

tooth on its anterior border; hand with six granular keels, the inner half of its upperside with two granular finger-keels and one keel between them, its outer surface with a median keel; width of hand about two-thirds the length of the underhand, which is almost equal to the movable finger; the latter a little shorter than the carapace, without lobe. *Legs* externally granular; coxæ thickly granular. *Pectinal teeth* 4; shaft of pecten distinctly segmented, divided by two transverse sulci into an apical, a median, and a basal sclerite, the latter divided by a longitudinal sulcus.

Measurements in mm.—Total length 32, carapace 4.5, tail 16; width of first segment 2, of fifth 1.5, of brachium 1.5, of hand 2.5; length of underhand 3.5, of movable finger 4.

Hab. MEXICO, Atoyac in Vera Cruz (*A. Dugès*¹).

Fam. BUTHIDÆ.

In all the known Central-American genera of this family the sternum of the cephalothorax is triangular, its sides anteriorly converging; there are two pedal spurs upon the arthrodial membrane connecting the protarsus with the tarsus, and the anterior of these is branched; the two halves of the genital operculum are separated in both sexes and there is a single tooth upon the lower side of the immovable fang of the mandible.

Distribution. Tropical and temperate countries of Eastern and Western Hemispheres to the south of 40°–45° of North latitude.

Synopsis of the Central-American Genera.

- a. Dentition of the fingers of the chela consisting of series of median rows of teeth flanked by numerous small supernumerary teeth.
 - a¹. Tail not posteriorly expanded, longer in male than in female; sternum of first abdominal somite scarcely sulcate. CENTRUROIDES, Marx.
 - b¹. Tail posteriorly expanded, much thicker but scarcely longer in male than in female; first abdominal sternum strongly sulcate. RHOPALURUS, Thor.
- b. Dentition of fingers of chelæ consisting of median rows of teeth.
 - a². Rows of teeth on the fingers of the chelæ not overlapping . . . ISOMETRUS, Hempr. & Ehr.
 - b². Rows of teeth on the fingers of the chelæ largely overlapping . . . TITYUS, C. Koch.

CENTRUROIDES.

Centrurus, Hempr. & Ehrenb. Symb. Phys., Scorp. p. 12 (1828) (part.) (nomen nudum); Peters, Mon. Ak. Wiss. Berlin, 1861, p. 512 (part.); Thorell, Ann. & Mag. Nat. Hist. (4) xvii. p. 9 (1876); Atti Soc. Ital. Sci. Nat. xix. p. 83 (1877); Karsch, Mittheil. Münch. ent. Ver. iii. p. 18 (1879); Pocock, Journ. Linn. Soc., Zool. xxiv. pp. 385, 391 (1893); Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 119 (1891); Das Tierr., Scorpiones et Pedipalpi, p. 87 (1899) (part.).

Tityus, C. Koch, Die Arachn. xi. pp. 1–48 (1845) (part.) [nec iii. p. 33 (1836)].

Nec *Centrurus*, C. Koch, Die Arachn. iv. p. 110 (1838); Gervais, Ins. Apt. iii. p. 49 (1844).

Nec *Centrurus*, Wood, Proc. Ac. Philad. 1863, p. 111; Journ. Ac. Philad. (2) v. p. 372 (1863).

Centruroides, Marx, Proc. U. S. Nat. Mus. 1889, p. 211.

The median rows of teeth on the digits of the *chela* not overlapping at the apices and flanked on each side by rows of more scattered teeth, which occupy the interspaces between the large lateral teeth. *Pectines* narrow, only gradually attenuate from base to tip; without enlarged basal lobe. *Sternum* of first abdominal segment with an ill-defined shallow depression, not a distinct groove, on each side running forwards from the inner extremity of the stigma and with no definite depressed lateral area beneath the pectines. *Tail* without median lateral keel on the second and third segments, always narrowed posteriorly in the female and generally also in the male, and always longer and not broader in the male than in the female.

Type *C. exilicauda* (Wood).

Distribution. Southern States of North America (California, Texas, Florida); West Indies, Bahamas, and the islands of the Caribbean Sea; Central America as far south as Panama, whence one species spreads along the Andean Chain through Colombia and Ecuador as far as Chile.

Synopsis of the Species.

- a.* Fingers of the chelæ furnished with eight rows of teeth along the middle line (or seven when the two proximal rows are coalesced), without including the apical row.
- a*¹. Fingers black, at least on the basal half, and sharply contrasted with the pale-coloured hand.
- a*². Terga with broad, median, and lateral pale bands; hands very wide, in female equalling, in male much exceeding width of second caudal segment; subaculear tooth minute or absent *nitidus*, Thor.
- b*². Terga with narrow median and lateral pale bands; hands in female much narrower than second caudal segment, in male a little narrower; subaculear tooth large *flavopictus*, Poc.
- b*¹. Fingers practically the same colour as the hand.
- a*³. Upperside of trunk, chelæ, legs, tail, and the abdominal sterna marbled with black and yellow; pectinal teeth 13-15 *thorelli*, Kraep.
- b*³. At least the first four abdominal sterna uniformly pale; pectinal teeth not less than 16.
- a*⁴. Upperside of abdomen ornamented with a pair of black bands separated from each other and from the lateral border by yellow bands.
- a*⁵. Carapace yellow only at the sides, the whole of the interocular triangle and the area behind the tubercle fuscous.
- a*⁶. Subaculear tooth close to base of aculeus; black bands on terga hardly or not wider than median and lateral pale bands; tail in male very long and slender; the vesicle more than twice as long as high *vittatus*, Say.
- b*⁶. Subaculear tooth remote from base of aculeus; black bands on trunk quite twice as wide as the yellow bands; vesicle in male less than twice as long as high *ornatus*, sp. n.
- b*⁵. Carapace rarely uniformly yellow, more usually marked with

- four narrow black stripes; terga coloured as in *C. vittatus*;
tail of male as in *C. ornatus* *elegans*, Thor.
- b*⁴. Upperside of carapace and terga uniformly coloured in the adult.
- a*⁷. Legs, chelæ, sterna, and tail uniformly ochre-yellow; terga either the same tint as the legs or tinted with fuscous; vesicle of male evenly oval when viewed from below.
- a*⁸. Keels on hands and last sternal plate strong and smooth or almost smooth; subaculear spine long and sharp . . . *ochraceus*, Poc.
- b*⁸. Keels on hands and last sternal plate evenly and finely granular; subaculear tooth small.
- a*⁹. Vesicle of male ovate, only twice as long as wide . . . *bertholdi*, Thor.
- b*⁹. Vesicle of male long, nearly three times as long as wide . *subgranosus*, Kraep.
- b*⁷. Chelæ with the hands much darker than the brachium; tail much darker posteriorly; upperside of trunk deep reddish-or blackish-brown; chelæ thickly hairy; vesicle of male broad and shouldered at base of aculeus *margaritatus*, Gerv.
- b*. Fingers of chelæ furnished with nine rows of teeth along the middle line, not including a short apical row.
- a*¹⁰. Subaculear spine close to base of aculeus, barely its own basal width from it; its apex turned towards the aculeus.
- a*¹¹. Legs, chelæ, trunk, and tail uniformly black, only the tips of the fingers and the tarsi pale *nigrescens*, Poc.
- b*¹¹. Not uniformly black; the legs rich yellow; at least the humerus and basal segments of the chelæ yellow, last tergal plate paler than the rest; anterior caudal segments yellowish, the posterior darker.
- a*¹². Brachium of chela the same colour as the hand and much darker than the humerus *fulvipes*, Poc.
- b*¹². Brachium of chela pale yellowish like the humerus and much paler than the hand *nigrimanus*, Poc.
- b*¹⁰. Subaculear spine more than its own basal width from the aculeus, from which its apex is turned away.
- a*¹³. Colour of body, legs, chelæ, and tail yellow, except that the edges of the terga, the fingers, and the end of the tail are black . . . *limbatus*, Poc.
- b*¹³. At least the carapace and terga (with the exception of the last in *C. bicolor*) blackish or deep brown.
- a*¹⁴. Last tergal plate of abdomen yellow; hands much darker than brachium *bicolor*, Poc.
- b*¹⁴. Last tergal plate of abdomen not yellow, at most a little paler than the rest; hand not darker, usually paler than brachium.
- a*¹⁵. Pectinal teeth 20-23; granules on caudal keels few in number and remote from each other *rubricauda*, Poc.
- b*¹⁵. Pectinal teeth 26-36; granules on caudal keels numerous and close-set *gracilis*, Latr.

1. *Centruroides thorelli*. (Tab. V. figg. 2, 2 a-c, ♀ ♂.)

Centruroides thorelli, Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 124 (1891)¹; Das Tierr., Scorpiones et Pedipalpi, p. 89 (1899)².

♀. *Colour*: upperside of trunk blackish, the carapace variegated with symmetrically arranged yellow patches; the terga with a narrow median and marginal yellow stripe and generally a pair of irregularly defined ><-shaped marks; sterna yellow, variegated with black, the first almost uniformly yellow, the fifth densely variegated; tail marbled with black below and laterally, especially at its posterior end; legs, chelæ, and chelicerae marbled black and yellow, the fingers uniformly yellow throughout. Upperside of *trunk* closely and coarsely granular, no lateral keels on the terga; carapace as long as the first and one-third of the second caudal segments, and about as long as the fourth. *Sterna* smooth; the last finely granular, with four granular keels. *Tail* a little more than five times as long as the carapace, slightly narrowed posteriorly, fourth segment about twice as long as wide; the intercarinal spaces, even on the upperside, finely granular, all the keels coarsely granular; vesicle coarsely granular below, with a large subaculear tooth remote from the base of the aculeus. *Chelæ* finely granular; the crests, including those on the upperside of the hand, granular; hand only slightly wider than the brachium, the width about three-quarters the length of the underhand, which is more than half the length of the movable finger, the latter very weakly lobate and furnished with eight rows of teeth (seven when the two proximal rows are united). *Pectinal teeth* 13-16.

♂. Like the female in colour and most structural features, but the *tail* much longer, more than seven times as long as the carapace, which is about equal to its first segment, its fourth segment nearly four times as long as wide. *Vesicle* unique in shape, flat below, nearly parallel-sided, but widest distally on each side of the base of the aculeus, where it rises into a pair of rounded shoulder-prominences. *Chelæ* longer than in female; the hand weakly crested; fingers not lobate, movable one-third longer than underhand.

Measurements in mm.—♀: Total length 39, carapace 4, tail 22; width of hand 1.2; length of underhand 2.5, of movable finger 4.5. ♂: Total length 42, carapace 3.2, tail 28; width of hand 1; length of underhand 2.5, of movable finger 4.2.

Hab. GUATEMALA¹ (*Mus. Brit.*), Guatemala city and Volcan de Agua (*O. Stoll*).

2. *Centruroides elegans*. (Tab. V. figg. 3, 3 a-c, ♀ ♂.)

? *Scorpio granosus*, Gervais, in Castelnau's Expéd. dans l'Amér. du Sud, Myriap. et Scorp. p. 42, t. 2. figg. 2, 2 a-c¹ (nec *Scorpio granosus*, Gervais, Arch. Mus. iv. p. 233, 1844).

? *Tityus infamatus*, C. Koch, Die Arachn. xi. p. 46, fig. 873 (1845)².

Centruroides infamatus, Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 125 (1891) (part.)³; Das Tierr., Scorpiones et Pedipalpi, p. 90 (1899) (part.)⁴.

Centruroides elegans, Thorell, Atti Soc. Ital. Sci. Nat. xix. p. 145 (1877)⁵.

Centruroides limpidus, Karsch, Mittheil. Münch. ent. Ver. iii. p. 120 (1879)⁶.

♀. *Colour*: upperside of trunk yellow, banded with black; carapace with black margin, black ocular tubercle, and four black lines, one on each side passing backwards and slightly inwards from the lateral eyes to the posterior border, and one on each side close to the middle line from the anterior border to the ocular tubercle, thence backwards on each side of the median groove to the hinder border; dorsal side of abdomen with a pair of broad black bands separated by a broad median yellow band and from the lateral borders by another yellow band, the yellow and black bands approximately equal in width; last tergite not distinctly banded; ventral surface pale; tail, legs, and chelæ quite pale or mottled with black; fingers same colour as hands. Upperside of *trunk* closely and thickly granular, the terga with scarcely a trace of lateral keels even on the fifth and sixth. *Carapace* as long as the first + $\frac{1}{3}$ of the second caudal segments, a little longer than the fourth, and shorter than the fifth. *Sterna* smooth and polished, the third mesially pitted, fourth with a pair of abbreviated submedian keels, fifth closely granular, with four granular crests. *Tail* a little more than five times as long as the carapace, finely granular throughout, with strong keels studded with pearly granulations; vesicle nearly smooth, with a small tubercle beneath and remote from

the aculeus. *Chelæ* at most finely granular, the crests with pearl-like granulations; hand wider than the brachium, its width less than half the length of the movable finger, its upperside with two finely granular keels running from the immovable finger; movable finger a little longer than the carapace, furnished with a large basal lobe and with eight rows of teeth. Pectinal teeth 22-23.

- ♂. Like the female in colour and granulation. *Tail* much longer, as much as about six and a half times as long as carapace, which is slightly longer than the first segment and about half the length of the first and second; fifth caudal segment a little narrower than the first, almost as high as wide and a little less than three times as long as high; vesicle broadly oval, about twice as long as high. *Hand* a little wider and longer than in female; the fingers not quite in contact basally when closed. Pectinal teeth 23-25.

Measurements in mm.—♀. Total length 60, carapace 6, tail 35; width of brachium 2, of hand 2.2. ♂. Total length 63, carapace 5.5, tail 40; width of first segment 2.7, of fifth 2.5, height of latter 2.5; length of vesicle 4, height and width 2; width of brachium 2, of hand 2.3.

Hab. MEXICO³⁻⁶, Yautepec (*A. Dugès*), Acapulco, Amula, Omilteme, Cuernavaca (*H. H. Smith*).

The above-given description is taken from adult male and female examples from Yautepec. In addition to these, the Godman and Salvin collection contains large numbers of specimens ticketed S. Mexico, and others from Acapulco, Amula, and Omilteme (8000-8500 feet), in the State of Guerrero, as well as a few from Cuernavaca.

Kraepelin determined this species as *C. infamatus*, *C. Koch*, but none of the specimens that I have seen agree with the description and figures of the typical example of that species, for which no locality was known. This specimen, measuring 60 mm. in length, had a large, blunt, subaculear tubercle; the legs were marbled, but the chelæ entirely pale, and the carapace had not the arrangement of colour characteristic of the examples described above, the antecular area being given as brown, and the lateral portions dark brown with yellow edges, whereas the figure shows the carapace to have been ornamented on each side with three oblique black stripes, the anterior passing forwards from the median ocular tubercle. In this feature *C. infamatus* more nearly approaches the following species, *C. vittatus*.

Again, the individuals from Mexico described by Thorell as *Centrurus elegans*, although agreeing in coloration with those described above, differ in their very much larger size, being 82 mm. in length, with the carapace 8 and the tail 50, and in having a small and slender subaculear tooth. Of specimens representing, I believe, this form the British Museum has several examples, including adult males and females, for which, unfortunately, no locality is known. They differ from those described above in having the chelæ, chelicæ, legs, and tail entirely pale, without trace of variegation, and in their larger size and in the presence of a distinct and slender subaculear tooth. An adult female measures 79 mm., with the carapace 8 and the tail 50, as in Thorell's type; and an adult male measures 68 mm., with the tail 44 and the carapace 6. It is interesting to observe that in one of the female examples the subaculear tooth is reduced to a small tubercle. The greater part of the specimens that I refer to this species seem to belong to the form that Karsch described as *C. limpidus*, the types of

which are said to be less than 50 mm. long and to have the subaculear tooth represented by a small tubercle.

It is probable that *C. elegans* and *C. limpidus* represent distinct subspecific forms of one and the same species, and no doubt many more will be brought to light with diligent collecting in other localities.

In addition to the two already discussed, the following may, I think, be recognized:—

Subsp. *insularis*, nov.

Resembling the forms identified above as *C. elegans* and *C. limpidus* in colour, size, and structural features, but without any trace of marbled variation on the legs, chelæ, chelicerae, or underside of the tail, as in *C. elegans*.

Hab. MEXICO, Tres Marias Is. (*Forrer*).

Three specimens—one male and two females.

Subsp. *nigrovariatus*. (Tab. V. figg. 4, 4 a, ♂.)

Centrurus nigrovariatus, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 387 (1898) ⁷.

Centrurus infamatus, var. *nigrovariatus*, Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 90 (1899) ⁸.

♂. Resembling male of form referred to *C. elegans* in colour and most structural features, but differing in the formation of the posterior segments of the tail, the fifth segment being wider than the first, with its upper surface much elevated in the middle, with a deep median groove expanding posteriorly into an oval depression.

Measurements in mm.—Total length 52, carapace 4·5, tail 33; width of its first segment 2·3, of its fifth 2·7; height of latter 2·5.

Hab. MEXICO, Oaxaca ⁷.

Subsp. *pallidiceps*, nov.

♀. A pale form, with the chelæ, legs, and tail without trace of infuscation, and the carapace without stripes, only the ocular tubercle and the lateral border being infuscate; the spots on the terga faint. Further differing from *C. elegans* in having a relatively large and triangular subaculear tooth. Pectinal teeth 19.

Measurements in mm.—Total length 54, carapace 5·5, tail 33.

Hab. MEXICO, Presidio (*Forrer*).

One specimen.

3. *Centrurus vittatus*. (Tab. VI. figg. 1, 1 a, b, ♀ ♂.)

? *Tityus infamatus*, C. Koch, Die Arachn. xi. p. 46, fig. 873 (1845) ¹.

Buthus vittatus, Say, Journ. Ac. Sci. Philad. ii. pp. 61, 62 (1821) ² [nec *Buthus vittatus*, Guérin, Voyage de la Coquille, ii. 2, p. 50 (1830)].

Scorpio (Atreus) californicus, Girard, in Marcy's Rep. Red River, p. 269 (1853) ³.

Buthus californicus, Wood, Journ. Ac. Sci. Philad. (2) v. p. 364 (1863) ⁴.

Buthus carolinianus, Wood, Journ. Ac. Sci. Philad. (2) v. p. 363 (1863) ⁵ [nec *Scorpio carolinianus*, Palisot de Beauv. Ins. rec. Afr. Amér. p. 191, t. 5. fig. 3 (1821), which = *Vajovis carolinianus*].

? *Centrurus olivaceus*, Thorell, Atti Soc. Ital. Sci. Nat. xix. p. 145 (1877) ⁶.

Hab. NORTH AMERICA ³, Georgia ², Florida ², Kansas ⁵, Texas ⁵, California ⁴.

Subsp. *suffusus*, nov. (Tab. VI. figg. 2, 2a, ♂ ♀.)

♀. Colour differing from that of the female of *C. elegans* in that the carapace has a deep black triangular patch in front of and involving the eyes, and a pair of irregular broad bands extending from the ocular tubercle to the posterior border, sometimes uniting in the middle line, sometimes encroaching on the lateral area of the carapace; legs, chelæ, lower side of tail, and upperside of chelicerae indistinctly speckled or uniformly pale; lower side of tail with traces at least of a median band. Structurally resembling female of *C. elegans*, but the subaculear tubercle much nearer to the base of the aculeus. Pectinal teeth 18.

♂. Like ♀ in colour. Structurally differing from the male of *C. elegans* in the form of the tail; this organ much longer and thinner, being about seven and a half times as long as the carapace, which is as long as its first segment, but less than half the length of the first and second segments taken together; fifth segment as high as wide, a little more than four times as long as high; vesicle long and oval, more than twice as long as high; subaculear tubercle close to base of aculeus. Pectinal teeth 23-24.

Measurements in mm.—♀. Total length 46, carapace 4.5, tail 27. ♂ (type). Total length 62, carapace 5, tail 40; length of fifth segment 8, height and width 1.5; width of first segment 2, length 5; length of third 7.8, width 1.8; length of vesicle 4, height 1.5.

Hab. MEXICO, Ventanas in Durango (*Forrer*), Durango (type, *A. Dugès*).

This description of the subsp. *suffusus* is taken from a male sent by Dr. Dugès and a young female example from Ventanas, both being from Durango. In addition to these, and a young specimen from the latter locality and a second male from Durango, the British Museum has many individuals of the typical form collected by Mr. William Taylor at San Diego and Duval in Texas. Say records the species from Georgia and Florida, and Wood states that it ranges through the Southern Atlantic States into Texas and Southern Kansas. It also occurs in California, if, as has been asserted (*cf. infra*, p. 26), *C. californicus*, Gir., be the same species.

Between the Texan and Mexican examples there are observable slight differences, both in colour and structure, which warrant the separation of the latter as a distinct subspecies. The two may be contrasted as follows:—

- a. Antecular triangle with sharply defined lateral edge; subaculear tooth in female remote from base of aculeus, as in *C. elegans*; in male the tail shorter and thicker, first segment much less than twice, third much less than thrice as long as wide; vesicle more elongate, with its aculeus less curved *vittatus*, Say (Texan forms).
- b. Antecular patch with irregularly defined lateral edge, the whole of the upperside of the carapace more generally suffused with black; subaculear tooth close to base of aculeus in female; male with very long and slender tail, the first segment more than twice, the third at least thrice as long as broad; vesicle higher, the aculeus more curved Subsp. *suffusus*, n.

The largest female example of the typical form from San Diego gives the following measurements:—Total length 68 mm., carapace 6.5, tail 42; and the largest male the following:—Total length 55 mm., carapace 5, tail 37; width of first segment 2.5, length 4.5; width of third 2.3, length 6; width of fifth 2, length 8.

BIOL. CENTR.-AMER., Arachn. Scorp., August 1902.

In very young specimens the fifth segment of the tail and the hand of the chelæ are black. Traces of this blackness are also observable in half-grown examples. The pectinal teeth reach 25 in the female and 26 in the male.

In the above-given synonymy of *C. vittatus* I have cited *Buthus californicus* and *B. carolinianus* of Wood on the authority of Marx [Proc. Ent. Soc. Washington, i. p. 91 (1888)], although in a question of this kind requiring considerable powers of discrimination, backed by a longer experience and study than Dr. Marx possessed, no great weight can be attached to his opinion.

No doubt Wood's *B. carolinianus* is, as he states, Say's *B. vittatus*. In comparing *Scorpio californicus* of Girard with *Buthus carolinianus*, Wood says that the former differs from the latter in colour (the carapace being yellow and immaculate, except for a black border and black eye-spot), in the greater roughness of the body, the more strongly marked denticulate crests on the tail, in the more spinose inner surface of the chelæ, and the crests on these appendages more crenulate—characters which, if reliable, point at least to a subspecific distinction. Beyond this it would be unsafe to assert, since Wood's verdict was based upon the examination of the single specimen of *B. californicus* known to him and Girard. Marx, unfortunately, vouchsafes no word of explanation of the differences of colour and structure pointed out by Wood, leaving us to accept or reject his *ipse dixit* on the subject.

4. **Centruroides ornatus**, sp. n. (Tab. VI. figg. 3, 3 a, b, ♀ ♂.)

♀. Differing from *C. elegans* principally in colour. Carapace with the whole of its median area deep brown, yellow only externally; the brown tergal bands broad, about twice as broad as the median yellow stripe or rather broader, also considerably broader than the lateral pale band, each patch, moreover, is complete and extends from the anterior to the posterior border of the tergum; a narrow dark stripe on the extreme edge of the carapace and at least upon the anterior half of the edge of the terga; the crests on the last sternum and on the lower side of the tail lightly infuscate; chelæ, legs, and tail uniformly pale. Closely resembling *C. elegans* in structure, but with the hands thinner, as wide as brachium, and a more distinct subaculear tooth. Pectinal teeth 17-18.

♂. Like the male of *C. elegans* in sexual characters; fifth caudal segment narrower than the first, a little wider than high. Hands a little wider than brachium. Pectinal teeth 21-22.

Measurements in mm.—♀. Total length 45, carapace 4, tail 24; width of hand 1.5. ♂. Total length 50, carapace 4.5, tail 30.5.

Hab. MEXICO, Jalisco, north of the Rio de Santiago (*Schumann*).

5. **Centruroides subgranosus**. (Tab. VI. figg. 4, 4 a, b, ♀.)

Centrurus subgranosus, Kraepelin, Jahrb. Hamb. Wiss. Aust. xv. p. 44 (1898)¹; Das Tierr., Scorpiones et Pedipalpi, p. 90 (1899)².

♀. About the same form and size as *C. elegans*, but nearly uniformly yellowish-brown, there being at most indistinct traces of a median and lateral pale spot separated by a slightly darker patch; legs, tail, and chelæ uniformly yellowish-brown. Granulation of trunk finer and closer than in *C. elegans*, and, as in that species, with lateral keels traceable as a pair or more of serially-arranged granules. Sterna as in *C. elegans*, but the fourth with the keels less well developed, but still traceable. Tail about five and a

half times as long as carapace, which equals its fourth caudal segment in length; its subaculear tooth longer than in *C. elegans*. *Chelæ* as in the latter.

♂. Apparently resembling that of *C. vittatus*, being described as very slender, with the fifth segment rounded at the sides, with the inferior lateral crests very feebly developed, and the vesicle three times as long as wide and almost cylindrical.

Measurements in mm.—♀. Total length 46, carapace 4.5, tail 28.

Hab. CENTRAL AMERICA¹.

The description of the female given above is taken from one of the co-typical examples received by the British Museum from Prof. Kraepelin. Although he describes the species as "einfarbig gelbroth," and as having no trace of keels on the fourth sternal plate, nevertheless the abdominal bands characteristic of *C. elegans* and crests on the sternum in question are distinctly traceable in this specimen.

6. *Centruroides bertholdi*.

Centruroides bertholdi, Thorell, Atti Soc. Ital. Sci. Nat. xix. p. 158 (1877)¹.

♂. *Colour*: upperside of trunk uniformly fuscous or subferruginous, tail a little paler towards the extremity; legs and chelæ also uniformly coloured and paler than the trunk. Upperside of *trunk* thickly granular, the granules not forming definite series; the tergites with short lateral crests. *Sterna* smooth, coriaceous laterally, the last with four crenulated crests, and very finely granular in front and laterally, and with a large granule on each side between the keels and side margin. *Tail* very long and narrow, about eight times as long as the carapace, which is shorter than its first segment, and about one-third the length of the fourth + the fifth, fifth segment more than three times as long as broad and high, first about twice as long as wide, third about three times as long as wide; the surface very finely coriaceous, all the keels on segments 1-4 normally granulate; fifth segment almost smooth, with the superior edges widely rounded, the keels at most represented by very minute granules, the lower keels weak; vesicle ovato-cylindrical, about twice as long as wide; a slender conical subaculear tooth. *Chelæ* normally keeled, very finely granular above; hand wider than brachium, the keels granular; movable finger with eight rows of teeth.

Pectinal teeth 26-27.

Measurements in mm.—Total length 79.5, carapace 6.5; tail 51.5, its first segment 7, second 8.5, fifth 10.3; vesicle and aculeus 6.5.

Hab. MEXICO¹.

Judging by the description, this species, of which the male alone has been described, differs from the rest of the uniformly-coloured Mexican forms in the extreme length of its tail, which is almost eight times as long as the carapace, with its first segment exceeding the latter in length. In some respects it approaches *C. margaritatus*, but is smaller, has the granules of the carapace not serially arranged, and the tail longer and paler at the posterior end, instead of darker; nor can the hand of *C. margaritatus* be said to be furnished above with three granular keels running on to the immovable finger.

According to Kraepelin, *C. bertholdi* is based upon the male of *C. granosus*, Thorell. There appear to me to be grave reasons for doubting this. At all events, no great weight can be attached to Kraepelin's opinion on this point, considering that the male of the species from Curaçoa he determined as *C. granosus* ♀ + *C. bertholdi* differs from *C. bertholdi*, Thor., in having no subaculear tooth, the carapace longer than the first

caudal segment, half the length of the sum of the first and second, more than one-seventh the length of the tail, the superior keel on the hand practically smooth, &c. (*cf. infra*, p. 32, where *C. granosus*, Thor., is further discussed).

7. **Centruroides nitidus.** (Tab. VI. figg. 5, 5 *a, b*, ♀ ♂.)

Centruroides nitidus, Thorell, Atti Soc. Ital. Sci. Nat. xix. p. 152 (1877)¹; Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 129 (1891)²; Pocock, Journ. Linn. Soc., Zool. xxiv. p. 390 (1893)³.

Centruroides tenuis, Thorell, loc. cit. p. 153⁴.

Centruroides republicanus, Karsch, Mittheil. Münch. ent. Ver. iii. p. 120 (1879)⁵.

♀. *Colour* much as in *C. elegans*, the terga with a pair of black bands as in that species; the carapace not banded nor mesially infuscate, the lower side of the tail with a broad, median, black band, sometimes complete, sometimes failing on the first and fifth, more rarely on the fourth segment; chelæ and legs uniformly yellowish-brown, but the fingers black, at least in the basal half, where they are much darker than the hand. Upperside of *trunk* finely and closely granular, studded with coarser granulation, the terga without lateral granular crests. *Sterna* as in *C. elegans*, the third and fourth finely coriaceous, the fourth with scarcely a trace of crests. *Tail* parallel-sided, more than four times as long as carapace, the first segment as wide as the fifth, the third as long as the carapace, the fourth slightly longer, the intercarinal spaces finely granular or almost smooth, the sides of the segments more convex than in *C. elegans*; the fifth segment as high as wide, scarcely twice as wide as long; vesicle almost as high as wide, without a spine beneath the aculeus. *Chelæ* finely granular, with coarsely granular crests on humerus and brachium; the latter thicker than in *C. infamatus*, its width much more than one-third, nearly one-half, of its length; hand also very broad, its width about half the length of the movable finger, the keels on its upperside strong but smooth; movable finger with eight rows of teeth, barely one-third longer than the length of the underhand. *Pectinal teeth* 17-21.

♂. Coloured like the female. *Tail* from seven and a half to eight times the length of the carapace, parallel-sided or slightly expanded posteriorly, the fifth segment from two and a half to over three times as long as wide. *Hands* longer than in female, the underhand almost as long as the carapace. *Pectinal teeth* up to 25.

Measurements in mm.—♀. Total length 62, carapace 6, tail 37; width of hand 3.5, of brachium 2.5; length of underhand 5, of movable finger 6.8. ♂. Total length 68, carapace 6, tail 49; width of hand 3, of brachium 2.2; length of underhand 5.5, of movable finger 7.

Hab. MEXICO, Vera Cruz².—ANTILLES, Haiti¹⁻⁵, Puerto Rico².

The original examples of *C. nitidus*, *C. tenuis*, and *C. republicanus* were from Haiti, whence the British Museum also has specimens of the species. The British Museum has additional examples ticketed "Brazil," a locality which is perhaps erroneous. The description here given has been taken from these specimens.

8. **Centruroides flavopictus.** (Tab. VI. figg. 6, 6 *a-d*, ♂ ♀.)

Centruroides flavopictus, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 387 (1898)¹; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 94 (1899)².

♀. *Colour*: upperside of trunk blackish or yellowish-brown, the last tergite paler, the others with a narrow median yellow stripe or spot and a marginal spot on each side; tail reddish-brown, deep blackish-brown beneath at its posterior end, vesicle paler than fifth segment; chelæ pale at base, humerus and brachium, especially the brachium, stained with brown; hands yellowish-red, much lighter in colour than the brachium; fingers black, much blacker than the hand, with pale tips. *Legs* yellow. *Carapace* and *terga* relatively finely granular, the former without serial arrangement of granules, the latter without a trace of lateral keels, except on the fifth and sixth plates; fourth sternal plate mesially carinate; fifth coriaceous, finely granular laterally, the keels granular or crenulate. *Tail* about five and a half times as long as

carapace, moderately stout, fourth segment twice as long as wide, and about as long as the carapace, the intercarinal spaces almost smooth, the sides and under surface of the fifth segment closely but weakly granular; all the crests normal, with pearly granulation; upperside of fifth higher than its superior lateral keel; no trace of median lateral keel on second segment; vesicle granular, with triangular subaculear tooth close to base of aculeus. *Chelæ* finely and closely granular or coriaceous; normally keeled; hand narrow, a little wider than brachium, the three finger-keels on its upperside evenly granular or crenulated, the external weak, the rest of the hand smooth; the underhand about half the length of the movable finger, which has a low basal lobe and eight rows of teeth. *Pectinal teeth* 20-22.

♂. *Tail* about six and a half times as long as carapace, which is considerably more than half the length of the sum of its first and second segments, and almost equal to the third; second segment slightly more than twice as long as broad, fifth about three times as long as wide, slightly higher than wide, with rounded superior lateral edges, the dorsal surface rising well above the weakly granular keel; vesicle evenly oval when viewed from below, without trace of lateral projection forming shoulder-prominence at base of aculeus. *Chelæ* much longer and stouter than in female; width of hand much exceeding that of brachium, length of underhand much more than half the length of the movable finger. *Pectinal teeth* 22.

Measurements in mm.—♀. Total length 62, tail 37, carapace 6.7; width of first caudal segment 3.5, length 4.2; width of fifth 2.8, length 7. ♂. Total length 69, carapace 7, tail 46; length of second caudal segment 7, width 3; length of fifth 9, width 3.

Hab. MEXICO, Jalapa¹ (*Höge*).

Kraepelin² places *C. flavopictus* in close proximity to *C. margaritatus*, doubting apparently its specific distinctness; and Borelli [Boll. Mus. Torino, xiv. no. 338, p. 3 (1899)] goes a step further and declares it to be based upon the young of that species, an opinion which he supports by the presence of a pale narrow median band and lateral marginal spots in the young forms of the latter. This view, however, is quite untenable. When describing *C. flavopictus* I was well acquainted with the characters of the immature *C. margaritatus* and with the features in its coloration that Dr. Borelli mentions; but no specimens of *C. margaritatus*, whether young or old, that I have seen resemble *C. flavopictus* in having the basal half of the finger black, and contrasting forcibly with the pale yellowish-red hand, which is also much paler than the brachium. In *C. flavopictus*, again, the granulation is much finer, and there are no traces of coarse lineally arranged granules on the carapace; there are also differences in the number of pectinal teeth, the form and size of the subaculear tooth and of the vesicle in the male, and the granulation of the hand-keels. Lastly, the adulthood of the typical specimens of the species is attested by the development of well-marked secondary sexual characters.

9. *Centruroides ochraceus*. (Tab. VI. figg. 7, 7 a-d, ♀ ♂.)

Centruroides ochraceus, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 386 (1898)¹; Kraepelin, Das Tier., Scorpiones et Pedipalpi, p. 94 (1899)².

♀. *Colour*: upperside of trunk a deep uniform yellowish-brown; tail, legs, and chelæ uniformly ochre-yellow. *Carapace* and *terga* studded with coarse granules, which are arranged on the former in definite series and on the latter in the usual way, the lateral keels being apparent on all but the first and second tergites. *Sterna* smooth, third with only a few coarse punctures, fourth with weak crests, fifth very finely granular laterally, the four keels smooth, the laterals at most crenulate. *Tail* about five and a half times as long as carapace, which is equal to its fourth segment in length; third segment twice as long as wide, fifth

two and a half times as long as wide, as high as wide; intercarinal spaces of segments 1-4 almost smooth, the keels strong and with normal pearly granulation, the inferior medians smooth on the first, crenulate on second; fifth segment finely granular, its upper surface raised slightly above the superior lateral keel; vesicle slightly wider than high, weakly granular, subaculear tooth long, broad at base, slender and pointed apically; aculeus abruptly curved backwards from its base. *Chele* at most very finely granular; upper finger-keels on hand strong and smooth, inner finger-keel crenulate, rest of the hand smooth, with only a few weak granules on its inner surface; hand wider than brachium, which is three times as long as wide; width of hand less than half the length of the movable finger, which has a strong basal lobe and eight rows of teeth. *Pectinal teeth* 27.

♂. *Tail* nearly seven times as long as carapace, which is as long as its second segment, the latter twice as long as wide, fifth as high as wide and about four times as long as wide; vesicle long and narrow, narrowly elliptical when viewed from below, without trace of shoulder-prominences. *Hand* approximately as in female. *Pectinal teeth* 27-28.

Measurements in mm.—♀. Total length 72, carapace 7.2, tail 42; width of first segment 3.5, length 4.8, length of eighth 8.8, width 2.8; width of hand 3, of brachium 2.3. ♂. Total length 67, carapace 6, tail 43; length of first segment 5, width 3, length of fifth 8.5, width 2+; width of vesicle 1.5.

Hab. MEXICO, Yucatan (*coll. Keyserling*¹), Temax in N. Yucatan (*Gaumer*).

Though resembling *C. margaritatus* in some respects, *C. ochraceus* may be at once distinguished by its uniformly yellowish-brown coloration, smaller size, very sparsely hairy chelæ, large subaculear tooth, and more abruptly bent aculeus. Again, in the male, the carapace is as long as the second caudal segment, whereas in the male of *C. margaritatus* it is much shorter, and the vesicle, when viewed from below, is narrowly elliptical, without shoulder-prominence, while in *C. margaritatus* it is parallel-sided and strongly shouldered.

10. *Centruroides margaritatus*. (Tab. VII. figg. 1, 1 *a-e*, ♂; 2, 2 *a, b*, ♀.)

Scorpio margaritatus, Gervais, Voyage de la Bonite, i. p. 281, Atlas, Aptères, t. 1. figg. 13-17 (1841)¹; Ins. Apt. iii. p. 55 (1844)²; Arch. Mus. iv. p. 224 (1844)³.

Centruroides margaritatus, Pocock, Journ. Linn. Soc., Zool. xxiv. p. 386 (1893)⁴; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 93 (1899)⁵; Borelli, Boll. Mus. Torino, xiv. no. 338, p. 3 (1899)⁶.

Scorpio edwardsii, Gervais, Arch. Mus. iv. p. 216, t. 11. figg. 13, 14 (1844)⁷; Ins. Apt. iii. p. 53⁸; and in Castelnau's Expéd. dans l'Amér. du Sud, Myriap. et Scorp. p. 41, t. 1. figg. 1, 1 *a-c* (1859)⁹.

Scorpio de geerii, Gervais, Arch. Mus. iv. p. 217, t. 11. figg. 16, 17 (1844)¹⁰; Ins. Apt. iii. p. 54 (1844)¹¹.

Centruroides de geerii, Thorell, Atti Soc. Ital. xix. p. 167 (1877)¹²; Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 133 (1891)¹³.

Tityus carinatus, C. Koch, Die Arachn. xi. p. 2, fig. 851 (1845)¹⁴.

Tityus macrurus, C. Koch, loc. cit. p. 16, fig. 859¹⁵.

Tityus ducalis, C. Koch, loc. cit. p. 38, fig. 869¹⁶.

Centruroides gambiensis, Karsch, Mittheil. Münch. ent. Ver. iii. p. 123 (1879)¹⁷.

? *Centruroides granosus*, Thorell, Atti Soc. Ital. Sci. Nat. xix. p. 155 (1877) (nec *C. granosus*, Kraepelin)¹⁸.

♀. *Colour* of upperside of trunk a rich deep reddish-brown, the last tergal plate generally paler; sterna paler, the posterior darker than the anterior; tail on its anterior segments yellowish, brownish posteriorly,

the lower side darker than the upper, and the keels darker than the intercarinal spaces; chelicerae yellowish-brown; chelæ with humerus and brachium yellow; hand and fingers deep reddish-brown, much darker than the brachium, base of fingers the same colour as the hand, their distal extremities generally paler; legs yellowish. *Carapace* as long as the first + $\frac{1}{4}$ of the second caudal segment, about as long as the third; beset with coarse subserially arranged granules. *Terga* also coarsely granular, the interstices and anterior portion finely granular; lateral crests distinct and consisting of three or four granules. *Sterna* 1-4 smooth, except the subpectinal area of the first, which is finely granular; a pair of indistinct crests on the fourth; fifth sparsely granular, the keels strong, the laterals granular, the medians crenulate. *Tail* strong, about five and a half times as long as the carapace; the first segment slightly wider than the rest, about one-third or one-fourth longer than wide, fourth barely, fifth slightly more than twice as long as wide; the keels strong and coarsely granular, the interstices scarcely or weakly granular, the fourth more so than the third, and the fifth much more so than the others; vesicle weakly granular, its width as great as that of the brachium, the subaculear tooth distinct in young specimens, but often quite small and tubercular in adults. *Chelæ* thickly studded with long hairs internally, with the intercarinal spaces scarcely granular; the keels of humerus and brachium coarsely granular; hand large, its width nearly equal to that of the underhand, equal to that of the third segment and half the length of the movable finger, the upperside furnished with a pair of strong, nearly smooth crests, the external more broken up into low tubercles than the internal; a few granules on the inner surface of the hand and a few on the outer side below the outer crest; movable finger with a strong lobe, furnished with eight rows of teeth (excluding the small apical row) and rather longer than the carapace. *Pectinal teeth* 25-30.

♂. Like the female in colour and granulation. *Tail* very long, about seven and a half times as long as the carapace, which above equals the first segment in length, and a little exceeds one-third of the length of the fourth + the fifth; the first segment a little more than twice as long as wide, the fourth three times as long as wide, the fifth rather more than that; the vesicle with subparallel sides, expanded or shouldered at the base of the aculeus, a small subaculear tooth. *Chelæ* a little longer than in the female; the hand narrower, its width about two-thirds the length of the underhand, less than half that of the movable finger, and equal to or slightly exceeding that of the first caudal segment. *Pectinal teeth* 27 to over 30.

Measurements in mm.—♀. Total length 96; length of carapace 10, of tail 58; width of brachium 3.5, of hand 5.5; length of underhand 6, of movable finger 10.5. ♂. Total length 101, carapace 8.8, tail 69; width of brachium 2.5, of hand 4.5; length of underhand 6.2, of movable finger 9.8.

Hab. NORTH AMERICA, California.—MEXICO, Presidio and Mazatlan (*Forrer*), Sierra Madre del Sur and Dos Arroyos in Guerrero (*H. H. Smith*), Cordova (*Mus. Brit.*), Yucatan (*Cuming*); GUATEMALA, near the city and Lanquin (*Stoll*); COSTA RICA (*Rogers*), Guadalupe and San José (*Tristan and Biolley*); PANAMA (*Cuming*), Punta de Sabana, Darien (*Festa*), San José in the Pearl Is.¹⁸.—SOUTH AMERICA to Peru, Brazil, and Chile; JAMAICA.—W. AFRICA, Gambia, Sierra Leone.

This species has a wide range in Central and South America. In addition to numerous examples ticketed merely Central America or Mexico, the British Museum has others from the above-mentioned localities in that region, and also large numbers as well from Jamaica (*Elmsley, Peckham, and Cockerell*), and some ticketed California (*J. H. Gurney*). Southwards from Darien *C. margaritatus* runs into the mainland of Colombia—Ibaque (*Goudot, in Mus. Brit.*), Cartagena and Bogota (type of *Scorpio edwardsii*, teste *Gervais*⁷); into Ecuador—Guayaquil (*E. Whymper, in Mus. Brit.*), Chimborazo and Santa Rosa (*Simons, in Mus. Brit.*), and the island of Puna in the Gulf of Guayaquil, where, according to *Gervais*¹, the type of *C. margaritatus* was procured; thence southward into Peru (teste *Gervais*) and Chile, where, according to *Gervais*¹⁰, the type of *Scorpio de geerii* was collected. *Gervais* also records

it from Brazil ; and, lastly, the species has been met with in West Africa—in Gambia (type of *C. gambiensis*) and Sierra Leone (*Surg.-Major Clements, in Mus. Brit.*). No doubt, however, its presence in Africa is attributable to artificial introduction through human agency in connection, perhaps, with the slave-trade—a supposition supported by the circumstance that the species in San José, Costa Rica, is common in the roofs of old houses, according to Tristan.

Centrurus granosus, Thorell¹⁸, based upon a specimen from the island of San José, in the Gulf of Panama, is, I suspect, to be referred to the young of this species. There appears to be nothing in the description to discountenance this belief, and much to be found in its favour. The coarsely and serially granular carapace, the strong and smooth superior keels on the hand, the eight rows of teeth on the movable finger, the number of pectinal teeth (26–27), the presence of a moderately strong, conical, subaculear tooth, the flatness of the upperside of the fifth caudal segment and its squared lateral angles, the paler colour of the last abdominal somite, the darker tint of the underside of the fifth caudal segment, the blackish keels, the hands rather more deeply tinted (*paullo saturatius coloratis*) than the rest of the chelæ and the legs, with the fingers not infusate—all these characters agree with those of *C. margaritatus*; whereas the smaller size (54 mm. in total length, with the carapace 6 and the tail 32.5), the narrow hand, which is scarcely wider than the brachium ($2\frac{1}{3}$ mm. : $2\frac{1}{4}$ mm.), and the lightly lobate movable finger attest the immaturity of the type specimen. Lastly, it is significant that Thorell himself, who, curiously enough, did not recognize that *C. margaritatus*, Gervais, is the same species as the one that he identified as *C. de geeri*, compares *C. granosus* with *C. margaritatus* in the following words:—“Hæc species [*C. granosus*] *Scorp. margaritato*, Gerv., certe valde affinis est, sed verisimiliter diversa : in *C. margaritato*, secundum figuram a Cel. Gervais datam, costæ manuum fortiter granulose sunt, in nostra specie omnino sunt læves.” As a matter of fact, the granulation of the keels in this figure is grossly exaggerated, as I have elsewhere⁴ pointed out, so that the only difference between the two forms mentioned by Thorell falls to the ground.

Prof. Kraepelin appears to me to have fallen into errors in his identification of *C. granosus*—errors which careful perusal of Thorell’s descriptions would have rendered impossible. He determines as *C. granosus* a species from Curaçoa and, as he alleges, from Barbados, which is uniformly coloured throughout, and has no subaculear tooth, quite ignoring Thorell’s account of the coloration of the type of *C. granosus* and his statement as to the presence of a “*dens sat fortis, conicus*,” beneath the aculeus.

11. *Centruroides gracilis*. (Tab. VII. figg. 3, 3 *a*, ♂ ; 4, 4 *a*, ♀.)

Scopio australis, De Geer, Mém. etc. vii. p. 348 (1778)¹ [*teste* Thorell, Atti Soc. Ital. Sci. Nat. xix. p. 166 (1877)] (nec *Scopio australis*, Linn.).

Scopio gracilis, Latreille, Hist. Nat. Gén. Crust. et Ins. vii. p. 127 (1804)².

- Centrurus gracilis*, Karsch, Mittheil. Münch. ent. Ver. iii. p. 18 (1879)³; Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 131 (1891)⁴; Pocock, Journ. Linn. Soc., Zool. xxiv. pp. 385, 386 (1893)⁵; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 92 (1899)⁶.
- Androctonus biaculeatus*, Lucas, in Webb & Berthelot, Hist. Nat. Canar., Arachn. p. 45 (1835)⁷.
- Scorpio (Atræus) biaculeatus*, Gervais, Ins. Apt. iii. p. 54, t. 23. fig. 1 (1844)⁸; Arch. Mus. iii. p. 218 (1844)⁹; and in Castelnau's Expéd. dans l'Amér. du Sud, Myriapodes et Scorpiones, p. 43, t. 2. fig. 4 (1859)¹⁰.
- Buthus biaculeatus*, Wood, Journ. Acad. Nat. Sci. Philad. v. p. 366 (1863)¹¹ (part.).
- Centrurus biaculeatus*, Thorell, Atti Soc. Ital. xix. p. 166 (1877)¹².
- Tityus mulatinus*, C. Koch, Die Arachn. xi. p. 5, fig. 854 (1845)¹³.
- Tityus congener*, C. Koch, loc. cit. p. 19, fig. 860¹⁴.
- Tityus nebulosus*, C. Koch, loc. cit. p. 25, fig. 862¹⁵.
- Scorpio (Atræus) sayi*, Girard, in Marcy's Rep. Red River, p. 269 (1853)¹⁶.
- Scorpio (Atræus) nigrifrons*, Berthold, Nachr. Ges. Götting. 1846, p. 59¹⁷ (teste Kraepelin).
- Centrurus heterurus*, Karsch, Mittheil. Münch. ent. Ver. iii. p. 122 (1879)¹⁸.

♀. *Colour*: carapace and terga deep reddish-black or brown, sterna paler but clouded with rich brown; tail yellowish-brown, paler than the terga, darker posteriorly and beneath; legs ochre-yellow; chelæ rather darker than the legs, the hand redder than the brachium, fingers nearly black with yellow tips; chelicerae deep brown; coxæ, sternum, &c. pale. Upperside of *trunk* studded with coarse, shining, symmetrically arranged tubercles, an area extending obliquely forwards on each side of the median eyes and the interstices between the rows of coarse tubercles finely granular; anterior portion of terga finely and closely granular; carapace as long as the second caudal segment, a little shorter than the third or fourth, as long as brachium, rather longer than humerus. *Tail* about six and a half times as long as carapace, all the crests evenly granular, the interspaces at most very weakly granular; vesicle weakly granular below, slightly wider than high; subaculear spine well developed, triangular, its upper (anterior) edge lightly convex, the distance between it and the base of the aculeus exceeding the width of the base of the spine. *Sterna* shining, the second, third, and fourth coarsely punctured in the middle, the last very finely granular laterally, and furnished with four keels, the medians nearly smooth, anteriorly abbreviated, the laterals converging inwards posteriorly against the medians. *Chelæ* shagreened, the crests on humerus and brachium closely granular; hand with one complete weakly granular finger-keel, an incomplete keel close to it on the outer side; width of hand about one-third the length of the movable finger, and about two-thirds that of the underhand, which is almost half the length of the movable finger; the latter lobate at base, the immovable finger with corresponding shallow excavation, the movable with nine rows of teeth. *Pectinal teeth* 25-30.

♂. Smaller and slenderer than female. *Tail* much longer, about eight times as long as the carapace, which is scarcely as long as the first segment, and about three-quarters the length of the second; vesicle with nearly straight sides and shouldered at base of vesicle on each side, its posterior surface much less convex. *Chelæ* a little longer than in female, the carapace a little shorter than the humerus. *Pectinal teeth* 30-36.

Measurements in mm.—♀. Total length 102, carapace 9.5; tail 62, caudal segments 1+2 (second 9.5) 18.5, fifth 12. ♂. Total length 118, carapace 9.5; tail 78, caudal segments 1+2 (second 12.5) 24, fifth 15.

Hab. MEXICO, Lake of Chalco, Yucatan (*coll. Keyserling, in Mus. Brit.*), Atoyac in Vera Cruz, Teapa in Tabasco (*H. H. Smith*), Temax in N. Yucatan (*Gaumer*); BRITISH HONDURAS (*Indo-Colonial Exhib.*), Stain Creek (*Robertson*); GUATEMALA, Panzos (*Conradt*), Salinas de Nueve Cerros, Rio Negro (*Sarg*).—VENEZUELA, Caracas; ANTILLES, Cuba, Jamaica.

BIOL. CENTR.-AMER., Arachn. Scorp., October 1902.

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This species is widely distributed throughout Central America. In addition to examples vaguely ticketed Mexico, the British Museum has representatives from the above-mentioned localities in that region, as well as others from Caracas (*Dr. Ernst*).

Under the name *C. heterurus*, which, according to Kraepelin, is a synonym of *C. gracilis*, Karsch has recorded it from Jamaica, Havana, Caracas, and Honduras.

When more material from the various localities is available for comparison, it is probable that many local races or subspecies will be discovered, especially when adults and young of both sexes are to hand for examination. For example, the above-described specimens from Honduras are alike in colour in the two sexes, as also are a number of specimens from Caracas. On the other hand, there is often considerable sexual diversity of colouring, the males having the legs bright yellow*.

12. *Centruroides rubricauda*.

Centruroides rubricauda, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 389 (1898)¹; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 93 (1899)².

Nearly allied to *C. gracilis*. Trunk, legs, and chelæ in female alike in colour and deep brown; chelæ of male also deep brown, with reddish hand as in female, but the legs uniformly clear yellow and contrasting strongly with the darker tint of the trunk; tail in both sexes a uniform deep reddish olive-brown, much lighter than the trunk; ventral surface deep blackish-brown in female, and with maxillary processes of first and second legs black, paler in male, with maxillary processes deeply infuscate at apices. Carapace in female longer than second or third, as long as fourth, and almost as long as fifth caudal segment, or as the movable finger. Tail about five and a half times as long as carapace; the crests granular, but the granules fewer in number and less closely set than in *C. gracilis*, there being only about 20 along the inferior lateral keel of the fifth as opposed to about 25 or 30 in *C. gracilis*, and from 15 to 19 on that of the third segment as opposed to 25 in *C. gracilis*; vesicle shaped much as in the latter, but the aculeus more abruptly bent backwards from the base; in the male also the vesicle is more parallel-sided, with the shoulders more pronounced and rectangular and less sloping. Chelæ as in *C. gracilis*, but the crests much less strongly granular. Pectinal teeth 20-21, ♀; 21-23, ♂.

Measurements in mm.—♀. Total length 80, carapace 8.5; tail 51, second segment 7.3, fifth 9. ♂. Total length 103, carapace 9; tail 71, second caudal segment 11.3, fifth 13.3.

Hab. COSTA RICA, Managua (*Dr. Rothschild*^{1 2}).

* *Notes on synonymy.*—Latreille was the first to point out that the scorpion from America, identified by De Geer as *Scorpio australis* of Linnæus, is specifically distinct from that species; and by an examination of De Geer's type Thorell established its probable identity with the form described by Lucas as *S. biaculeatus*. I have followed Kraepelin in regarding *Centruroides mulatinus* and *C. congener*, two Mexican forms, as referable to this species rather than to *C. margaritatus* on the strength of the blackness of the fingers as compared with the hand and the rest of the chelæ; but this feature, it must be remembered, is common to all the species with nine rows of teeth on the fingers. No locality is known for *C. nebulosus*, which is also included on account of its black fingers. The species described as *Atrous sayi* by Girard, and based upon examples from Pensacola in Florida, Wood declared to be specifically identical with *C. biaculeatus*. This opinion may be correct; but since Wood includes *S. edwardsii* and *S. de geerii* in his synonymy of *C. biaculeatus*, his verdict is open to suspicion. Moreover, he points out that the Florida specimen differs in certain structural points from more southern examples. This, if true, attests, at least, a subspecific distinctness between the two. Kraepelin's inclusion of *C. nigrifrons* of Berthold, the type of which was from Popayan in Colombia, is presumably justified by an examination of the original specimens in the Gottingen Museum.

13. *Centruroides bicolor*. (Tab. VII. figg. 5, 5 a, ♂.)

Centruroides bicolor, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 388 (1898)¹; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 93 (1899)².

Colour alike in the two sexes; carapace and upperside of abdomen mostly black, yellowish-brown in parts, the last tergite yellowish-brown with black keels; sterna yellowish-brown, blackish on the margins (and in the middle in the female); tail darkening posteriorly, its first four segments deep ochre-yellow, paler than the pale areas on the trunk, the granules on the keels black, the inferior keels more diffused with black; fifth segment with its sides and under surface blackish; vesicle blackish, red above like the upperside of the fifth segment; mandibles infuscate; chelæ yellow for the most part, a blackish spot at the tip of the brachium, the hand deep reddish-brown with black keels, fingers blackish with pale tips; legs a rich yellow like the humerus and brachium, with the maxillary processes of first and second pairs apically infuscate; pectines pale. *Carapace* and *terga* granular, as in *C. gracilis*; *sterna* also as in that species, but the third more thickly pitted mesially, and the fourth and fifth finely and closely granular mesially as well as laterally, the second and third also very weakly granular mesially. *Tail* and *chelæ* practically as in *C. gracilis*. In the male the caudal keels are smoother than in *C. gracilis*, those on the fifth segment being almost entirely smooth, and the vesicle is more globular and more uniformly sloped on each side of the aculeus. *Pectinal teeth* 26-28, ♀; 28-29, ♂.

Measurements in mm.—♀. Total length 109, carapace 10; tail 63, second segment 9.5, fifth 11.8. ♂. Total length 120, carapace 11; tail 82, second segment 13, fifth 15.

Hab. COSTA RICA, Pozo Azul de Pirris, Atlantic slope (*Zeledon*¹), Santo Domingo de Golfo Dulce, in the straw of old roofs (*Pittier*¹), Carillo (*Underwood*); PANAMA, Chiriqui.

14. *Centruroides limbatus*. (Tab. VIII. figg. 1, 1 a, ♂.)

Centruroides limbatus, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 387 (1898)¹; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 92 (1899)².

Allied to the foregoing, but strikingly different in colour; carapace and terga yellow or reddish with black margins, ocular tubercle black, chelicerae yellow at base, infuscate apically; first four segments of tail uniformly yellow, with granules on keels darker, fifth segment and vesicle deep blackish-brown; sterna entirely yellow, with blackish side margins, and in female clouded with black mesially; legs entirely yellow, including apices of maxillary processes; chelæ entirely yellow, except the digits, which are black with pale tips. Granules on *trunk*, *tail*, and *chelæ* much finer than in *C. bicolor*; sterna granularly coriaceous as in that species. *Pectinal teeth* 22-23, ♀; 25, ♂.

Measurements in mm.—Total length 100, carapace 9; tail 70, second segment 11, fifth 12.5. Another specimen (♂) measures 125 mm. The only known female of this species is young, and measures 66 mm. in total length.

Hab. COSTA RICA, Sirires in Talamanca (*Pittier*¹), Sipurio in Talamanca (*Cherrie*).

15. *Centruroides nigrimanus*.

? *Scorpio (Atræus) edwardsii*, Gervais, Arch. Mus. Paris, iv. p. 217 (in note) (1844)¹.

Centruroides nigrimanus, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 388 (1898)²; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 93 (1899)³.

♂. Resembling the male of *C. bicolor* in colour, but more coarsely and closely granular above, the fifth caudal segment having its crests very distinctly granular, and its interstices also granular, whereas in *C. bicolor* this segment is almost entirely smooth throughout; vesicle very different in form from that of *C. bicolor*, being strongly compressed antero-posteriorly, its height equal to the width of the humerus (in *C. bicolor* its height is considerably greater than the width of the humerus), flat behind, parallel-sided, and laterally pitted, the aculeus more abruptly bent backwards from the base, and the subaculear tooth very

close to its base, and with its apex turned towards the aculeus, the distance between the two being less, or at least not greater, than the basal width of the tooth. *Legs* more coarsely granular externally than in *C. bicolor*. *Pectinal teeth* 32-33.

Measurements in mm.—Total length 110, carapace 9·5; tail 76, second segment 12·5, fifth 15.

Hab. MEXICO, Oaxaca (*Mus. Brit.*¹); HONDURAS (*Indo-Colonial Exhib.*¹).

It is highly probable that the specimen from Oaxaca in the Paris Museum recorded by Gervais¹ as a very distinct variety of *Scorpio (Atræus) edwardsii*, Gerv., is referable to this species.

16. *Centruroides nigrescens*. (Tab. VIII. figg. 2, 2 a, ♀; 3, 3 a, ♂.)

Centruroides nigrescens, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 389 (1898)¹; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 93 (1899)².

Colour alike in both sexes, and differing from that of all the species closely related to *C. gracilis* in being of a uniform blackish-green on the upperside of the trunk, the tail, legs, and chelæ, the tarsi only and the distal half of the fingers being, however, pale; coxæ and sternal plates mesially yellowish-brown; pectines flavous. Upperside of *trunk* coarsely and closely granular. *Sterna* smooth and polished, not coriaceous or granular, except the fifth. *Tail* with all the keels coarsely granular in the female, less so in the male; vesicle in male of the same shape as in *C. nigrimanus*; in female the subaculear tooth equally close to the base of the aculeus. *Pectinal teeth* 25-27, ♀; 28-30, ♂.

Measurements in mm.—♀. Total length 85, carapace 8·5; tail 53, second segment 8, fifth 10·5. ♂. Total length 107, carapace 8·8; tail 73, second segment 11·5, fifth 14.

Hab. MEXICO, Xautipa and Amula in Guerrero, Orizaba (*H. H. Smith*¹).

17. *Centruroides fulvipes*. (Tab. VIII. figg. 4, 4 a, ♀.)

Centruroides fulvipes, Pocock, Ann. & Mag. Nat. Hist. (7) i. p. 390 (1898)¹; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 93 (1899)².

♀. Structurally resembling *C. nigrescens*, but totally different in colour, the trunk brownish-black above, the last tergite paler than the others; tail blackish posteriorly and beneath, the upperside of the first, second, and third segments reddish-brown; chelæ with trochanter and humerus yellow; brachium, hand, and base of fingers blackish-brown, nearly the whole of the fingers deep brown; legs and coxæ reddish-yellow, maxillary processes not infuscate. *Pectinal teeth* 28-29.

Measurements in mm.—Total length 83, carapace 8·5; tail 52, second segment 7·5, fifth 10.

Hab. MEXICO, Xautipa in Guerrero^{1 2} (*H. H. Smith*).

RHOPALURUS.

Rhopalurus, Thorell, Ann. & Mag. Nat. Hist. (4) xvii. p. 9 (1876); Atti Soc. Ital. Sci. Nat. xix. p. 83 (1877); Karsch, Mittheil. Münch. ent. Ver. iii. p. 18 (1879). (Type *R. laticauda*.)

Heteroctenus, Pocock, Journ. Linn. Soc., Zool. xxiv. pp. 385, 391 (1893). (Type *H. junceus*.)

Centruroides, Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 119 (1891); Das Tierr., Scorpiones et Pedipalpi, p. 87 (1899).

Resembling *Centruroides* in the dentition of the fingers of the chelæ, but differing in having the tail in the female a little wider in its posterior than in its anterior half, and in the male much wider than in the female. The first sternal plate of the abdomen is marked with a pair of grooves, which are much deeper than in *Centruroides*, and run forwards and inwards from the inner edge of the stigmata to meet close behind the anterior border of the sternum, and form the inner boundary of a depressed area upon

which the pecten rests (Tab. VIII. fig. 5 a). The pectines a little or very much wider in the basal than in the distal half, and frequently there is a strong median lateral keel on the second and a weaker one on the third caudal segment.

Type *R. laticauda*.

Distribution. Cuba, Haiti, Central America, and the northern parts of South America.

Of the five species referred by me to this genus all differ from *Centruroides* in the thickness of the tail in the female, and its greater expansion in the male than in the former sex. Apart from this character, the structural features of the genus are exemplified in the greatest perfection in the Brazilian species, *R. borellii*, sp. n., which possesses the median lateral keel on the second and third caudal segments, strongly expanded pectines, and on the first abdominal sternum deep grooves which pass inwards from the stigmata, and then turn abruptly forwards in a direction nearly parallel with each other, enclosing a narrow, slightly raised area which ends on the anterior border of the sternum in a blunt point. Two species, namely *R. junceus* (Herbst) and *R. agamemnon* (Koch), resemble *R. borellii* in the structure of the pectines and the shape and depth of the sternal grooves, but have not acquired the median lateral crests upon the second and third caudal segments; whereas, on the other hand, the remaining two species, *R. laticauda* and *R. princeps*, which possess the supernumerary keel, have the pectines only a little broader basally than in *Centruroides*, and the sternal grooves approaching those of that genus, being shallower than in the remaining three species, and running obliquely forwards from the stigmata to meet in an acute angle. *R. borellii*, in fact, occupies a central position, with *R. junceus* and *R. agamemnon* approaching *Centruroides* on the one side and *R. laticauda* and *R. princeps* on the other.

Only one species of the genus has been recorded from Central America.

1. *Rhopalurus junceus*. (Tab. VIII. figg. 5, 5 a, ♀; Tab. IX. figg. 1, 1 a, ♂.)

Scorpio junceus, Herbst, Nat. ungeflügelt. Ins. iv. p. 65, t. 3. fig. 2 (1800)¹.

Heteroctenus junceus, Pocock, Journ. Linn. Soc., Zool. xxiv. p. 392 (1893)².

Centrurus junceus, Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 94 (1899)³.

Scorpio (Atreus) hemprichii, Gervais, Ins. Apt. iii. p. 54 (1844)⁴; Arch. Mus. Paris, iv. p. 218, t. 11. fig. 18 (1844)⁵.

Scorpio hemprichii, Lucas, in Ramon de la Sagra's Hist. Nat. Cuba, Crust. et Ins. p. lxx, Atlas Anim. Artic. t. 5. figg. 5-5 c (1851)⁶; Gervais, in Castelnau's Expéd. dans l'Amér. du Sud, Myriap. et Scorpiones, p. 41, t. 1. figg. 2, 2 a, b (1859)⁷.

Rhopalurus hemprichii, Karsch, Mittheil. Münch. ent. Ver. iii. p. 119 (1879)⁸.

Centrurus hemprichii, Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 135 (1891)⁹.

♀. Colour a tolerably uniform deep yellowish-brown; the tail darker posteriorly, especially beneath; fingers black with yellow tips. Carapace coarsely granular, the granules subserially arranged at the sides. Terga also coarsely granular, without trace of lateral keel. Sterna smooth, except quite at the sides; the smooth depressed lateral area of the first smooth, the last finely granular, with four strong weakly

subtubercular crests: at the anterior extremity of the lateral keel on the outer side are some small tubercles forming a short transverse crest. *Tail* about five and a half times as long as carapace, which is slightly longer than the fourth, and shorter than the fifth segment, the inferior and lateral intercarinal spaces rather coarsely granular, the anterior segments sparsely so, the posterior thickly; upperside of first, second, and third, and in a lesser degree of the fourth segment finely and closely granular in the middle, the granular area broader behind; all the keels coarsely granular, the inferior and superior lateral posteriorly denticulated, indications only of a median lateral keel on the second segment; first segment slightly wider than the second, a little narrower than the third, which equals the fifth, fourth the widest of all; upperside of fourth excavated, of fifth with a median groove; fourth rather more than one-third wider than long, fifth less than twice as wide as long; vesicle granular, as wide as the brachium, a little wider than high; no subaculear tooth. *Chelæ* very finely granular; crests strongly granular; hand shagreened, scarcely keeled, its width exceeding that of the brachium, and about three-fourths the length of the underhand, which is about half the length of the movable finger; the latter exceeding the fifth caudal segment, with a strong basal lobe, and furnished with eight median rows of teeth. *Pectines* very broad at the base, furnished with from (16) 17-19 teeth.

♂. *Tail* only slightly longer than in female, but much thicker; fourth segment almost as wide as long, fifth segment only one-third wider than long, and as wide as the fourth or wider. *Chelæ* with hand very wide, its width nearly equal to length of underhand, and half the length of the movable finger; the two fingers in contact only in the distal third of their length, proximally strongly arched away from each other so as to leave a long and wide space between them.

Measurements in mm.—♀. Total length 104, carapace 11.5; tail 66, width of first segment 6.5, of fourth 7, length of first 8, of fourth 11; width of brachium 4, of hand 5.5; length of underhand 7, of movable finger 14. ♂. Total length 98, carapace 11; tail 63, width of first segment 6.5, of fourth 8.5, length of first 7.5, of fourth 10; width of brachium 4, of hand 6.6; length of underhand 7.3, of movable finger 13.3.

Hab. MEXICO (*Mus. Brit.*).—BRAZIL; CUBA; HAITI.

The description given above is taken from adult specimens in the British Museum, which are ticketed Mexico, and belonged originally to Keyserling's collection. The Museum also has examples labelled Brazil. These localities require confirmation.

The only authentic localities known for the animal are Cuba and Haiti.

ISOMETRUS.

Isometrus, Hempr. & Ehrenb. *Symb. Phys.*, Scorpiones (1828); also of Thorell, Karsch, Simon, Pocock (prior to 1891), Kraepelin [*Jahrb. Hamb. Wiss. Anst.* viii. p. 244 (1891)], and of subsequent authors.

Differing from the following genus, *Tityus* (p. 39), in that the fingers of the chelæ are furnished with only about five or six rows of teeth set end to end without overlapping, also with an inner series consisting of six large teeth set close to the apices of the median rows, and an outer series of large teeth corresponding to those of the inner series, and placed in a straight transverse line with them.

Type *I. europæus*, Linn. (*Scorpio*).

Distribution. Confined to the Oriental region, and ranging from India as far as Queensland, with the exception of the type-species, which has been transported by commerce into almost all tropical countries.

1. *Isometrus europæus*.

Scorpio europæus, Linn. *Syst. Nat.* ed. 10, p. 625 (1758)¹.

Isometrus europæus, Lönning, *Ann. & Mag. Nat. Hist.* (7) i. p. 86 (1898)²; Pocock, *Fauna British India, Arachn.* p. 46 (1900)³.

- Scorpio maculatus*, De Geer, Mém. Hist. Ins. vii. p. 346, t. 41. figg. 9, 10 (1778)⁴.
Lychas maculatus, C. L. Koch, Die Arachn. xii. p. 1, fig. 960 (1845)⁵.
Isometrus maculatus, Thorell, Ann. & Mag. Nat. Hist. (4) xvii. (1876)⁶; Simon, Ann. Mus. Genova, xx. p. 370 (1884)⁷; Oates, Journ. Bomb. Nat. Hist. Soc. iii. p. 250, figg. 3, 4 (1888)⁸; Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 245 (1891)⁹; Das Tierr., Scorpiones et Pedipalpi, p. 66 (1899)¹⁰.
Scorpio dentatus et *americanus*, Herbst, Nat. ungeflügelt. Ins. iv. pp. 55, 60, t. 6. figg. 2, 3 (1800)¹¹.
Lychas americanus, C. L. Koch, Die Arachn. xii. p. 1, fig. 961 (1845)¹².
Buthus (Isometrus) flum, Hempr. & Ehrenb. Symb. Phys., Scorp. p. 3, t. 1. fig. 3 (1828)¹³.
Scorpio (Atreus) flum, Gervais, Ins. Apt. iii. p. 52 (1844)¹⁴.
Lychas paraensis, C. L. Koch, Die Arachn. xii. p. 6, fig. 963 (1845)¹⁵.
Scorpio (Lychas) gabonensis, Lucas, in Thomson's Arch. Ent. ii. p. 430, t. 12. fig. 8 (1858)¹⁶.
Scorpio (Lychas) guineensis, Lucas, op. cit. p. 432, t. 12. fig. 9 (1858)¹⁷.

Colour yellow varied with black, frontal area of carapace with a triangular yellow patch; terga marked posteriorly with five black spots separated by six clear yellow spots; tail, legs, and chelæ spotted or lined with black. Carapace about as long as the first and half the second caudal segments, or as long as the fourth. Upperside of trunk evenly granular; sterna smooth, the last finely granular, with four granular crests. Tail slender, about five and a half times as long as carapace, evenly granular. Chelæ granular; hand keelless, scarcely as wide as brachium; underhand less than half the length of the movable finger, which is longer than the carapace.

♂. Tail very long, about eight times as long as carapace; fourth segment about one and a half times as long as carapace. Chelæ long and slender; hand slender, parallel-sided, its width about one-third the length of the underhand, which is at least two-thirds the length of the movable finger. Pectinal teeth 17-19 (♂ ♀).

Measurements in mm.—♀. Total length 49, carapace 5, tail 28, underhand 2.5, movable finger 6. ♂. Total length 62, carapace 5, tail 42, underhand 4.5, movable finger 7.

Hab. ? CENTRAL AMERICA.—TROPICAL SOUTH AMERICA; ANTILLES, &c.

Although this species has not been actually recorded from Central America, there can be little doubt as to its occurrence in or near the seaport towns of that country, since it has been noticed in most of the West-Indian Islands, and in various parts of South America, as well as in Africa, India, Spain, &c.

TITYUS.

- Tityus*, C. L. Koch, Die Arachn. iii. p. 33 (1836) (part.); Pocock, Journ. Linn. Soc., Zool. xxiv. p. 376 (1893); Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 69 (1899).
Isometrus (part.), Thorell, Ann. & Mag. Nat. Hist. (4) xvii. p. 8 (1876); Karsch, Mittheil. Münch. ent. Ver. iii. p. 18 (1879); Pocock, P. Z. S. 1890, p. 119.
Phassus, Thorell, Ann. & Mag. Nat. Hist. (4) xxii. p. 8 (1876); Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 107 (1891).
Androcottus, Karsch, Mittheil. Münch. ent. Ver. iii. p. 11 (1879).

Fingers of the chelæ furnished with many rows of teeth largely overlapping each other, so that the distal extremity of each row, which has an enlarged terminal tooth, lies on a level with the middle of the series distal to it (Tab. IX. fig. 6 a).

In all the Central-American species the base of the pecten is furnished with a smooth and rounded lobe in the female, and the males have the chelæ either longer or stouter and the tail longer than in the female.

Type *T. bahiensis*, Perty (*Scorpio*).

Distribution. Neotropical Region; Central America and the West Indies, over the whole of South America as far south as Argentina.

Key to the Species.

- a.* Inferior median keels on segments 2 and 3 of tail uniting posteriorly, and completely fused on segment 4 *androcottoides*, Karsch.
- b.* Inferior median keels on segments 2-4 of tail separated and parallel.
- a*¹. Subaculear tooth represented by an inconspicuous tubercle.
Lateral and inferior surfaces of the posterior caudal segments covered with coarse, close-set, shining granules; variegated in the adult *crassimanus*, Thor.
- b*¹. Subaculear tooth represented by a large triangular bitubercular spike; lateral and inferior surfaces of the tail at most weakly and scantily granular; adult uniformly black.
- a*². Pecten with smooth, rounded, basal lobe; carapace slightly longer than third caudal segment *cambridgei*, Poc., ♀.
- b*². Pecten without basal lobe; carapace noticeably shorter than third caudal segment.
- a*³. Hand slender, concave externally, its width equal to one-third the length of the underhand and to that of the brachium, which is four times as long as wide *cambridgei*, Poc., ♂.
- b*³. Hand thick, not concave externally, its width exceeding half the length of the underhand, and much greater than that of the brachium, which is three times as wide as long *festæ*, Bor., ♂.

1. ***Tityus cambridgei***. (Tab. IX. figg. 2, 3, 3 *a.*)

Tityus cambridgei, Pocock, Ann. & Mag. Nat. Hist. (6) xix. p. 360 (1897)¹; op. cit. pp. 517, 518²; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 78 (1899) (where a long list of doubtful synonyms is appended)³; Borelli, Boll. Mus. Torino, xiv. no. 338, p. 1 (1899)⁴.

Hab. GUIANA; AMAZONS, Pará.

Subsp. *championi*.

Tityus championi, Pocock, Ann. & Mag. Nat. Hist. (7) i. pp. 384, 385 (1898)⁵; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 81 (1899)⁶.

- ♂. *Colour* in adult tolerably uniform black or blackish-brown, generally paler on the chelæ and tail; tarsi, pectines, and a triangular patch in the middle of the posterior border of the third sternal plate pale yellow. *Carapace* and *terga* finely granular, some coarser granules on the sides and frontal area of the carapace, and others forming ill-defined frontal and posterior keels; a row of coarse granules along the posterior border of the terga, a single median and a pair of transverse keels; the last tergum with a pair of strong granular crests on each side and a short anterior crest. *Sterna* finely granular anteriorly, smooth along the posterior border and in the middle behind; the last granular throughout, with four weakly granular crests. *Tail* long, about six and a half times as long as the carapace, which is scarcely as long as the second segment, shorter than the third, and about one-third the length of the first three segments; fourth and fifth segments slightly wider than the first; anterior caudal segments finely granular, posterior almost smooth, all the keels, except the inferior medians of the fourth, which are practically obsolete,

weakly granular; vesicle weakly granular, with a large, triangular, bitubercular, subaculear spine: first caudal segment about one-third longer than wide, second about twice as long as wide, fifth twice and a half as long as wide. *Chelæ* finely granular, with granular keels; anterior keel of the brachium irregularly denticulate; brachium longer by one-third of its length than the carapace, and at least four times as long as wide; hand scarcely as wide as the brachium, the underhand concave, almost as long as the carapace, and about three times as long as the width of the hand; keels on the hand almost obsolete; *fingers* long, the movable with a weak basal lobe, longer by one-third of its length than the carapace, and furnished with fifteen rows of teeth. *Legs* finely granular, crested. *Pectines* with only a small basal lobe and 19-20 teeth.

- ♀. Like the male in colouring, but with the tail shorter, less than six times as long as the carapace, with the keels more strongly granular; the fourth segment as long as the carapace, the third about twice as long as wide, the first segment a little wider than the fourth or fifth. *Chelæ* shorter and stouter than in male; the brachium twice and a half as long as wide; hand as wide as the brachium, lightly convex externally, globular internally, distinctly crested above and externally; the underhand less than twice as long as the width of the hand, and a little less than half the length of the movable finger, which is more strongly lobate than in the male. *Pectines* with 20 teeth, and a large, smooth, subcircular, basal lobe.

Measurements in mm.—♂. Total length 85, carapace 8; tail 56, its first segment 10; length of brachium 12.5, width 2.3; length of underhand 7.5, width of hand 2; length of movable finger 12.5. ♀. Total length 75, length of carapace 7.5, of tail 45, of brachium 7.5; width of brachium 3, of hand 3; length of underhand 4.5, of movable finger 10.

Hab. COSTA RICA, Cerros de los Carrones, Buvica (*Pittier*); PANAMA, Bugaba (*Champion*), forest along the Rio Cianati and on the shores of Lake Pita, Darien (*Dr. Festa*).

On the label accompanying the specimen collected by H. Pittier is the information that the species is to be met with "In damp places under dried leaves."

The typical form of *Tityus cambridgei* occurs at Pará, near the mouth of the Amazons, where examples (♂ ♀) were collected by Messrs. F. O. P. Cambridge and E. E. Austen. From the Amazons the species ranges northwards into Surinam, whence the British Museum has received examples (♂ ♀) obtained on the Upper Surinam River by Mr. C. W. Ellacombe, and from Surinam to Ecuador and Panama. The Surinam and Panama scorpions, however, differ from the southern form in certain characters which justify the view as to the subspecific distinction of the two.

The differences may be tabulated as follows:—

- a. Keels on the hand standing out as sharply defined, finely granular crests; intercarinal spaces of the tail, especially in the female, very distinctly and closely granular throughout, the keels more coarsely granular; hand in the female thinner, narrower than the brachium, its width about half the length of the underhand; inferior median keels on the fourth caudal segment in the male distinct and granular *cambridgei*, Poc., typical form.
- b. Keels on the hand weaker and smooth; intercarinal spaces of tail obsolete granular, the keels less strongly granular; hand in the female as wide as brachium, its width much more than half the length of the underhand; inferior median keels on the fourth caudal segment in the male obsolete and smooth Subsp. *championi*, Poc.

The above-given description of this subspecies is taken from adult male and female specimens from the Rio Cianati, Darien, kindly lent to me for the purpose by Dr. A. Borelli.

A comparison of the female with the type of *Tityus championi*, Poc., from Bugaba, Panama, convinces me that the two are conspecific, and that the supposedly specific characters of the latter are due to immaturity. In most structural points the two are practically alike, the chief differences being the absence of the pectinal lobe, the thinner hand, more granular caudal keels, and the variegated coloration of the type of *T. championi*.

The adult male, as described above, is a tolerably uniform deep blackish-brown colour, with scarcely a trace of paler spots, except on the posterior angles of the terga. The female, on the contrary, which, although adult, is rather smaller, is distinctly redder than the male, especially on the tail and chelæ, and the terga exhibit a distinct angular yellow spot and four smaller less distinct spots on the posterior margin on each side of the middle line. The type of *T. championi* is smaller still and very considerably paler, the prevailing coloration being yellowish-brown with darker mottling; the legs are indistinctly annulated, the chelæ are reddish-yellow with very indistinct pale spots, the fingers being blackish with yellow tips; three dark bands are traceable on the terga, and the posterior yellow spots on these plates are very distinct; the sides of the caudal segments are paler in the middle than in front and behind, and the vesicle and lower side of the fifth segment are nearly black. Its measurements are as follows:—Total length 62 mm., tail 39, carapace 6·5; width of hand 2·5; length of underhand 4·5, of movable finger 9. In a second, but much smaller, specimen from Bugaba measuring 30 mm., with the carapace 3, and the tail 18, the variegated coloration traceable in the type is much more pronounced, the specimen closely resembling in colour the species of *Tityus*, typified by *T. columbianus*, *T. silvestris*, &c. It is noticeable that the humerus and brachium are palely fuscous with yellow spots, and that the clear yellow hand contrasts strongly with the fuscous tint of the fingers, which have clear yellow tips. This species, in short, is prettily variegated with black and yellow in its young stages, and gradually assumes a darker hue as it approaches maturity, becoming ultimately, when adult, almost entirely black. It is highly probable that all the numerous allied species pass through similar stages of coloration.

2. *Tityus festæ*. (Tab. IX. fig. 4.)

Tityus festæ, Borelli, Boll. Mus. Torino, xiv. no. 338, pp. 1-3 (1899) ¹.

♂. Resembling the male of *T. cambridgei* in colour and most structural points, but with the caudal crests much more coarsely granular, the inferior crests of the fourth segment distinctly granular; the first segment as wide as the fourth. *Chelæ* much shorter and the hand broader; the brachium only a little longer than the carapace, and about three times as long as wide; the hand much wider than the brachium, its width more than half the length of the underhand, the latter much more than half the length of the movable finger; the movable finger about as long as the fifth caudal segment, longer by one-fourth of its length than the carapace, both fingers strongly lobate, but not widely separated at base. *Pectinal teeth* 20-21.

Measurements in mm.—Total length 83, carapace 8; tail 54, its fifth segment 10; length of brachium 9, width 3; width of hand 4; length of underhand 6.2, of movable finger 10.5.

Hab. PANAMA, Tintin in Darien (*Dr. Festa*¹).

This description and figure are taken from the typical and only known example kindly lent to me by Dr. Borelli.

3. *Tityus androcottoides*. (Tab. IX. figg. 5, 5 a-c.)

Isometrus americanus, var. *androcottoides*, Karsch, Mittheil. Münch. ent. Ver. iii. p. 113 (1879)¹.

Isometrus androcottoides, Pocock, Ann. & Mag. Nat. Hist. (6) iv. p. 57 (1889)².

Phassus americanus (Linn.), Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 113 (1891)³ (part.); Thorell, Bull. Soc. Ent. Ital. xxv. p. 371 (1893)⁴.

Tityus androcottoides, Pocock, Journ. Linn. Soc., Zool. xxiv. p. 377 (1893)⁵ (excl. examples from Trinidad); Ann. & Mag. Nat. Hist. (6) xix. p. 514 (1897)⁶; Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 77 (1899)⁷.

♀. *Colour* of trunk above and below tolerably uniform deep brownish-black or reddish-brown, chelæ redder, with black yellow-tipped fingers, pectines and tarsi yellow; in smaller forms the legs are mottled, and there are traces of spots on the terga. *Carapace* granular, with coarsely granular keels, about as long as the third caudal segment, a little shorter than the brachium. *Terga* coarsely granular, with median granular keel, the anterior overlapped area finely granular. *Sterna* finely but thickly granular throughout, except the subpectinal area of the first, which is nearly smooth; a nearly smooth narrow ridge on the second, third, and fourth, that on the third expanding posteriorly into a smooth triangular area, the last with four coarsely granular keels. *Tail* nearly six times as long as the carapace, slender, nearly parallel-sided; the first segment about one-third longer than wide, second not quite twice as long as wide, third twice as long as wide, fourth and fifth more than twice as long as wide; the intercarinal spaces finely and closely granular, the upperside more finely so than the sides and lower surface; all the keels well developed, and evenly and coarsely granular; median lateral keel present only on the first segment; the two inferior median crests on the first distinct, but inwardly geniculate towards the posterior ends; on the second extending throughout the anterior half of the segment, but behind that point replaced by a median keel which extends for a short distance forwards between the two, and posteriorly bifurcates into a right-angled triangle; on the third segment the pair of keels is present only on the anterior fifth of the under surface, the median keel occupying the rest of the area, and not so distinctly bifurcated as on the second; on the fourth the paired keels are only represented by three or four granules, the median keel extending practically throughout the length of the segment; fifth segment with squared edges; vesicle granular below, wider than high, and as wide as the brachium or hand, with a strong, triangular, subaculear tooth. *Chelæ* finely and closely granular, with coarsely granular keels; hand as wide as brachium, its width barely two-thirds the length of the underhand, which is less than half that of the movable finger; upperside of hand coriaceous, the finger-keels weakly granular or crenulate, the external finger-keel completely divided; fingers long and slender, the movable long and slender, much longer than the fifth caudal segment. *Legs* finely granular, granularly crested. *Pectines* with 16-17 teeth and conspicuous basal lobe.

♂. Resembling the female, except in the greater length of the tail and chelæ. *Tail* more than seven times as long as the carapace, which is about equal to its first segment, the latter rather more than twice as long as wide, the fourth about four times as long as wide; vesicle also longer than in the female. *Chelæ* with humerus and brachium distinctly longer than carapace; hand wider than brachium, its width scarcely more than half the length of the underhand, which is more than half the length of the movable finger; the latter resembling that of the female. *Pectinal teeth* 18.

Measurements in mm.—♀. Total length 73, carapace 7; tail 44, width of first segment 3.5, of fifth 3.2; length of brachium 8, width 2.6; width of hand 2.8; length of underhand 4, of movable finger 9.8,

♂. Total length 80, carapace 7; tail 55, width of first segment 3, of fifth 2·8; length of brachium 8·8, width 2; width of hand 2·5; length of underhand 5, of movable finger 9.

Hab. PANAMA¹ (*Mus. Brit.*).—GUIANA, Demerara.

Although Kraepelin gives Venezuela as a doubtful locality for this species, it has only been previously recorded with certainty from Demerara, whence the British Museum has several examples. The above-given description is taken from an adult male and female collected in Demerara by Mr. W. L. Sclater.

In general appearance *T. androcottoides* closely resembles *T. cambridgei*, but differs essentially in the fusion of the inferior keels of the second, third, and fourth caudal segments, as well as in the secondary sexual characters of the male.

4. *Tityus crassimanus*. (Tab. IX. figg. 6, 6 a-c.)

Isometrus crassimanus, Thorell, Atti Soc. Ital. Sci. Nat. xix. p. 129 (1877)¹.

Phassus crassimanus, Kraepelin, Jahrb. Hamb. Wiss. Anst. viii. p. 111 (1891)².

Tityus crassimanus, Kraepelin, Das Tierr., Scorpiones et Pedipalpi, p. 76 (1899)³.

♂. *Colour* yellowish-red, mandibles infuscate; carapace with a triangular fuscous interocular area and a black margin; terga with three black patches, one median divided by a spot on the keel, and one on each side midway between the lateral border and the median patch, these patches constituting three longitudinal black bands; ventral surface yellow, the last sternum infuscate posteriorly; tail yellowish above, darker posteriorly, the underside of the segments spotted with black, the fourth and fifth segments deep blackish-brown, vesicle reddish-brown; legs and chelæ mottled with black; hands reddish, fingers black with yellow tips. *Carapace* somewhat coarsely granular, with granular crests on the ocular tubercle; shorter than the first, about as long as the second caudal segment, and as long as the brachium. *Terga* also beset with somewhat coarse shining granules. *Sterna* finely granular, the posterior more so than the anterior, a smooth area on the posterior third of the first, second, third, and fourth, the fifth granular throughout, with four granular keels. *Tail* a little more than six times as long as the carapace, expanded posteriorly, the first segment one-fourth longer than wide, second, third, fourth, and fifth almost twice as long as wide; vesicle wide, much wider than the brachium, its width much more than half the length of the latter; the superior caudal keels weak, the rest normally developed and granular; sides and lower surface of tail studded with coarse shining granules, which, on the fourth and fifth segments, are very numerous and close-set or even confluent; upperside of fifth, and in a lesser degree of fourth segment, granular; vesicle studded with low squamiform granules, subaculear spine reduced to a minute tubercle. *Chelæ* granular above, with coarsely granular keels; brachium scarcely more than twice as long as wide; hand shining, granular, especially internally, crested, very wide, the width equal to that of the fourth caudal segment, and almost equal to the length of the underhand, and to about half the length of the movable finger; the latter, like the immovable, strongly lobate and furnished with 14–15 rows of teeth. *Pectines* with 18–20 teeth.

Measurements in mm.—♂. Total length 65, carapace 6; tail 40, width of first segment 3·5, of fifth 4; length of brachium 6, width 2·5; width of hand 3·8; length of underhand 4·3, of movable finger 7.

Hab. MEXICO.

The above characters are taken from a dried unlocalized male specimen in the British Museum. This individual, however, agrees closely in all essential points with Thorell's and Kraepelin's description of *T. crassimanus*. According to Kraepelin, the female has a rounded lobe at the base of the pecten as in *T. cambridgei*. The

examples examined by this author, moreover, have the legs and chelæ yellowish-red, and the crests on the fifth sternum scarcely granular. They attained a length of 80 mm.

The following scorpion has been recorded by Gervais from Mexico, but the identification must be regarded as doubtful. The recognition of the differences between the various species allied to such forms as *T. cambridgei*, *T. festæ*, and *T. androcottoides*, especially in the case of the female sex, requires considerable powers of discrimination and analysis, and a large number of specimens from various localities for comparison and study. Hence the Mexican example determined by Gervais as *T. obscurus* may be referable to either of the three just mentioned, and may or may not belong to the genuine *T. obscurus*, which was from Cayenne.

Tityus obscurus.

Scorpio (Atreus) obscurus, Gervais, Arch. Mus. iv. p. 249 (1844)¹; Ins. Apt. iii. p. 55 (1844)²; and in Castelnau's Expéd. dans l'Amér. du Sud, Myriap. et Scorp. p. 42, t. 1. figg. 3, 3 a, b (1859)³.

Hab. MEXICO (*Parzudacki*).—COLOMBIA; GUIANA.

This species was based on a female from Cayenne. Gervais also records it from Colombia.

Except for the statement that *T. obscurus* possesses twenty-two pectinal teeth, there is nothing in the description that serves to differentiate this species from the females of almost all the many allied forms. That Gervais himself certainly confused more than one form under the name *S. obscurus* is attested by his determination of a Colombian specimen with only fifteen pectinal teeth, now in the British Museum, as that species.

Order PEDIPALPI.

The Central-American genera of this Order fall into two Suborders, which may be diagnosed as follows:—

- a. Carapace longer than broad; chelæ forming a pair of stout pincers, their basal segments fused in the middle line; legs of first pair with only the terminal segment subdivided, basal segments of second and third pairs meeting or almost meeting in the middle line; abdomen elongate, its last three segments narrowed to form a caudal support for a long many-jointed postanal flagellum UROTRICHA.
- b. Carapace wider than long; chelæ not pincer-like, being without digitiform prolongations; legs of first pair with their three distal segments forming a long many-jointed lash, those of the second and third pairs widely separated basally by the sternal area; no postanal flagellum, and the last three abdominal segments not narrowed to form a caudal prolongation AMBLYPYGI.