol. 90, 1914, p. 357 (Formosa).

⁸ Macao or Canton, according to Mell, Arch. Naturg., vol. 88, 1922, sec. A, pt. 10, p. 127.

1870. Trimercsurus erythrurus SWINHOE. Proc. Zool. Soc. London, 1870, p. 412 (Takow, Formosa) (not of Cantor, 1839).

- 1922. Lachesis gramineus gramineus MELL, Arch. Naturg., vol. 88, 1922, sect. A, pt. 10, p. 127 (Frontier mountains between Kwangtung, Kiangsi, and Hunan) (not of Shaw).
- 1925. Trimeresurus stejnegeri SCHMIDT, Amer. Mus. Novit., No. 157, Feb. 13, 1925, p. 4 (type locality, Shaowu, Fukien, China; type Amer. Mus. N. Y. No. 21054; Andrews and Heller, collectors).

Mr. A. de C. Sowerby has recently sent the Museum a fine specimen from Knatun, Fukien (U.S.N.M., Cat. No. 73140, Collector No. 1294), which is typical of this form in every respect. The internasals are small and separated by 4 scales. Body scale rows 21.

Through the courtesy of Dr. Thomas Barbour I have examined a Chekiang specimen collected by J. Wright in the Museum of Comparative Zoölogy (Collector's No. 1177) which clearly belongs to this subspecies and closely agrees with the two other Chekiang specimens in the United States National Museum already reported upon by me.⁹ They all have several scales separating the internasals, distinct nasal and first labial, and intercalated scales between nasal and anterior pit scale, but the specimen collected by Mr. J. Wright (No. 1177) at Tunglu, Chekiang, has 23 scale rows as against the normal 21 in the others.

There are also in the collection belonging to the Zoological Museum of the University of Michigan and submitted to me by Dr. A. G. Ruthven for examination, two young specimens of this form. Unfortunately they are without precise locality but the probability is that they are from some place in Kiangsu. They agree with the above.

TRIMERESURUS GRAMINEUS YUNNANENSIS (Schmidt)

1925. Trimeresurus yunnanensis SCHMIDT, Amer. Mus. Novit., No. 157, Feb. 13, 1925, p. 4 (type locality Tengyueh, Yunnan, China; type, Amer. Mus. N. Y., No. 21058; Andrews and Heller, collectors).

Through the courtesy of Dr. Thomas Barbour I have been enabled to examine two specimens from Central Yunnan, namely, Mus. Comp. Zool. No. 14671, from Yunnan-fu, and No. 16734 from Fuchienhsien. Both have the internasals separated by scales, nasal distinct from first supralabial, and small scales in suture between nasal and anterior pit shield. The gular scales are of a somewhat intermediate character, but there can be no doubt that this form belongs to the highland type. The number of their scale rows is 19.

10

⁹ Proc. U. S. Nat. Mus., vol. 66, art. 25, 1925, p. 101.