

THE PSEUDOSCORPIONS DESCRIBED BY R. V. CHAMBERLIN (PSEUDOSCORPIONIDA, OLPIIDAE AND CHERNETIDAE)

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ABSTRACT

The four species of pseudoscorpions described by R. V. Chamberlin in 1925, but neglected since that time, are redescribed and placed in modern context. They are now *Pachyolpium isolatum*, *Lustrochernes consocius*, *Chelodamus atopus*, and *Chelodamus mexicolens*. The genus *Chelodamus* is redefined and *Chelanops atopus* Banks is newly assigned to it.

INTRODUCTION

In a paper concerning a number of arachnids from Central America, R. V. Chamberlin (1925) described four new species of pseudoscorpions, namely, *Olpium isolatum*, *Chelanops consocius*, *Chelodamus atopus* and *Chelodamus mexicolens*, the latter two belonging to a new genus. However, for some unexplained reason, this paper has been ignored by most subsequent workers, the only exceptions being an acknowledgment by J. C. Chamberlin (1931:242) of the generic name *Chelodamus* and citations of the specific name *Chelodamus mirabilis* in synonymies by Hoff (1946:201) and Muchmore (1974:30). As a result of this neglect, the species involved have not been properly considered in the relevant literature. It is the purpose of the present paper to discuss the importance of these forms in relation to others which have been described since that time.

FAMILY OLPIIDAE CHAMBERLIN

Pachyolpium isolatum (R. V. Chamberlin), new combination

Fig. 1

Olpium isolatum R. V. Chamberlin, 1925:239, no Fig. Holotype female (WM 1949.010001) from Largo Remo Island, Canal Zone, Panama, in MCZ. The specimen has been cleared, dissected, mounted on a microscope slide, and examined.

Pachyolpium adiposum Hoff, 1945:12, Figs. 15, 16. Holotype female from Barro Colorado Island, Canal Zone, Panama, in AMNH, examined. NEW SYNONYMY.

Description of female (male unknown).—The holotype of *O. isolatum* is very similar to the female from Barro Colorado Island which Hoff described as *P. adiposum*. Because Chamberlin's and Hoff's descriptions taken together are so detailed, only the major features of interest will be mentioned here.

Carapace with an indistinct transverse furrow; with about 30 setae. Tergal chaetotaxy 4:6:9:9:12:?:12:11:12:10:?:2; sternal chaetotaxy 6:(0)4(0):(0)6(0):11:10:---. Cribriform plates not visible.

Chelicera 2/5 as long as carapace; hand with five long, acuminate setae; flagellum of three denticulate setae; galea with three slender rami (distorted by prior drying).

Palp with femur 2.45, tibia 2.1, and chela 2.65 times as long as broad; hand 1.5 times as long as deep; movable finger 0.97 as long as hand. Femur with a conspicuous tactile seta on dorsum about 1/3 distance from proximal end. Trichobothria as shown in Fig. 1; *ist* near base of fixed finger at level of *isb*. Venom apparatus well developed in both fingers; in fixed finger nodus ramosus of venom duct just proximad of trichobothrium *et*; in movable finger nodus ramosus about midway between *t* and finger tip. Fixed finger with 45 and movable finger with 44 marginal teeth; on both fingers teeth are flattened and acuspid proximally.

Legs moderately robust; leg IV with entire femur 2.75 times as long as deep. Leg I with basifemur 1.5 times as long as telofemur. Metatarsus IV with long tactile seta 1/6 distance from proximal end.

Measurements (mm) of mounted holotype.—Body length 3.18. Carapace length 0.70. Chelicera length 0.30. Palpal femur 0.59 by 0.24; tibia 0.60 by 0.285; chela (without pedicel) 1.06 by 0.40; hand 0.57 by 0.385; pedicel 0.10 long; movable finger 0.55 long. Leg I: basifemur 0.305 by 0.11; telofemur 0.20 by 0.125. Leg IV: entire femur 0.66 by 0.24; tibia 0.47 by 0.135; metatarsus 0.24 by 0.08; telotarsus 0.175 by 0.075.

Remarks.—The measurements given here are somewhat greater than those recorded by Chamberlin (1925:239). The difference is probably due to the fact that Chamberlin

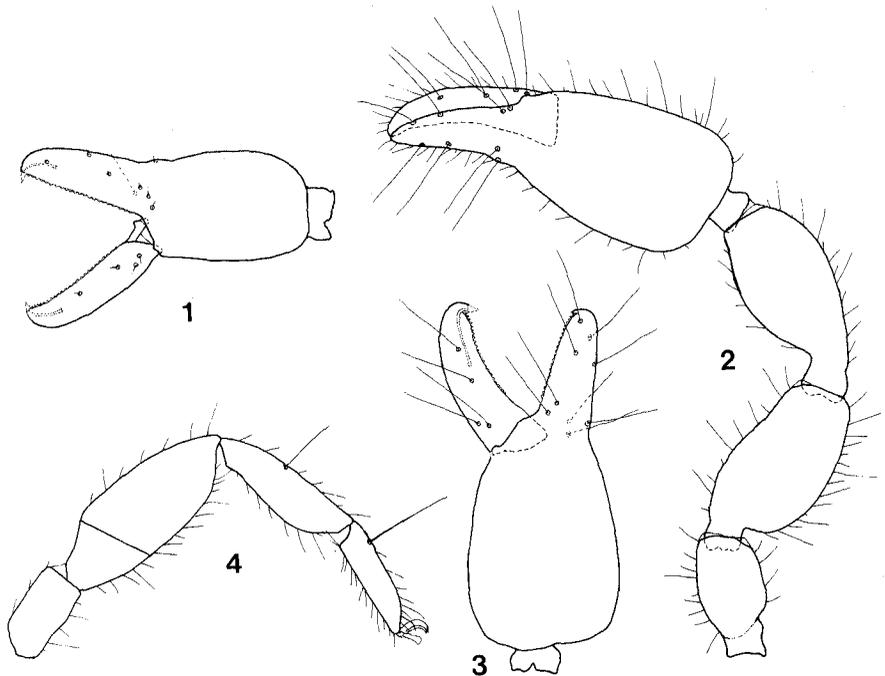


Fig. 1.—*Pachyolpium isolatum* (R. V. Chamberlin), holotype female: lateral view of left palpal chela (slightly tilted toward top).

Figs. 2-4.—*Lustrochernes consocius* (R. V. Chamberlin), holotype female: 2, dorsal view of right palp; 3, lateral view of left chela; 4, lateral view of leg IV.

measured the specimen entire, in alcohol, whereas I measured the dissected parts mounted in favorable positions on a slide.

The holotype female of *P. adiposum* Hoff (from Barro Colorado Island, Panama Canal Zone) has been examined and compared with the holotype female of *O. isolatum*. There is no doubt about their being conspecific. Though the characteristics of the genus *Pachyolpium* Beier are still not clearly defined (cf. Mahnert and Schuster 1981), this species belongs to the genus as diagnosed by Hoff (1964). I consider that the important parts of this diagnosis are the position of trichobothrium *ist* near the base of the fixed finger and the presence of 10-12 setae on the middle tergites of the abdomen. Also diagnostic, I consider, though not recognized previously, is the length of the venom ducts in the chelal fingers, with the nodus ramosus in the fixed finger occurring at or just proximad of trichobothrium *et*.

FAMILY CHERNETIDAE MENGE

Lustrochernes consocius (R. V. Chamberlin), new combination Figs. 2-4

Chelanops consocius R. V. Chamberlin, 1925:238, no Fig. Holotype female (*not* a male as stated by Chamberlin) (WM 1900.01001) from Barro Colorado Island, Canal Zone, Panama, in MCZ. The specimen has been cleared, dissected, mounted on a microscope slide, and examined.

Other material examined.—One male, also from Barro Colorado Island, 11-17 December 1974, K. W. Cooper, in FSCA.

Description.—The original description by Chamberlin is generally accurate but quite brief; therefore, a full account is given here of the holotype female, together with some comments about the male, which is generally very similar. Palps reddish brown, other parts lighter. Dorsal setae acuminate or with few small subterminal spinules, ventral setae acuminate. Carapace about as long as wide; surface smooth; eye spots very faint; anterior transverse furrow distinct, posterior one very faint; with about 70 setae, six at anterior and 16 at posterior margin. Abdomen elongate; tergites and sternites divided; surfaces smooth; pleural membranes longitudinally striate. Tergal chaetotaxy about 22:20:20:24:26:28:28:30:28:26:14:2; sternal chaetotaxy about 18:(3)12(3):(1)8(1):23:32:36:32:30:28:12:2; anterior genital operculum with central cluster of 12 small setae and few posterolaterally; anterior operculum of male with five long central setae surrounded by 17 smaller ones; posterior operculum with two pairs of small setae just inside anterior margin and 12 on face. Spermathecae of female in poor position to reveal details, but apparently similar to those of other species of *Lustrochernes*. Internal genitalia of male without obvious distinguishing characters.

Chelicera about $2/5$ as long as carapace; hand with five setae; flagellum of three setae; (galea broken); serrula exterior of 23 blades.

Palp heavy (Fig. 2); femur 2.15, tibia 2.2, and chela 2.5 times as long as wide; hand 1.35 times as long as deep; movable finger 0.78 as long as hand; palp of male more robust in all segments. Surfaces smooth except fine granules on flexor sides of femur, tibia, and hand at base of fingers; trochanter with a prominent dorsal protuberance. Trichobothria as shown in Fig. 3, *et* lying distad of middle of fixed finger and *it* closer to finger tip than distance between *ist* and *isb*. Venom apparatus well developed only in movable finger, nodus ramosus about midway between trichobothria *t* and *st*. Fixed finger with 35 and

movable finger with 34 contiguous, cusped teeth; each finger with 3-4 internal and 10-11 external accessory teeth.

Legs moderately slender; leg IV (Fig. 4) with entire femur 2.7, tibia 3.7, and tarsus 4.15 times as long as deep. Tibia IV with a conspicuous tactile seta just proximad of middle and tarsus IV with a larger tactile seta about 1/5 distance from proximal end.

Measurements (mm).—Figures given first for the holotype female, followed in parentheses by those for the topotype male. Body length 4.1(3.2). Carapace length 1.085(0.97). Chelicera length 0.40(0.385). Palpal femur 0.96(0.89) by 0.445(0.44); tibia 0.96(0.96) by 0.435(0.47); chela (without pedicel) 1.61(1.52) by 0.645(0.63); hand (without pedicel) 0.96(0.85) by 0.70(0.69); pedicel 0.12(0.11) long; movable finger 0.745(0.75) long. Leg IV: entire femur 0.94(0.93) by 0.35(0.31); tibia 0.74(0.72) by 0.20(0.18); tarsus 0.56(0.55) by 0.135(0.13).

Remarks.—The present species is placed in *Lustrochernes* Beier following the considerations mentioned by Muchmore (1976). *Lustrochernes* may be separated from *Americhernes* Muchmore by the placement of trichobothria on the fixed chelal finger; and it is distinguished from both *Cordylochernes* Beier and *Mesochernes* Beier in having less slender legs, e.g., tarsus IV being less than 5 times as long as wide (Beier 1932:82).

About a dozen species of *Lustrochernes* have been reported from Central America. The definitions of most of these are unsatisfactory by virtue of being very brief or based on only one or two specimens. As there is typically a considerable amount of variation in size and proportions and significant sexual dimorphism in some species of *Lustrochernes* (Hoff 1956; Mahnert 1979; personal observation), it is impossible at this time to determine whether any of the other species are the same as *L. consocius*. Sorting out the species in this genus and in the closely related *Cordylochernes* and *Mesochernes* must await extensive detailed reexamination and comparison of the many forms involved.

Genus *Chelodamus* R. V. Chamberlin

Chelodamus R. V. Chamberlin, 1925:236. Type species, *Chelodamus atopus* R. V. Chamberlin 1925:237.

Pseudozoaona Beier, 1932:182, 1933:542; Hoff 1947:539, 1949:471; Hoff and Bolsterli 1956:170. Type species, *Pseudozoaona communis* Beier 1932:182. **NEW SYNONYMY.**

Diagnosis (revised).—A genus of the family Chernetidae. Of moderately large size; generally heavily sclerotized, therefore, dark in color, with palps and carapace reddish to dark brown; surfaces distinctly granulate or scaly; dorsal setae clavodentate, ventral setae acuminate. Carapace with two transverse furrows; two weak eyespots; with up to 150 setae. Abdominal tergites and sternites divided (contrary to the statement of Chamberlin); pleural membranes strongly papillose; middle tergites and sternites with 16-22 setae, sometimes irregularly placed; 11th sternite may have two or four acuminate, tactile setae, 11th tergite may have two such setae. Cheliceral hand with five setae, *sb* terminally denticulate, the others acuminate; flagellum of four setae, denticulate on one margin (*not* three setae, as stated by Chamberlin); galea with 5-6 small rami, slightly less well developed in male. Palp long and slender, "approaching the chelifer type," as Chamberlin notes (1925:236), but less so in male than in female; tibia of male with distinct medial bulge proximad of middle; chelal fingers of male distinctly curved at middle (bowed); on movable chelal finger trichobothrium *st* closer to *t* than to *sb*; on fixed finger *ist* distad of *est*; venom apparatus well developed in movable finger, apparently absent in fixed finger; both fingers well provided with marginal and accessory teeth. Legs rather slender; tarsus

of leg IV without an acuminate tactile seta, but with a conspicuous long, denticulate seta distad of middle. Anterior genital operculum of male with 4-5 long setae surrounded by numerous smaller ones; anterior operculum of female with a group of 10-15 small setae at the center and an equal number scattered posterolaterally; internal genitalia of male of general chernetid type, without obvious distinguishing features; spermathecae of female are two long, thin tubules with ends expanded very little or not at all.

Contrary to the statement of Chamberlin, members of the genus *Chelodamus* have four setae in the cheliceral flagellum. *Chelodamus* is most similar to *Hesperochemes* Chamberlin (Muchmore 1974), from which it can be distinguished by the following characters: 1) male with palpal tibia having a distinct bulge proximad of the middle and chelal fingers distinctly bowed; 2) spermathecae of female not terminally expanded into an ovoid or spheroid bulb; 3) seta *b* on cheliceral hand acuminate rather than denticulate; 4) appendages, most noticeably the palps, long and slender, rather than short and stout. The last comparison fails in some cave-adapted species of *Hesperochemes*, such as *H. mirabilis* (Banks) and *H. occidentalis* (Hoff and Bolsterli), where the appendages are attenuated apparently as an accommodation to life in caves. *Chelodamus*, on the other hand, has the appendages elongated to adapt it to living between the leaves of bromeliads, as in *Macrochemes* Hoff and *Zaona* Chamberlin, for example.

Chelifer mirabilis Banks actually belongs in *Hesperochemes* (see Muchmore 1974) rather than in *Chelodamus* as suggested by Chamberlin.

Chelodamus atopus R. V. Chamberlin

Figs. 5-8

Chelodamus atopus R. V. Chamberlin, 1925:237, no Fig. Holotype male (WM 1739.01001) from Costa Rica, R. V. Chamberlin Coll. (no other collection data), accompanied by label "Boiled in KOH," in MCZ. One female labelled "*Chelanops atopus* Chamb., Paratype." from Costa Rica, R. V. Chamberlin Coll. (no other collection data), in MCZ. Both specimens have been cleared, dissected, mounted on microscope slides, and examined.

Description.—The original description of the holotype male by Chamberlin is generally accurate but not sufficiently detailed for present purposes. Therefore, a reiteration and clarification of important characters is given here together with some comments about the female. Body and appendages well sclerotized, shades of brown. Surfaces generally granulate or scaly; dorsal setae mostly clavodentate, ventral setae mostly acuminate. Carapace about as long as broad; both transverse furrows distinct; eyespots faint; setae on male difficult to see, perhaps because of the KOH treatment, but female with about 140. Abdomen ovoid; tergites granulate, sternites scaly, pleural membranes heavily papillose. Tergal chaetotaxy 15:13:13:19:20:20:22:21:20:16:8:2; middle tergites with one or two setae on disc in addition to marginal row. Sternal chaetotaxy about 23: (2)5/22(2):(1)15(1):17:16:18:19:18:16:8:2; anterior genital operculum of male with four large central setae surrounded by 19 smaller ones, posterior operculum with 20 small setae on each side at middle of anterior margin; female anterior genital operculum with a group of 15-20 setae at center and about a dozen scattered posterolaterally (Fig. 5). Internal genitalia of male without obvious distinguishing features; spermathecae of female consisting of two long, thin tubules apparently of uniform diameter throughout (Fig. 6).

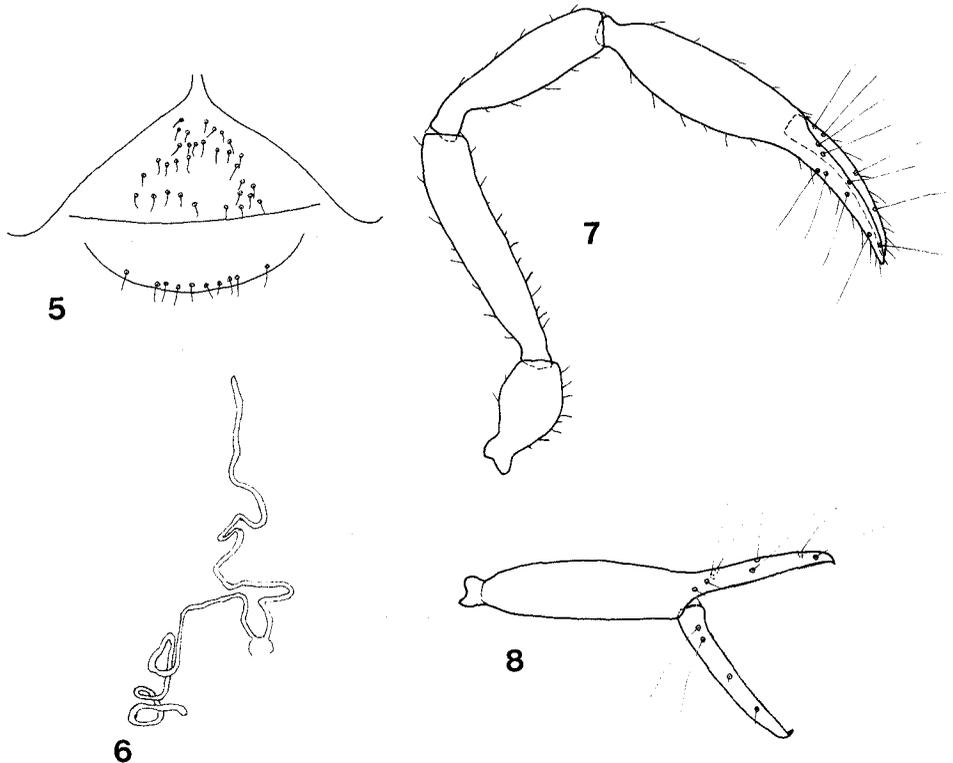
Chelicera 2/7 as long as carapace; hand with five setae, all appearing acuminate; flagellum of four setae (*not* three as reported by Chamberlin), all dentate; galea with five small rami.

Palp (as palps of holotype male have been distorted by the KOH treatment, this description is based mainly on those of the paratype female): long and slender (Fig. 7); femur 5.15, tibia 4.0, and chela 5.25 times as long as wide; hand 3.2 times as long as deep; movable finger 0.85 as long as hand. In spite of the distortion it is clear that tibia of male has distinct bulge proximad of middle on medial side and that movable finger of chela is distinctly curved near middle. Trichobothria on chela as shown in Fig. 8; *ist* distad of *est*, and *st* closer to *t* than to *sb*. Venom apparatus well developed only in movable finger, nodus ramosus closer to trichobothrium *t* than to *st*. Movable finger with about 70 and fixed finger with about 65 contiguous teeth; each finger with 8-12 external and 5-10 internal accessory teeth.

Legs slender; leg IV with entire femur about 4.5, tibia 6.0, and tarsus 5.5 times as long as deep. Tarsus IV without an acuminate tactile seta.

Measurements (mm).—Male and female are quite similar in size; because of the distortion of the holotype male by the KOH treatment, figures are given only for the female paratype. Body length 4.45. Carapace length 1.61. Chelicera length 0.435. Palpal femur 2.11 by 0.41; tibia 1.69 by 0.435; chela (without pedicel) 2.85 by 0.545; hand (without pedicel) 1.59 by 0.495; pedicel 0.20 long; movable finger 1.33 long. Leg IV: entire femur 1.66 by 0.38; tibia 1.10 by 0.18; tarsus 0.725 by 0.125.

Distribution.—Known only from Costa Rica.



Figs. 5-8.—*Chelodamus atopus* R. V. Chamberlin, paratype female: 5, genital opercula; 6, spermathecae; 7, dorsal view of left palp; 8, lateral view of right chela.

Chelodamus mexicolens R. V. Chamberlin
Figs. 9-11

Chelodamus mexicolens R. V. Chamberlin, 1925:238, no Fig. Holotype female (WM 1738.01001) (not a male as stated by Chamberlin) from Guadalajara, Jalisco, Mexico, in MCZ. The specimen has been cleared, dissected, mounted on a microscope slide, and examined.

Pseudozoana communis Beier, 1932:182, Fig. 191; 1933:543, Figs. 13, 14; Muchmore 1974:30. Types (δ and ♀) from Cameron, Veracruz, Mexico. NEW SYNONYMY.

Other material examined.—One ♀ from Tampico, Veracruz, Mexico, in USNM; 2 ♀ from El Fortin and Potrero, Veracruz, Mexico, in UCD; 1 ♀ from Chichen Itza, Yucatan, Mexico, in MCZ; 3 ♀ from Mt. Pine Ridge, Belize, in MCZ.

Diagnosis.—About same size as *C. atopus* but with less attenuated appendages, e.g., 1/w of palpal femur 4.1-4.3 rather than 5.15.

Description of female (male not available).—Body generally heavily sclerotized; shades of brown; surfaces heavily granulate or scaly; most dorsal setae clavodentate, most ventral setae acuminate. Carapace about as long as broad; both transverse furrows distinct; two small smooth eyespots; about 150 setae. Abdomen ovoid; tergal chaetotaxy of holotype 12:15:11:15:20:20:17:19:17:16:10:2; sternal chaetotaxy 30:(3)11(3):(1)10(1):20:21:22:21:17:14:8:2; others more or less similar. Anterior genital operculum of female with 10-12 setae in group at center and an equal number scattered posterolaterally. Spermathecae are two long, thin tubules with slightly expanded ends (Fig. 9).

Chelicera about 0.3 as long as carapace; hand with five setae, *sb* finely denticulate near tip; flagellum of four setae, all dentate; galea of holotype broken, but in others with 4-6 small rami.

Palp long and slender (Fig. 10) (see Beier 1932:Fig. 191 for male); femur 4.1-4.3, tibia 3.25-3.4, and chela 4.5-4.85 times as long as wide; hand 2.75-3.05 times as long as deep; movable finger 0.9-0.95 as long as hand (Beier, 1932:183, reported ratios for the male of *P. communis* as follows: femur 3.5, tibia 3.0, and chela 4.1). As shown by Beier (1932:Fig. 191), palp of male has tibia with distinct bulge proximad of middle on medial side, and movable finger of chela with distinct curve at middle. Trichobothria on chela as shown in Fig. 11. Movable finger with about 70 and fixed finger with about 65 marginal teeth; each finger with 10-15 internal and external accessory teeth.

Legs slender; leg IV with entire femur 4.1-4.55, tibia 5.5-6.1, and tarsus 5.2 times as long as deep. Tarsus IV without an acuminate tactile seta, but with a conspicuous long, denticulate seta about 2/3 distance from proximal end.

Measurements (mm).—Figures given first for holotype female, followed in parentheses by ranges for the seven available females. Body length 4.8 (3.75-5.1). Carapace 1.54(1.46-1.65). Chelicera length 0.44(0.43-0.465). Palpal femur 1.88(1.68-1.99) by 0.44(0.40-0.465); tibia 1.625(1.46-1.71) by 0.495(0.445-0.54); chela (without pedicel) 2.75(2.55-3.00) by ?(0.54-0.625); hand (without pedicel) 1.47(1.37-1.62) by 0.51(0.47-0.55); pedicel 0.18(0.16-0.19) long; movable finger 1.38(1.31-1.445) long. Leg IV: entire femur 1.53 (1.39-1.58) by 0.335(0.30-0.36); tibia 1.040(0.96-1.10) by 0.17(0.17-0.185); tarsus 0.65(0.63-0.70) by 0.12(0.12-0.13). According to the figures given by Beier (1932:183), the male may be considerably smaller than the female.

Distribution.—Southern Mexico from Jalisco to Yucatan and Belize.

Though not described by R. V. Chamberlin, the following species can also be included in the genus *Chelodamus*.

Chelodamus uniformis (Banks), new combination
Figs. 12-13

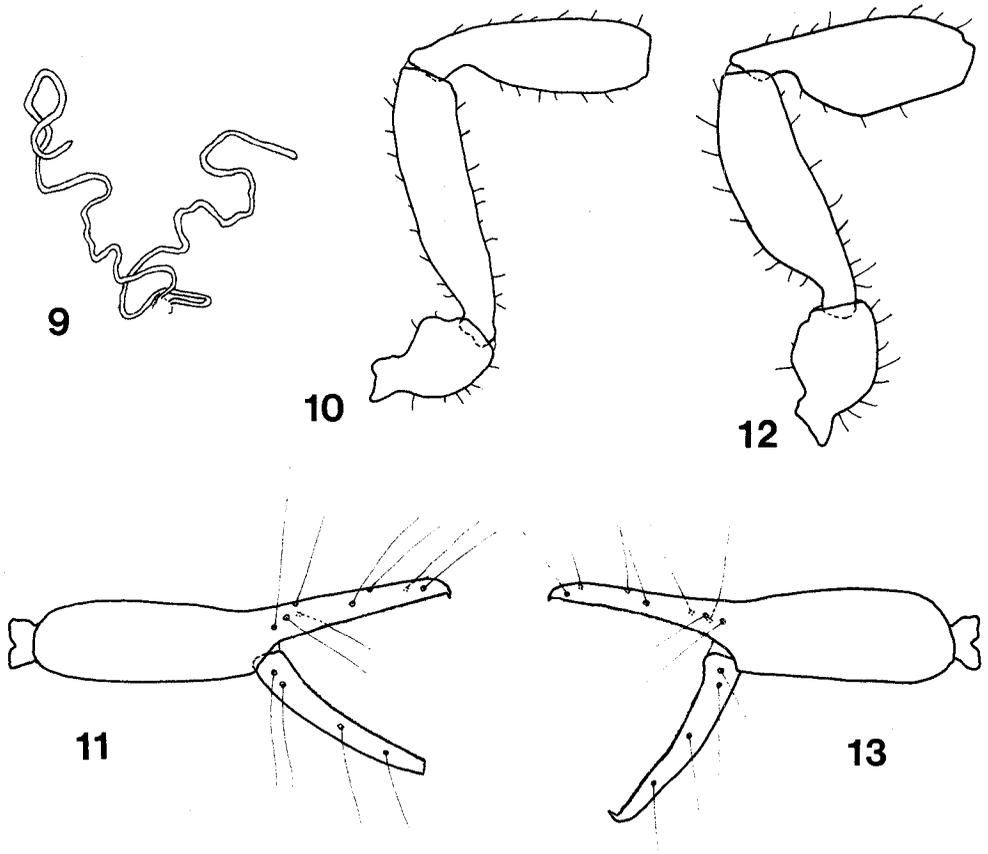
Chelanops uniformis Banks, 1914:683, Figs. 16, 18. Syntypes from La Emilia, Juan Viñas, and Reventazon Valley below Juan Viñas, Costa Rica, in ANSP, MCZ, and USNM: 4 ♂, 4 ♀, 1 tritonymph examined.

Pseudozaona uniformis (Banks); Hoff 1947:540, Figs. 34, 35. One of Banks's syntypes, a female from La Emilia, Costa Rica, designated as lectotype, in MCZ; examined.

Other material examined.—Four ♀ from bromeliad, Coto, Costa Rica, 4 August 1957, E. Dixon, in FSCA.

Diagnosis.—Generally similar to *C. mexicolens* but much smaller (palpal femur less than 1.4 mm in length and chela less than 2.0 mm).

Description.—The description by Hoff based on one female and two males is generally accurate. Some additional observations and measurements will be given here. Male about same size as female but with stouter palps. Carapace with about 100 setae. Tergal



Figs. 9-11.—*Chelodamus mexicolens* R. V. Chamberlin, holotype female: 9, spermathecae; 10, dorsal view of left palpal trochanter, femur and tibia; 11, lateral view of right chela (tip of movable finger broken).

Figs. 12-13.—*Chelodamus uniformis* (Banks), paratype male, 12, dorsal view of left palpal trochanter, femur and tibia; 13, lateral view of left chela.

chaetotaxy of lectotype 9:11:9:16:16:19:16:17:17:18:10:2; sternal chaetotaxy 20:(3)12(3):(1)10(1):16:22:17:18:18:13:9:2; anterior sternal chaetotaxy of male about 22:(3)4/15(3):(1)10(1):---. Anterior genital operculum of female with group of about 10 setae at center and an equal number scattered posterolaterally; spermathecae are long, thin tubules with ends little or not at all expanded. Internal genitalia of male without obvious distinguishing features.

Chelicera about 0.3 as long as carapace; hand with five setae, *sb* terminally denticulate, others acuminate; flagellum of four setae, all denticulate; galea with 5-6 rami.

Palp generally as figured by Banks (1914: Fig. 18) for the male and by Hoff (1947: Fig. 34) for the female. For females, femur 3.5-4.0, tibia 2.8-3.2, and chela 4.0-4.4 times as long as wide; hand 2.35-2.55 times as long as deep; movable finger about 0.95 as long as hand; corresponding ratios for males, femur 3.2-3.5, tibia 2.5-2.65, chela 3.8-4.15, hand 2.1-2.35, and movable finger 0.95. Tibia of male with distinct bulge on medial side proximad of middle (Fig. 12); chelal fingers of male distinctly curved at middle (Fig. 13). Trichobothria as shown in Fig. 13. Movable finger with 60-65 and fixed finger with 55-60 marginal teeth; each finger with 5-10 internal and external accessory teeth.

Leg IV with entire femur 3.6-4.6 and tibia 4.5-5.5 times as long as deep, females more slender than males. Tarsus IV without an acuminate tactile seta but with a prominent, terminally denticulate seta distad of middle.

Measurements.—Ranges for 12 mounted specimens, including lectotype. Body length 2.65-4.05. Carapace length 1.00-1.26. Chelicera 0.31-0.38 long. Palpal femur 1.04-1.39 by 0.305-0.395; tibia 0.93-1.24 by 0.35-0.48; chela (without pedicel) 1.58-2.11 by 0.39-0.51; hand (without pedicel) 0.84-1.14 by 0.38-0.49; pedicel 0.10-0.14 long; movable finger 0.89-1.05 long. Leg IV: entire femur 0.86-1.15 by 0.235-0.28; tibia 0.55-0.79 by 0.125-0.155; tarsus 0.42-0.59 by 0.09-0.11. Males are generally smaller than females.

Distribution.—Known only from Costa Rica.

Remarks.—Also at hand are two males and one female taken from bromeliads at Chamela, Jalisco, Mexico, 31 August 1974, J. R. Napoles. These specimens are intermediate in size and proportions between those known to represent *C. mexicolens* and *C. uniformis*. It is not clear at this time whether they actually represent a separate species or just provide evidence for the synonymy of the two species mentioned.

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Depositories referred to in the text are abbreviated thus: AMNH—American Museum of Natural History, New York, ANSP—Academy of Natural Sciences of Philadelphia, FSCA—Florida State Collection of Arthropods, Gainesville, MCZ—Museum of Comparative Zoology, Harvard University, Cambridge, NMNH—National Museum of Natural History, Washington, UCD—University of California, Davis.

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