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CHACTIDAE (SCORPIONES) FROM TRINIDAD AND TOBAGO

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ABSTRACT

The scorpions belonging to the family Chactidae from Trinidad and Tobago are studied. A new species, *Chactas raymondhansi,* from bromeliads on the highest mountains of Trinidad is described. The type species of the genus *Broteochactas* Pocock, *Broteochactas nitidus* Pocock from Trinidad, is resurrected from its synonymy under *Broteochactas gollmeri* (Karsch) from Venezuela. The genus *Auyantepuia* González-Sponga, from Venezuela, is synonymized under *Broteochactas.*

INTRODUCTION

Trinidad and Tobago are islands located on the continental shelf off the northeast coast of Venezuela. Their proximity to the mainland, and their location opposite the mouth of the Orinoco River have been used to hypothesize an Orinoco-Guianan origin for their biota via rafting. Their scorpion fauna, however, does not support this hypothesis at all. Kjellesvig-Waering (1966) noted that the affinities of the scorpion fauna of Trinidad and Tobago were with the Coastal Ranges of Venezuela to the east, rather than with the Orinoco River delta to the south. Only one of the seven scorpion species reported from Trinidad by Kjellesvig-Waering (1966) was regarded as an endemic; four were shared with Venezuela and two with the Guianas. Likewise, one of the three species reported from Tobago was considered an endemic; the other two were shared with both Trinidad and Venezuela.

Considerable work done on the Venezuelan fauna during the past 20 years by González-Sponga (summarized in his 1984 contribution) and additional collecting in Trinidad and Tobago have changed the picture considerably. The three chactids found in Trinidad and Tobago, including one new species described below, are endemic. Two of the buthids (*Microtityus rickyi* Kjellesvig-Waering,

and *Tityus trinitatis* Pocock) are now also considered endemic to the islands, and four others are shared with the mainland. The high percentage of scorpion endemism (55%) in Trinidad and Tobago reinforces the hypothesis put forth by Kjellesvig-Waering (1966) that the Venezuelan Coastal Ranges and the Trinidad Northern Range were continuous at one time; subsequently, faulting and erosion during Pliocene or Pleistocene times led to the isolation of the island fauna. The lack of shared species between the Orinoco River delta and Trinidad and Tobago indicates that rafting is an unlikely dispersal mechanism in scorpions in general.

The terminology used herein follows essentially that of Stahnke (1970), except for trichobothriotaxy (Vachon 1974), and metasomal carinae (Francke 1977). Acronyms for specimen depositories are given in the acknowledgments, except for those in the authors' collections which are followed by their initials.

FAMILY CHACTIDAE

The systematics of this worldwide scorpion family are chaotic and unreliable. The diagnostic characters given below will readily separate it from the Buthidae, the only other family found in Trinidad and Tobago. These characters are also useful for northeastern South America and the Caribbean region, as the families Bothriuridae, Iuridae and Vaejovidae do not occur there naturally.

Diagnosis.—Sternum pentagonal rather than subtriangular. Tibial spurs absent, prolateral and retrolateral pedal spurs present. Cheliceral fingers without ventral teeth, movable finger with distal ventral tine considerably longer than the dorsal tine. Pedipalps with trichobothrial pattern C of Vachon (1974): femur with three trichobothria, tibia with 5-7 ventral trichobothria. Telson without a ventral tooth under the sting.

Genus *Chactas* Gervais

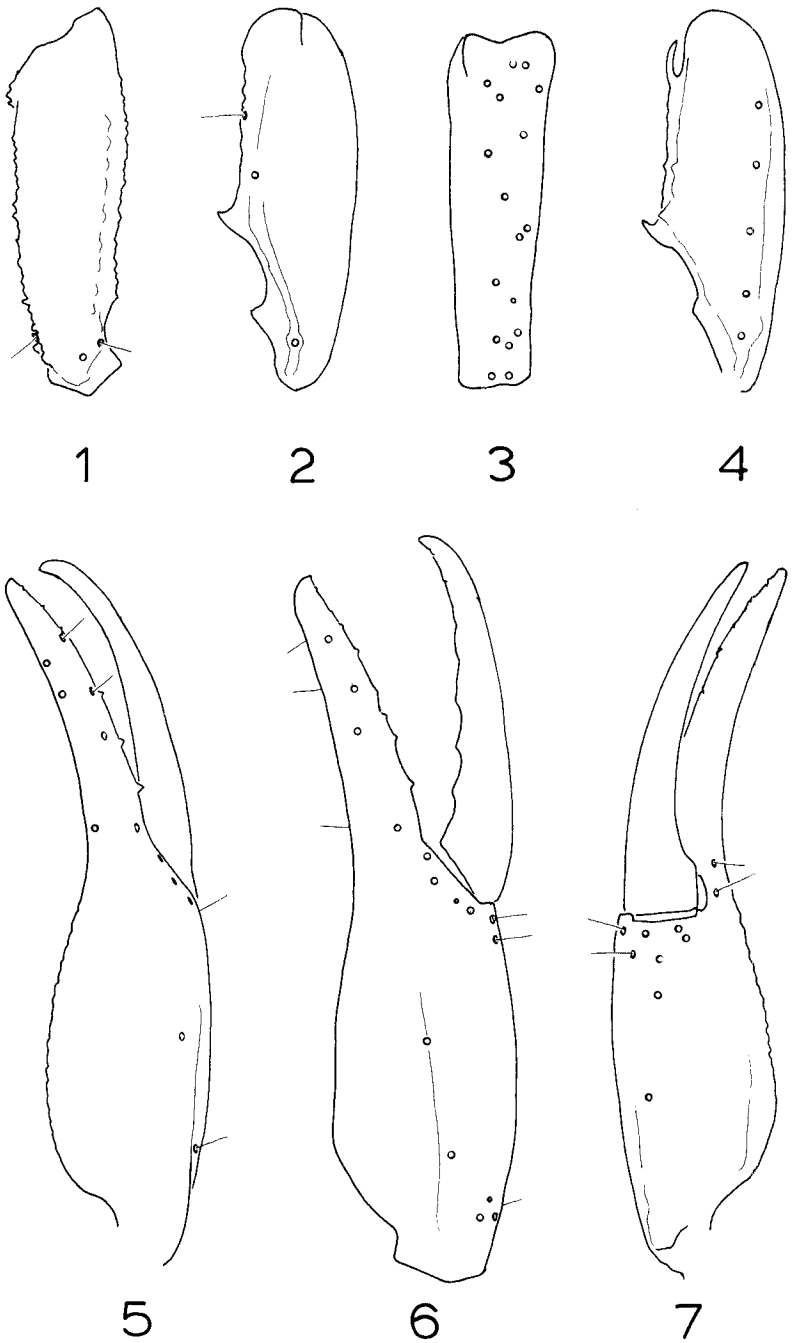
This genus is known from Central America (Costa Rica and Panama) and South America (as far south as Peru and Brazil). It differs from *Broteochactas* Pocock, the only other genus in this family known from Trinidad and Tobago, by having 5-6 instead of 7 ventral trichobothria on the tibia.

Five subgenera are presently recognized within the genus *Chactas* (Francke 1985). The new species described below belongs to the subgenus *Andinochactas* González-Sponga, characterized by having the tarsi armed with a ventral median row of spines, and five ventral trichobothria on both the tibia and the chela of the pedipalps.

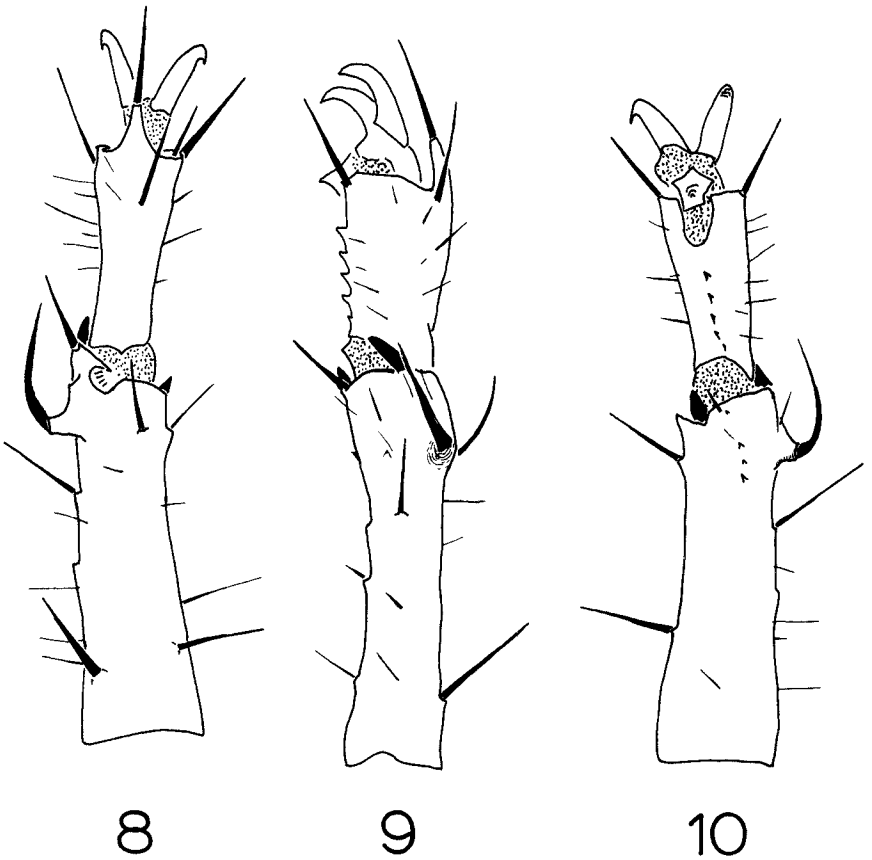
Chactas (Andinochactas) raymondhansi, new species
Figs. 1-10

Type data.—Holotype male found on a bromeliad along the eastern ridge near the summit of Mt. El Tucuche (1000 m), Northern Range, Trinidad, 26-VI-1982 (Betty Faber, Eddie Rooks and party). Deposited in the American Museum of Natural History, New York. Paratypes listed under specimens examined.

Distribution.—Known only from bromeliads on the highest mountains on the Northern Range of Trinidad.



Figs. 1-7.—Right pedipalp of holotype male of *Chactas (Andinochactas) raymondhansi,* new species, showing trichobothrial patterns: 1, dorsal aspect of femur; 2, dorsal aspect of tibia; 3, external aspect of tibia; 4, ventral aspect of tibia; 5, dorsal aspect of chela; 6, external aspect of chela; 7, ventral aspect of chela.



Figs. 8-10.—Tarsomeres on first right leg of holotype of *Chactas (Andinochactas) raymondhansi,* new species, showing diagnostic curved spiniform seta prolaterally: 8, dorsal aspect; 9, prolateral aspect; 10, ventral aspect.

Etymology.—This species is dedicated to Raymond A. Mendez and Hans E. A. Boos, joint collectors of the first specimen seen by the junior author. That specimen started the search that resulted in this publication.

Diagnosis.—Adult males 55-60 mm long, females 60-65 mm. Pedipalp tibia (Fig. 4) and chela (Fig. 7) with five ventral trichobothria each. Pectinal tooth counts 8-11. Tarsomere I of leg I with a strongly developed, curved spiniform seta prolaterally (Figs. 8-10). Tarsi on all legs with 5-8 ventral median spines.

Male.—Measurements (lengths in mm) of holotype: carapace 9.5, metasomal segment V 8.8; pedipalp femur 11.5, tibia 11.5, chela 20.5. Opisthosoma, metasoma, chelicera and pedipalps dark red brown; sternites, legs and telson yellow brown. Carapace and tergites acarinate. Pectinal tooth counts 9-11 (mode = 9). Stigmata large, suboval. Sternite VII acarinate. Metasomal segments I-IV: dorsolateral carinae weak, granulose; lateral supramedian carinae moderate, granulose; lateral inframedian carinae on I weak, granulose, on II-IV obsolete; ventrolateral keels weak, smooth; ventral submedian keels vestigial, smooth. Segment V: dorsolateral and lateral median carinae vestigial to obsolete; ventrolateral and ventromedian carinae weak, sparsely granulose. Pedipalps elongate, femur and tibia longer than carapace, chela slightly over twice as long as carapace. Trichobothrial pattern C (Vachon 1974): femur orthobothriotaxic

with 3 trichobothria (Fig. 1); tibia neobothriotaxic with 1 internal, 2 dorsal, 17 external, and 5 ventral trichobothria (Figs. 2-4); chela neobothriotaxic with 27 trichobothria, 5 ventrals (Figs. 5-7).

Female.—Measurements (lengths in mm) of largest female: carapace 10.3, metasomal segment V 8.8; pedipalp femur 9.0, tibia 9.0, chela 18.6. Sternites, legs and telson medium brown. Pectinal tooth counts 8-10 (mode = 9). Pedipalps not as elongate as on male: femur and tibia shorter than carapace, chela less than twice as long as carapace. Curved spiniform seta on tarsomere I of leg I not as strongly developed as on male, although still very conspicuous. Other characters as on male.

Variability.—Male sexual dimorphism in pedipalp length appears with the penultimate molt; immature males resemble females morphometrically. Pectinal tooth counts vary as follows: in males 14 combs with nine teeth, 1 comb with ten teeth, and 1 comb with eleven teeth; in females 2 combs with eight teeth, 11 combs with nine teeth, and 6 combs with ten teeth. Finally, the diagnostic, curved spiniform seta on tarsomere I is present in the smallest specimens examined (a male and a female with carapace lengths of 2.9 and 3.0 mm, respectively; probably represent second or third instars).

Comparisons.—The new species differs from *Chactas (Andinochactas) gestroi* Kraepelin, the only other member of the subgenus, (1) by having a strong, curved spiniform seta on tarsomere I of leg I, (2) by lacking dense punctations on the metasoma, and (3) by having higher pectinal tooth counts on both sexes (range 8-11 and mode is 9 in *C. raymondhansi;* range 6-8 and mode is 7 in *C. gestroi*).

Remarks.—This species has been collected only from water-filled spaces between leaf sheaths of the bromeliad *Glomeropitcairnia erectiflora* Mez. On live specimens a large chamber extending from the stigmata and surrounding the book lungs can be seen. This chamber may act as a reservoir for air if summersion becomes necessary or unavoidable.

The same species of bromeliad occurs on the Paria Peninsula and Margarita Island, Venezuela (Smith and Pittendrigh 1967). A search of this specific habitat in those locations might reveal the presence of *C. raymondhansi,* or a close relative, on the mainland.

Specimens examined.—TRINIDAD: Northern Range, on east ridge near summit of Mt. El Tucuche (1000 m), in bromeliad, 26-VI-1982 (Betty Faber, Eddie Rooks and party), holotype male (AMNH); same locality, in bromeliad 10 feet up small tree, 25-I-1981 (Raymond A. Mendez and Hans Boos), one adult male paratype (JB); same locality, in bromeliad, 16-V-1982 (R. W. Bruce, Jr. and L. Downie), one adult female paratype (JB); same locality, in bromeliad, 24-VI-82 (John Murphy and Ron Humbert), one adult male paratype (FSCA); same locality, in bromeliad, VIII-1982 (M. Read), one subadult female paratype (FSCA); same locality, in bromeliad, IX-1982 (M. Read), one subadult male paratype (MAGS); same locality, in bromeliad, 1980 (M. Koo), one juvenile male paratype (UWI); El Tucuche (3,000 ft.), 30 October 1937 (E. McC. Callan), one adult male paratype (USNM); Northern Range, top of Mt. Aripo, in bromeliads, 9-X-1982 (M. Read and J. Seyjagat), one adult male, one adult female, one subadult female, and one juvenile male paratypes (OFF); on ridge 1 mi W of Mt. Aripo, XI-1982 (M. Read), one juvenile female paratype (JB); El Aripo (2,800 ft.), 25 March 1942 (C. G. Pittendrigh), one adult female paratype (USNM); El Aripo (3,085 ft.), 24 February 1944 (A. M. Adamson), one adult female paratype (USNM); Northern Range, summit of Morne Bleu, in *Glomeropitcairnia* bromeliad, 4 March 1984 (M. Read), one juvenile female paratype (JB); St. Augustine, 1941 (E. McC. Callan), one subadult female paratype (USNM).

Genus *Broteochactas* Pocock

Broteochactas Pocock, 1893. Ann. Mag. Nat. Hist., ser. 6, 12:77 (Type species *Broteochactas nitidus* Pocock 1893 by original designation).

Auyantepuia González-Sponga, 1978. Escorpiofauna de la Region Oriental del Estado Bolivar, en Venezuela, p. 75. (Type species *Broteochactas scorzai* Dagert 1957, by monotypy). NEW SYNONYMY.

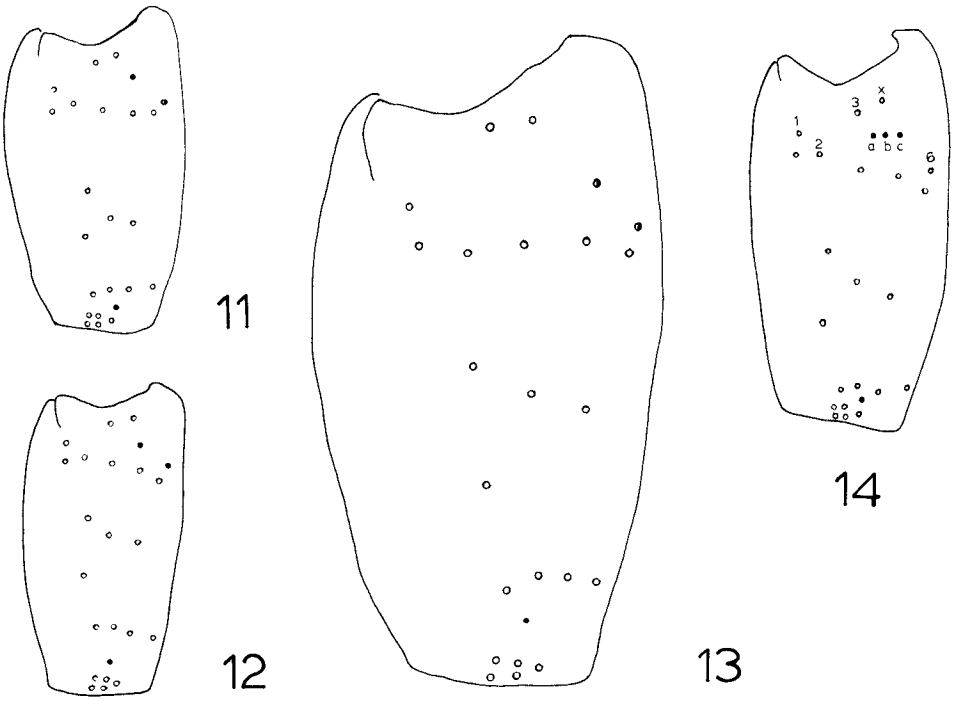
This genus is known from Panama, Colombia, Ecuador, Venezuela, the Guianas, Brasil, and Trinidad and Tobago. The type species, originally described from Trinidad, was synonymized under *Broteochactas gollmeri* (Karsch) from Caracas, Venezuela, by Kraepelin in 1894, and has remained in synonymy ever since. Comparison of material from Caracas, including the lectotype of *B. gollmeri* (hereby designated), with specimens from both Trinidad and Tobago revealed that these two taxa are not conspecific. Thus, *B. nitidus* is redescribed below.

The genus *Auyantepuia* was created by González-Sponga to accommodate *Broteochactas scorzai* Dagert, from Estado Bolivar, Venezuela. This small species differs from other *Broteochactas* spp. known from Estado Bolivar in three characters, which is why it was placed in a separate genus. First the dentition in the pedipalp fingers terminates in two distal teeth, rather than three to five. Second, the trichobothrium designated eb on the external series of the pedipalp chela finger (Vachon 1974, González-Sponga 1978) is found on the finger proper, rather than on the base of the finger basal to the commissure. Finally, among the supernumerary trichobothria on the external distal series on the tibia, et_4 is "petite" as opposed to et_5 and et_6 being "petite." When all species of *Broteochactas* are considered, rather than only those from Estado Bolivar, *B. scorzai* no longer stands out as a generically distinct entity.

The variation in the first character mentioned above appears to be size-related, with smaller species having fewer terminal teeth than larger species. *Broteochactas scorzai* and *Broteochactas laui* Kjellesvig-Waering, the two smallest species in the genus, have two terminal teeth on both the fixed and movable fingers of the pedipalp chela. *Broteochactas nitidus* and *B. gollmeri,* two medium sized species have two terminal teeth on the fixed finger and three on the movable finger. Finally, some of the larger *Broteochactas* spp. have three terminal teeth on the fixed finger, and three to five on the movable finger. Thus, this character is not taxonomically significant at the supraspecific level.

Regarding the second character used to diagnose *Auyantepuia, B. nitidus* and *B. gollmeri* have trichobothrium eb in the same position as *B. scorzai,* on the fixed finger proper, whereas *B. laui* and some of the larger Venezuelan *Broteochactas* spp. have eb on the basal portion near the fingers' commissure. Thus, this character does not have the taxonomic significance ascribed to it by González-Sponga.

The third "character" mentioned above actually involves two different, subjective problems, each of which is dealt with separately. First, a decision must be made as to what constitutes a normal versus a "petite" trichobothrium. Among the six trichobothria assigned to the external terminal (et) tibial series in *Broteochactas,* some species have one with a small pit and short hair, and another one with a normal pit but with a short hair (e.g., *B. laui,* Fig. 11); some



Figs. 11-13.—External aspect of pedipalp tibia (drawn on same scale) showing trichobothrial variability in *Broteochactas* spp. An open circle denotes a normal trichobothrium, a half-closed circle denotes a trichobothrium with a normal pit and a small seta, and a small dot denotes a trichobothrium with a small pit and a small seta. 11, *B. laui,* from Tobago; 12, *B. gollmeri,* from Venezuela; 13, *Broteochactas* sp. from Guyana.

Fig. 14.—Semi-diagrammatic illustration showing that positional variation in one small trichobothrium can lead to erroneous homologies in designations: a = et_4 and x = et_5, however c = et_5 and x = et_4 (see text for further discussion).

species have two trichobothria with small pits and short hairs (e.g., *B. gollmeri,* Fig. 12), and some have two with normal pits but short hairs (e.g., *Broteochactas* sp., Fig. 13). The second problem is that created by the numbering convention of Vachon (1974), and used by González-Sponga (1978), and its implied homologies (see Francke 1982, and Francke and Soleglad 1981, for further discussion on this problem). In Fig. 14, a small trichobothrium appearing in position "a" becomes et_4, and "x" becomes et_5; the same small trichobothrium in position "c" becomes et_5, and "x" is considered as et_4: and in position "b" it is a toss-up! The reputed difference between *Auyantepuia,* with trichobothria et_4 small and et_5 normal (position "a" in Fig. 14), and *Broteochactas,* with et_4 normal and et_5 small (positions "b" and "c" in Fig. 14) is based on a false homology and certainly does not justify the recognition of two separate genera.

Broteochactas nitidus Pocock
Figs. 15-20

Broteochactas nitidus Pocock 1893b:339-401, pl. 29, figs. 7-7a.

Broteochactas gollmeri (in part): Kraepelin 1894:176-177, 1899:173, 1912:53; Pocock 1897:365-366, 1900:68; Mello-Leitão 1932:32, 1945:100.

Broteochactas gollmeri (misidentification): Roewer 1943:237; Waterman 1950:169; Kjellesvig-Waering 1966:126.

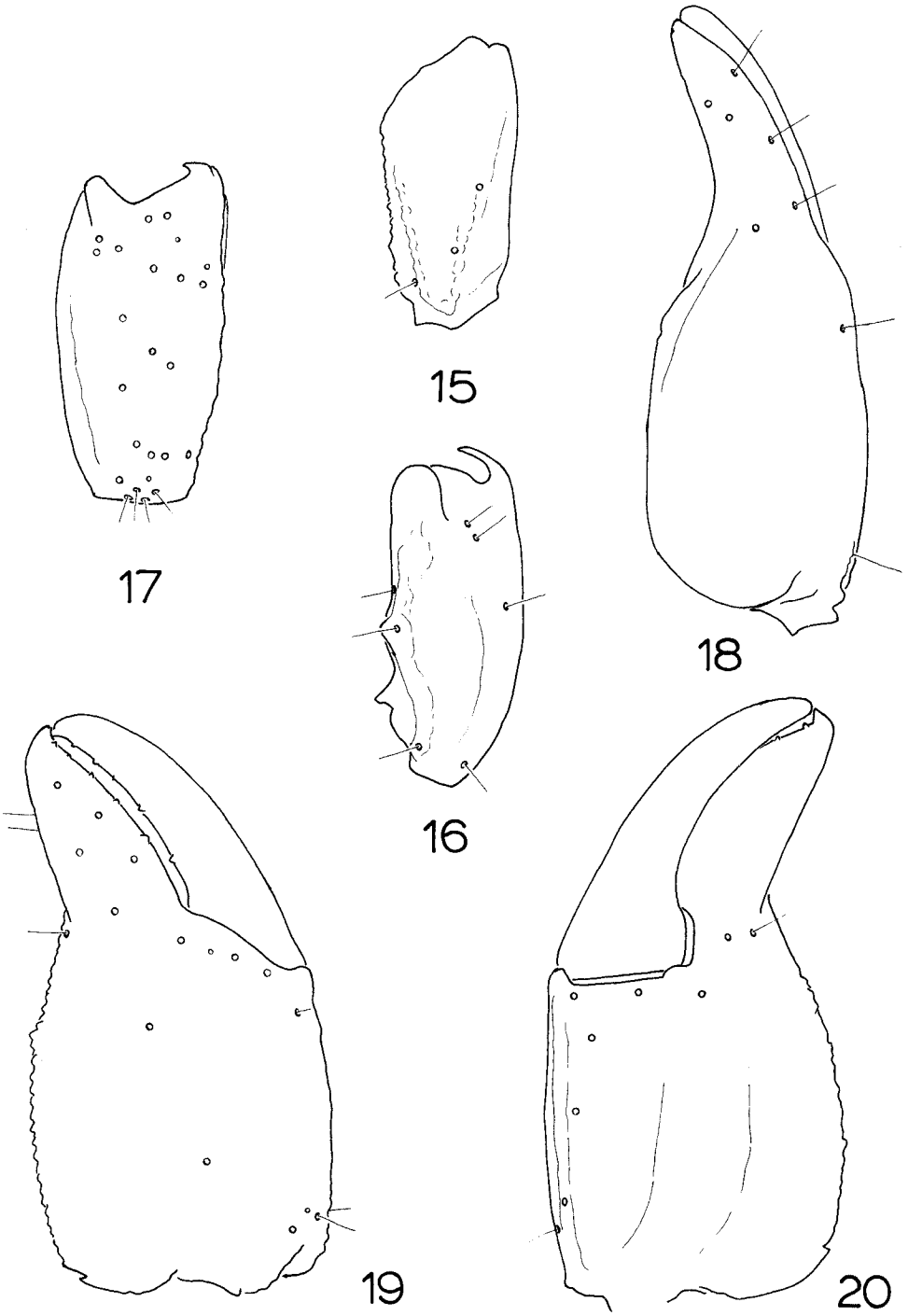


Fig. 15-20.—Right pedipalp of adult male *Broteochactas nitidus* Pocock, from Trinidad, showing trichobothrial patterns: 15, dorsal aspect of femur; 16, dorsal aspect of tibia; 17, external aspect of tibia; 18, dorsal aspect of chela; 19, external aspect of chela; 20, ventrointernal aspect of chela.

Type data.—Lectotype male and seven paralectotypes (hereby designated) from Trinidad (L. E. Broadway). Permanently deposited in the British Museum (Natural History). Examined.

Distribution.—Known only from Trinidad and Tobago.

Diagnosis.—Adults 30-35 mm long; dark brown to black, legs medium to dark brown. Pectinal tooth count 8 in males, 7 in females. Metasomal segments III-IV with ventrolateral keels moderate, granulose. Pedipalp chela with three external trichobothria on finger (Fig. 18); dorsal margin of manus with dense, coarse granulation; external aspect of manus with fine granules in reticulated pattern. Chela length less than twice its width.

Male.—Measurements (lengths in mm) of lectotype male from Trinidad: carapace 4.1, metasomal segment V 4.7; pedipalp femur 2.8, tibia 3.3, chela 6.3, fixed finger 2.6. Opisthosoma, metasoma and pedipalps dark red brown; sternites, chelicera and legs light brown; all areas heavily infuscate. Carapace and tergites shagreened, acarinate except for tergite VII with few distal granules on submedian and lateral carinal regions. Pectinal tooth count 8. Stigmata small, round. Sternites smooth, acarinate. Metasomal segments I-IV: dorsolateral carinae strong, granulose; lateral supramedian carinae moderate, granulose; lateral inframedian carinae on I vestigial, subgranose, on II-IV obsolete; ventrolateral carinae on I obsolete, on II vestigial and subgranose, on III and IV weak to moderate and granulose; ventral submedian carinae on I and II obsolete, on III vestigial and subgranose, on IV weak to moderate and granulose. Segment V: dorsolateral and lateromedian carinae weak, finely granulose; ventral keels moderate, granulose. Telson with moderately dense, small granulation. Pedipalps stout, chela considerably wider (1.3-1.5X) than fixed finger length. Bothriotaxia C (Vachon 1974): femur orthobothriotaxic with 3 trichobothria (Fig. 15); tibia neobothriotaxic with 1 internal, 2 dorsal, 24 external and 7 ventral trichobothria (Figs. 16 and 17); chela orthobothriotaxic with 26 trichobothria (Figs. 18-20). Tarsomere II on all legs armed ventrally with two submedian rows of long setae.

Female.—Measurements (length in mm) of adult from Chancellor Hill, Trinidad: carapace 5.0, metasomal segment V 5.0; pedipalp femur 3.5, tibia 4.0, chela 7.6, fixed finger 2.9. Pectinal tooth count 7.

Variability.—The populations from Trinidad and Tobago are remarkably uniform morphologically. However, specimens from mountainous areas tend to be darker (almost black) than lowland forms. Pectinal tooth counts display very low variability: in males 7 combs had seven teeth, 68 combs had eight teeth, and 1 comb had nine teeth; in females 2 combs had six teeth, 185 combs had seven teeth, and 9 combs had eight teeth.

Comparisons.—*Broteochactas nitidus* differs from *B. gollmeri,* with which it had been confused, as indicated below. First, in size: carapace length in adult males is greater than 4.0 mm in *B. nitidus,* and less than 4.0 mm in *B. gollmeri;* in females greater than 4.5 mm in *B. nitidus,* and less than 4.1 mm in *B. gollmeri.* Second, in pectinal tooth counts: in *B. nitidus* 8 in males, and 7 in females; in *B. gollmeri* 7 in males, and 6 in females. Third, in ornamentation on the dorsal and external faces of the pedipalp chela: densely granulose in *B. nitidus,* smooth and shiny in *B. gollmeri.* Fourth, in pedipalp chela proportions: 1.9 times longer than wide in males of *B. nitidus,* 2.1 times longer than wide in males of *B. gollmeri;* 1.8 times longer than wide in females of *B. nitidus,* 2.15 times longer than wide in females of *B. gollmeri.* Finally, in development of the ventral

submedian carinae on metasomal segments III and IV: weak to moderate and granulose on *B. nitidus,* vestigial and subgranose on *B. gollmeri.*

Broteochactas nitidus differs from *B. laui,* with which it coexists on Tobago, as follows. First, in size: carapace length in adults of *B. laui* is less than 4.0 mm. Second, in pectinal tooth counts: 7 on males and 6 on females of *B. laui.* Third, in the disposition of the external trichobothria along the fixed finger of the pedipalp chela: eb basal to the finger commissure in *B. laui* (Fig. 25), and distal to the commissure in *B. nitidus* (Fig. 19).

Specimens examined.—TRINIDAD: no date [29.IV.1890 ?] (L. E. Broadway), lectotype male, two paralectotype males, and five paralectotype females (BMNH); 3.4.1900 (W. Ince), one male, five females (BMNH); Maraval Valley, 1913 (Thaxter), two females (MCZ); Port-of-Spain, Jan. 1913 (R. Thaxter), two juveniles (MCZ); near Salibia, 28 April 1916 (H. L. Clark), one female (MCZ); La Seira Valley, April 1916 (H. L. Clark), two males, two females (MCZ); Mt. Tucuche (in bromeliads), 28 May 1917 (J. B. Rorer), one female (MCZ); Port-of-Spain, 28 Jan. 1926 (W. S. Brooks), one male (MCZ); Port-of-Spain, February 1942 (H. F. Loomis—A. V. Armour Exp.), two adult females (USNM); Port-of-Spain, Chancellor Hill (1000 ft.), 20 March 1964 (E. N. Kjellesvig-Waering), three adult males, one subadult female (FSCA); Simla, 18-25 April 1964 (no collector), four juveniles (MCZ); Port-of-Spain, 15-V-1965 (E. N. Kj. Waering), two adult, one juvenile females (FSCA); Port-of-Spain, Chancellor Hill (1000 ft.), 15-VII-1965 (E. N. Kj. Waering), four males, five females (FSCA); Port-of-Spain, 1 May 1966 (E. N. Kj. Waering), one juvenile (FSCA); Port-of-Spain, Chancellor Hill (1500 ft.), Aug. 1966 (E. N. Kjellesvig-Waering), one adult male, three adult females, two subadult females (OFF), three males, one female (FSCA); Port-of-Spain, Ft. George Hill (1200 ft.), 15-VIII-1967 (Ricky Kj. Waering), one juvenile male (FSCA); Port-of-Spain, Chancellor Hill (1500 ft.), March 1968 (E. N. Kj. Waering), four females (FSCA); Maraval, N of Port-of-Spain, 16 Dec. 1962 (E. N. Kj. Waering), one female (FSCA); Maraval, 4 Mar. 1963 (E. N. Kj. Waering), one female (FSCA); 5 Mar. 1964 (W. R. Jones), one male, three females (one with 46 first instars) (FSCA); Maraval, 6 March 1964 (W. R. Jones), one female (gave birth in captivity) FSCA); Maraval, 13 Mar. 1964 (W. R. Jones), two females (FSCA); Maraval, 12 April 1964 (E. N. Kj. Waering), one male, one female (FSCA); Maraval, 15 April 1964 (E. N. Kj. Waering), one female (FSCA); Maraval, 23 April 1964 (E. N. Kj. Waering), one male (FSCA); Maraval, 12-I-1968 (E. N. Kj. Waering), one female (with 27 first instars born in captivity) (FSCA); Maraval, Fondes Amandes Road, 2 Dec. 1967 (H. and J. Boos), four females (one with 44 first instars born in the wild) (FSCA); Maraval, Fondes Amandes Rd., 24-V-1968 (J. Boos), one female (FSCA); Mayaro Beach, 2 mi N Plaisance (2 m), 15 Mar. 1964 (E. N. Kj. Waering), one female (FSCA); Mayaro Beach area, Ortoire, 12 June 1964 (E. N. Kj. Waering), one female (FSCA); Mayaro Beach area, Ortoire Village, 20 Nov. 1964 (E. N. Kj. Waering), one female (FSCA); Mayaro Beach, 15 Nov. 1965 (E. N. Kj. Waering), one male, one female (FSCA); Mayaro Beach, 1 May 1966 (E. N. Kj. Waering), one female (FSCA); Mayaro, Ortoire Village, III-1968 (E. N. Kj. Waering), one female (FSCA); Mayaro Beach, Ortoire Village, 15-IV-1968 (E. N. Kj. Waering), three females (FSCA); Mayaro Beach, 15-V-68 (E. N. Kj. Waering), one male (FSCA); Maracas, 1941 (E. McC. Callan), one adult female (USNM); Maracas Valley, 9-IV-1968 (Hans Boos), one male, one female (FSCA); milepost 6.4 Maracas Bay to Port-of-Spain Rd. (800 ft.), 15-VI-1968 (Ricky Waering), one female (FSCA); milepost 6-1/4 on Maracas Bay Road, 20-VIII-1976 (J. Boos), one adult male (JB); Mt. Cathrine, 13-II-1977 (J. Boos), one adult male, one juvenile female (JB); St. Joseph, Maracas Falls trail, 8-III-1977 (J. Boos), two adult females (OFF); Asa Wright Nature Center, Arima Valley, 16-VII-1978 (R. A. Mendez), one adult female (OFF); Blanchisseuse Valley, 1-II-1979 (R. Mendez and J. Boos), one adult male, one subadult female, one immature male (OFF); El Tucuche (2,000 ft.), June 1944 (A. H. Strickland), one adult female with 27 first-instar young (USNM); Tucuche (2,500 ft.), 12 November 1944 (A. M. Adamson), one adult and one juvenile males (USNM); Mt. Tucuche (3000 ft.), 1-VI-1969 (Julius Boos), one male (FSCA); trail to Mt. El Tucuche (under rock), 18-II-1979 (J. Boos), one adult male, one subadult female (JB); in leaf litter nr. summit of Mt. El Tucuche, N. Range, 16-V-1982 (R. W. Bruce, Jr. and L. Downie), two adult females (MAGS); Verdant Vale Road, off Blanchisseuese Rd., Arima, July 1982 (M. Read), one adult female (JB); Simla, Blanchisseuse Rd., Arima, Sept. 1982 (M. Read), one adult female (UWI); in bromeliad, summit of Mt. Aripo, Northern Range, IX-1982 (M. Read), one female (UWI); Haven Hill farm, Talparo, Nov. 1983 (V. Quesnel), one juvenile female (JB); in rotting log, summit of Mt. Aripo, Northern Range, 14 Dec. 1983 (M. Read), one adult female (JB); Northern Range (2,000 ft.), 8 February 1942 (A. M. Adamson), one adult female (USNM); same locality (2,000 ft.),

24 March 1943 (A. M. Adamson), one adult male (USNM); Diego Martin, Petit Valley, 5 May 1964 (E. N. Kj. Waering), one male (FSCA); St. Anns, 12-XI-1968 (J. Boos), two females (FSCA); 3 mi W Morne Bleu, 30-VI-1968 (J. Boos), one female (FSCA); 1 mi W Morne Bleu, 9-III-1969 (J. Boos), two females (FSCA). TOBAGO: Speyside, 1 Sept. 1964 (Edgar Lau), one male (FSCA); Speyside, 28 Nov. 1969 (Egbert Lau), one female (FSCA); Speyside, .7.1970 (E. N. Kj. Waering), one female (FSCA); road to Hillsborough Dam, May 1977 (Ray Mendez), one adult female (OFF); Mertichon Estate nr. Speyside, 3-IV-1979 (Dave Hardy), one subadult female (JB); Pigeon Hill, nr. Charlotteville, 4-V-1979 (Dave Hardy), one adult female (JB); Pigeon Peak, nr. Charlotteville, 26-27-X-1982 (M. Read), two adult females (JB); near summit of Pigeon Peak, under stone in gulley, 26 Feb. 1984 (M. Read), two adult females (OFF).

Broteochactas laui Kjellesvig-Waering
Figs. 21-26

Broteochactas laui Kjellesvig-Waering 1966:126-128, figs. 1-2; González-Sponga 1974a:5, 1974b:300.

Type data.—Holotype female from Speyside (Paradise Inn Hotel), Tobago. Permanently deposited in the American Museum of Natural History, New York. Not examined.

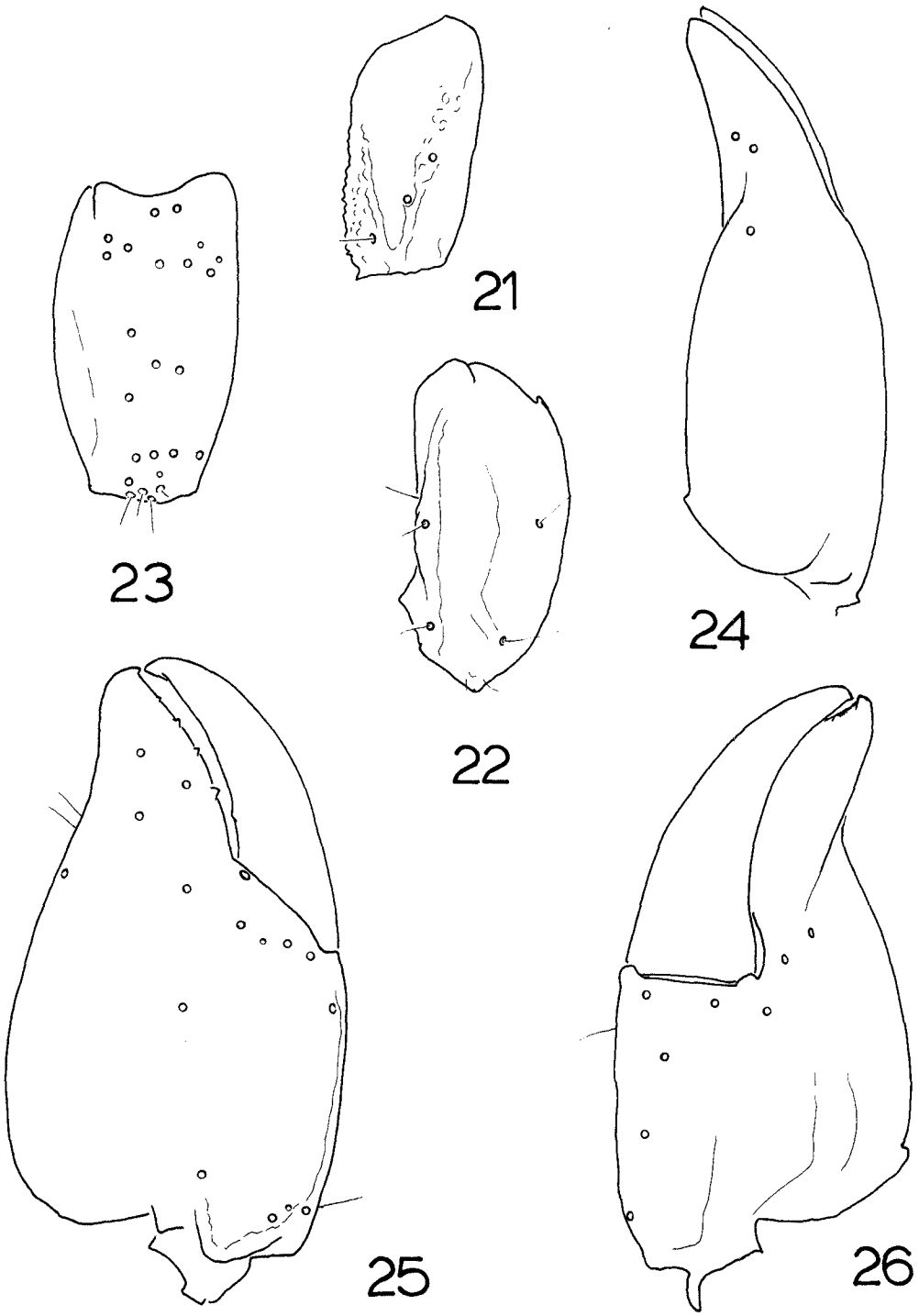
Distribution.—Known only from Tobago.

Diagnosis.—Adults 22-25 mm long; medium brown and heavily infuscate, with legs yellow brown and lightly infuscate. Pectinal tooth counts 6-7 (mode = 7) in males, 5-7 (mode = 6) in females. Pedipalp chela with two external trichobothria on finger (Fig. 25); dorsal and external aspects of chela densely and coarsely granulose. Carinae on metasomal segments I-IV absent, except for lateral supramedians on I and II and dorsolaterals on III and IV which are weak and subgranose.

Female.—Measurements (length in mm) of adult paratype from Speyside, Tobago: carapace 3.7; metasomal segment V 3.1; pedipalp femur 2.1, tibia 2.6, chela 5.0, fixed finger 1.9. Opisthosoma and metasoma medium brown, heavily infuscate; pedipalps dark red brown, heavily infuscate; sternites, chelicera and legs yellow brown, lightly infuscate. Carapace and tergites acarinate, smooth and shiny. Sternites smooth and shiny; stigmata small, round. Metasomal carinae on I-IV: lateral supramedians on I and II, and dorsolaterals on III and IV weak, subgranose; all others obsolete. Segment V with dorsolateral keels weak, finely granulose; ventral keels moderate, granulose. Telson shiny, with sparse small granules. Pedipalps stout; chela with broad, stubby fixed finger. Bothriotaxia C (Vachon 1974): femur orthobothriotaxic with 3 trichobothria (Fig. 21); tibia neobothriotaxic with 1 internal, 2 dorsal, 24 external, and 7 ventral trichobothria (Figs. 22 and 23); chela orthobothriotaxic with 26 trichobothria (Figs. 24-26). Tarsomere II on all legs armed ventrally with two submedian rows of setae.

Male.—Measurements (lengths in millimeters) of adult paratype from Speyside, Tobago: carapace 3.5; metasomal segment V 3.5; pedipalp femur 2.2, tibia 2.7, chela 4.7, fixed finger 1.7. Differ from females primarily in pedipalp chela proportions, having a wider manus and a shorter fixed finger; in pectinal morphology, with one more tooth, and each tooth is 2.5 to 3 times longer than on females.

Variability.—Pectinal tooth counts varied as follows: on males 1 comb with six teeth, 3 combs with seven teeth (one male reported upon by Kjellesvig-Waering 1966); on females 1 comb with five teeth, 22 combs with six teeth, and 7 combs with seven teeth.



Figs. 21-26.—Right pedipalp of adult female *Broteochactas laui* Kjellesvig-Waering, from Tobago, showing trichobothrial patterns: 21, dorsal aspect of femur; 22, dorsal aspect of tibia; 23, external aspect of tibia; 24, dorsal aspect of chela; 25, external aspect of chela; 26, ventrointernal aspect of chela.

Comparisons.—See the section under *B. nitidus* for differential characters with that species.

Specimens examined.—TOBAGO: Speyside (under rocks in burrows; forest), 15-II-1965 (Edgar Lau), one adult male, one adult female paratypes (FSCA); Speyside, 20 April 1965 (Edgar Lau), two adult female paratypes (FSCA); between Charlotteville and Speyside, 29 Oct. 1982 (M. Read), one adult female (JB); milepost 26 Windward road, among rocks and soil from walls of gulley in cocoa plantation, 19-20 Feb. 1984 (M. Read), five adult, one subadult and three juvenile females (JB, OFF).

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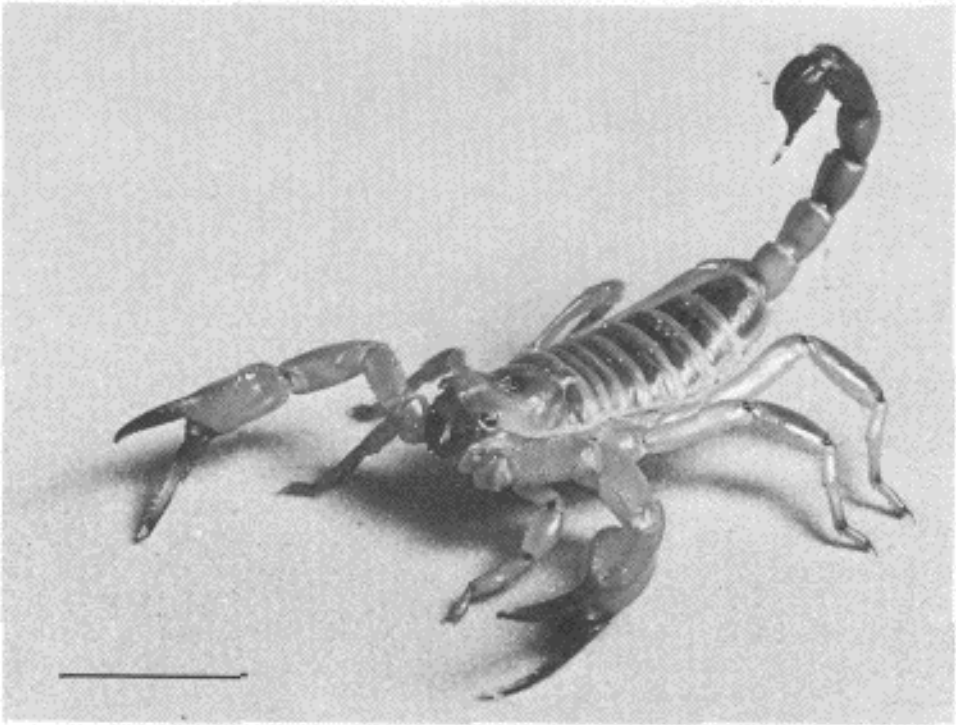

Fig. 2.—*Urodacus yaschenkoi*, normal. The darkness of chelae and fingers, aculeus, tarsal claws and leg joints is due to dark sclerotization whereas that of eyes and surrounds, vesicle and metasomal segments is caused by pigmentation. Scale = 10 mm.

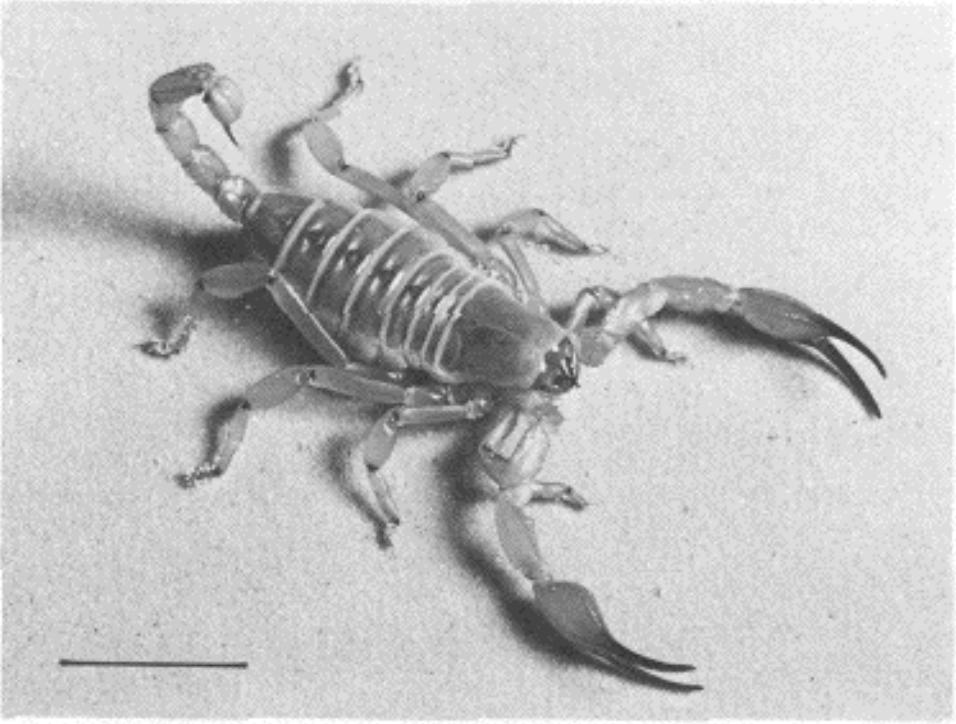

Fig. 3.—*Urodacus yaschenkoi*, albino. Sclerotized parts resemble normal, but eyes, vesicle and metasomal segments lack pigment. Scale = 10 mm.

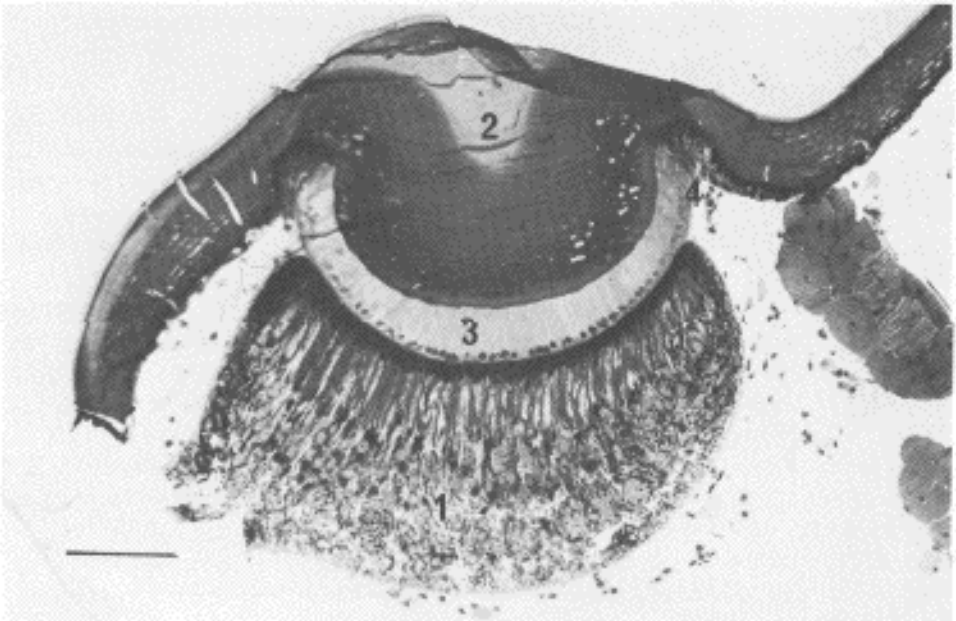

Fig. 4.—Normal median eye, coronal section. Retina, 1, is separated from lens, 2, by vitreous 3. Epidermis is heavily pigmented, particularly at limbus, 4. Retina contains abundant pigment. Scale = 100 μm.

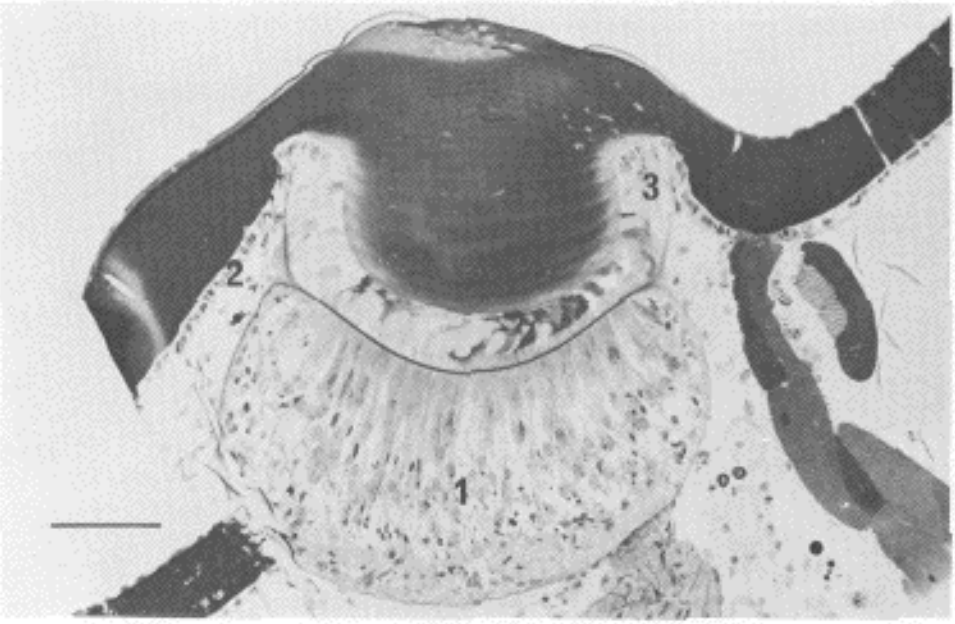

Fig. 5.—Albino median eye, coronal section. Retina, 1, epidermis, 2, and limbus, 3, are devoid of pigment. Scale = 100 μm.

the cells give rise to nerve fibres that form bundles in the deep part of the eye before piercing the postretinal membrane to form the optic nerve.

The normal retinula cells each contain a rounded body called by Lankester and Bourne (1883) a phaosphere, presumably from their dark appearance in stained

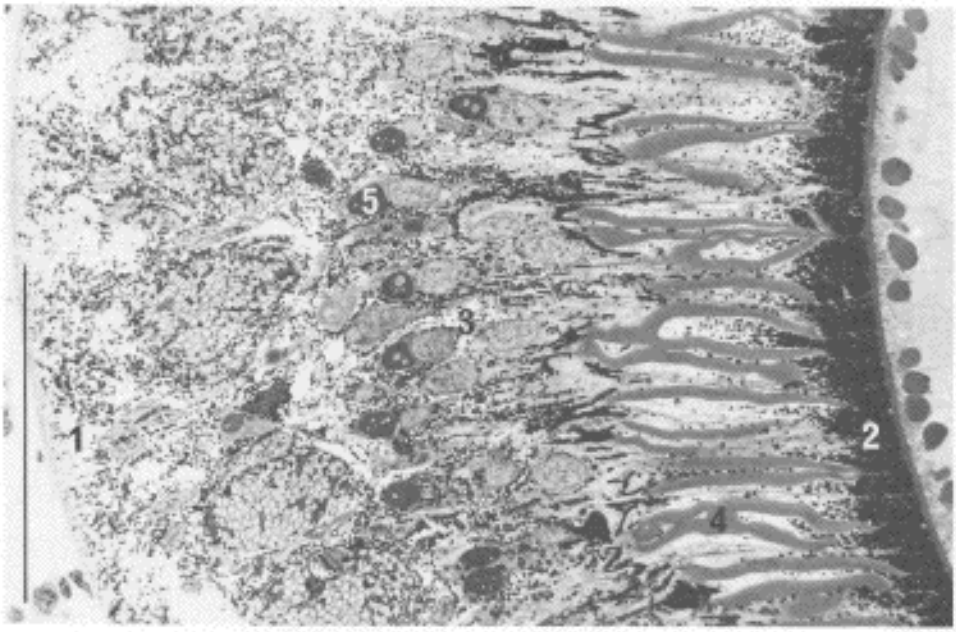

Fig. 6.—Retinal periphery, normal. Abundant pigment in peripheral pigment cells, 1, vitread end of retinula cells, 2, and in substance of retina, 3. Rhabdoms, 4, and phaospheres, 5, well formed. Scale = 100 μm.

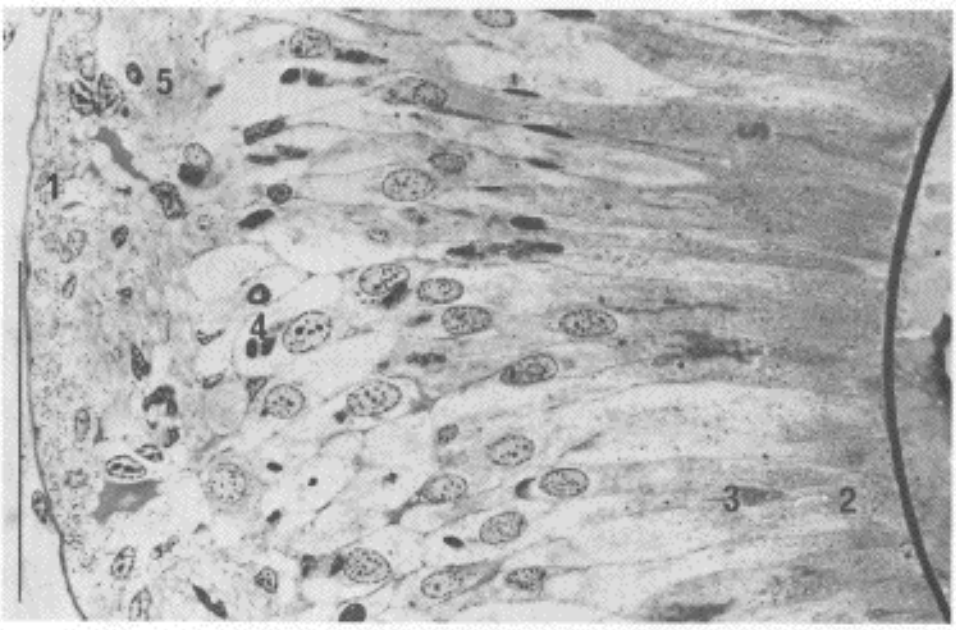

Fig. 7.—Retinal periphery, albino. Granules replace pigment in peripheral cells, 1, and retinula cells, 2, Rhabdoms, 3, and phaospheres, 4, are degenerate. Nuclei, and nerve fibres, 5, appear normal. Scale = 100 μm.

sections. The phaospheres, of which at least one appears to be present in each retinula cell, are usually located deep to the nucleus and are of comparable size. Ultrastructurally they appear as an aggregation of dense granules approximately 40 nm in diameter (Fig. 10). The phaospheres contain vacuoles that stain with

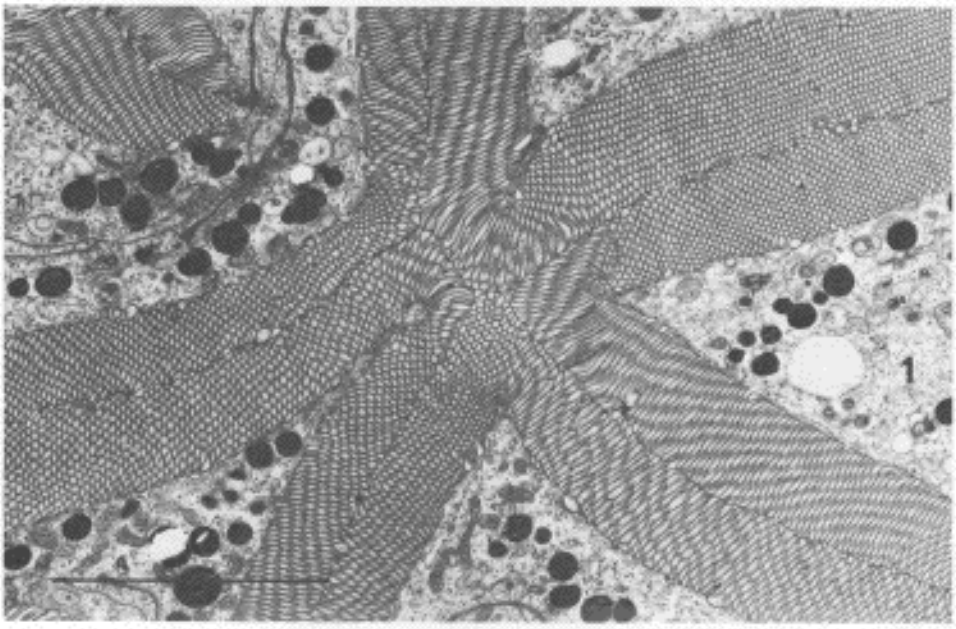

Fig. 8.—T. S. rhabdom, normal, E. M. Each retinula cell, 1, contributes microvilli to two arms of the star-shaped rhabdom. Cytoplasm contains mitochondria, ribosomes and abundant melanin granules. Scale = 5 μm.

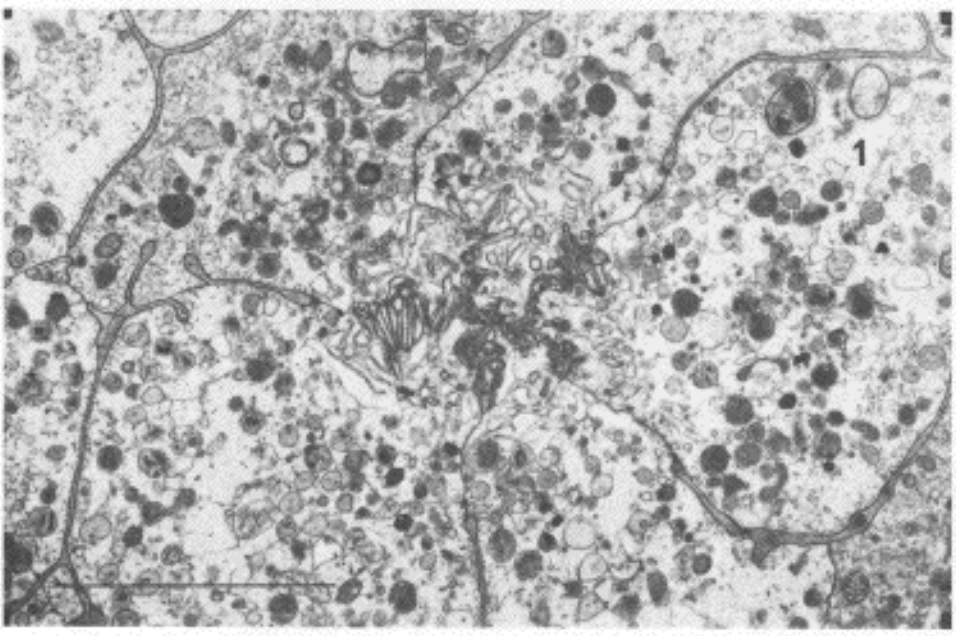

Fig. 9.—T. S. rhabdom, albino, E. M. Groups of five retinula cells, 1, bear reduced and disorganised microvilli. Mitochondria and ribosomes deficient. Pigment granules replaced by non-pigmented premelanosomes. Scale = 5 μm.

cuticle is well sclerotized but pale, and there is little epidermal pigment. Other scorpions are very dark; *Heterometrus* species from Asia and *Urodacus manicatus* from Australia are cases in point. Of these *U. manicatus* certainly owes its colouration to both dark cuticle and epidermal pigmentation. The fingers and

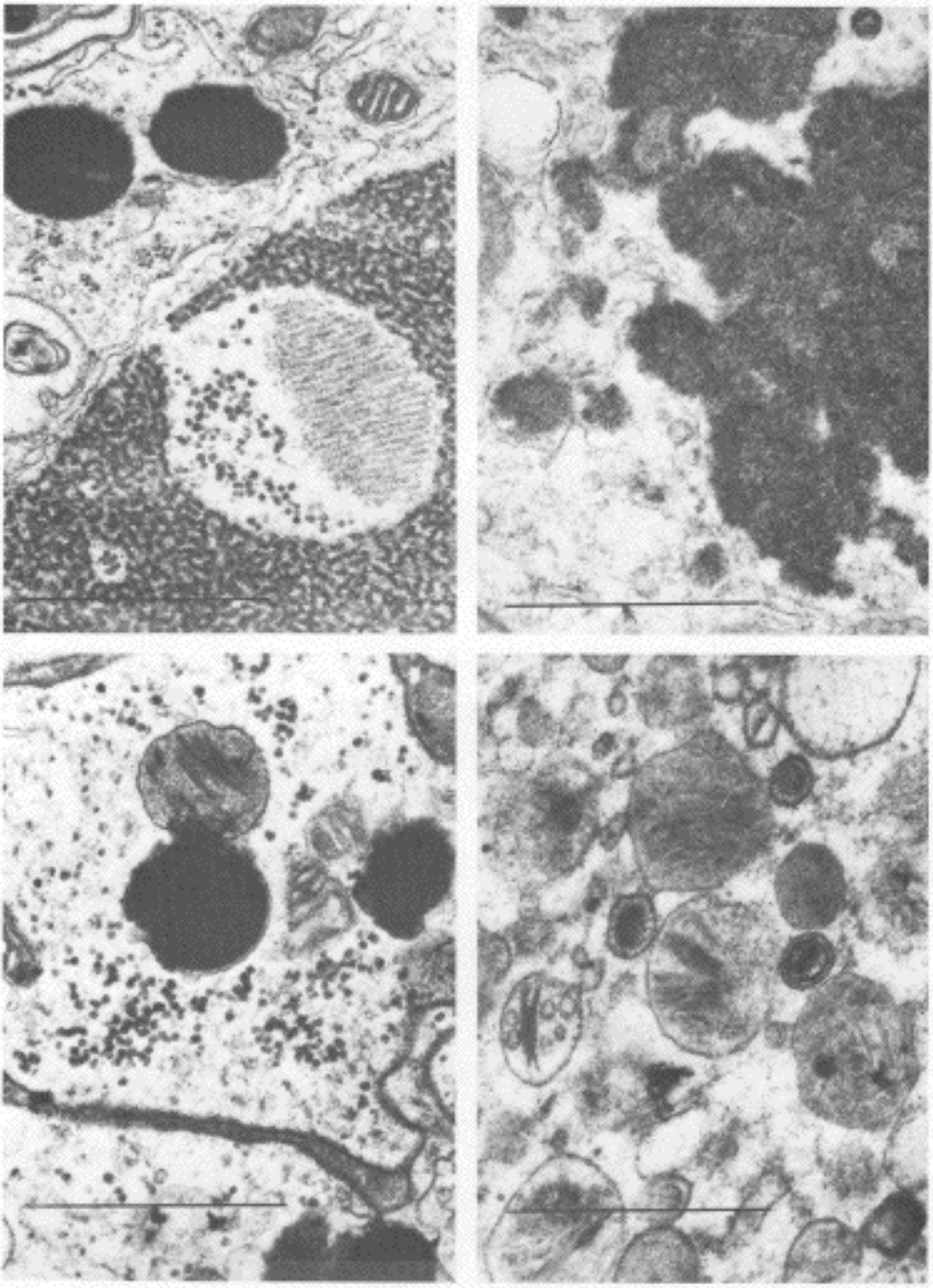

Fig. 10.—Phaosphere, normal, E. M. Phaosphere consists of aggregated granules. Similar granules present in cytoplasm and within vacuole. Paracrystalline array of smaller granules in some vacuoles. Scale = 1 μm.

Fig. 11.—Phaosphere, albino, E. M. Dense amorphous mass replaces well-defined granules. Scale = 1 μm.

Fig. 12.—Pigment granules, normal, E. M. Melanin granules are dense and membrane-bound. Adjacent premelanosome contains granular matrix and lamellae. Scale = 1 μm.

Fig. 13.—"Pigment" granules, albino, E. M. Membrane-bound granules resemble normal premelanosomes, but occur in greater size range. No melanin present. Scale = 1 μm.