

A NEW TROGLOBITIC *PARAPHRYNUS* FROM OAXACA, MEXICO (AMBLYPYGI, PHRYNIDAE)

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ABSTRACT

Paraphrynus grubbsi n. sp. is described from both an adult male and female from caves in the Huautla de Jiménez region of Oaxaca, Mexico. The new species is the sixth troglobitic member of the genus. A taxonomic key to troglobitic *Paraphrynus* is provided.

INTRODUCTION

Mullinex (1975) revised the genus *Paraphrynus* Moreno. She accepted 15 species from Central and North America and the northern West Indies. García Acosta (1977) and Reddell (1981) provided some new records from Mexico, but no new species were described. Quintero (1983) revised the species of the genus from Cuba but only recognized four Cuban species. Quintero synonymised *P. astes* Mullinex from Cuba with an older name that was not recognized by Mullinex. He deemed another species [*P. intermedius* (Franganillo, 1926)] that was accepted by Mullinex to be a dubious species. Since then, a new *Paraphrynus* species was described from Mexico by Mullinex (1979) and Quintero (1979) placed the Guatemalan *P. leptus* Mullinex as a synonym of *P. emaciatus* Mullinex.

Almost half of the approximately 100 species of amblypygids are known from caves (Weygoldt, 1994; Armas and Pérez, 1994; Harvey and West, 1998). Of these, the vast majority are troglaphiles. Troglobites are known from the Phrynidae (*Phrynus noeli* Armas and Pérez, 1994 from Cuba and five *Paraphrynus* spp. from Mexico) and the Charinidae (*Charinus* sp. = *diblemma* Simon, 1936 [*nomen dubium* according to Weygoldt, 1994] from Zanzibar, Tanzania, and two species of *Charinus* (*Speleophrynus*) from caves in Venezuela). The present contribution describes the sixth troglobitic species of *Paraphrynus*.

METHODS

The specimens examined are deposited in the American Museum of Natural History, New York (AMNH) and the Texas Memorial Museum, Austin (TMMC).

Morphological terminology and methods for making measurements essentially follow Mullinex (1975), except for the nomenclature of some of the pedipalp and leg segments. We follow Harvey and West (1998) in the naming of appendages. We also use cephalothorax

rather than carapace; the latter being reserved for members of the Crustacea. The pedipalp segments and their alternate names used by Mullinex (in parenthesis) are: coxa (gnathocoxa), trochanter, femur, patella (tibia), tibia (basitarsus), and tarsus. In some species, the tarsus is further divided into a post-tarsus. The leg segments are: coxa, trochanter, femur, patella, tibia (tibia + basitarsus), metatarsus (tarsus 1), and tarsus (tarsus 2-4). The first pair of legs are modified into antenniform appendages, with the tibiae and tarsi being greatly subdivided. Tibiae II-IV are subdivided into a basitibia and a distitibia. Basitibiae IV are further subdivided into three segments and numbered 1-3 from the proximal end. Quintero (1981) called these segments proximal tibia, pre-basitibia, and basitibia, respectively. The distitibia (basitarsus of Mullinex, 1975) is easily recognized because it has long series of trichobothria on its distal end (Fig. 3). The metatarsus (tarsus 1 of Mullinex, 1975) is not divided. Tarsi II-IV are subdivided into three segments and numbered 1-3 here (proximal to distal, respectively). Our tarsal segments 1-3 are equal to Mullinex's tarsal segments 2-4.

The male holotype and allotype female were measured. The other three females were not measured because Amblypygi molt after reaching maturity

(Weygoldt, pers. comm., 1998) and our N value was low. Because size varies with age we have tried to emphasize shapes and numbers of structures rather than size.

The genital sternites were removed from the abdomen and examined while they were immersed in lactophenol at room temperature.

We numbered all the spines on the pedipalp femur and patella of the male. Like Quintero (1981), we found that these numbers do not necessarily correspond with those on any other species. None the less, this system of numbering is useful for discussing variation in spination. Some of the major spines can be recognized in other species, but the homologies of others have not been demonstrated. See the illustrations (Figs. 1, 2) for spine numbers. Spines are numbered from dorsal (d) and ventral (v), femur (f) and patella (p), proximal to distal (1-x). Thus, df4 would be the fourth spine from the proximal end on the dorsal surface of the femur. We did not fully illustrate the pedipalp trochanter or tibia; preferring to simply record the spines as numbered by Mullinex (1975). Some details of these structures are present in Figs. 6, 7.

Trichobothrial designations (Fig. 3) of the distitibia follow Weygoldt (1970).

Key to Troglotic Species of *Paraphrynus*

1. All eyes entirely missing, pedipalp with large spine between vf2 and vf3 (Yucatán).....*P. reddelli* Mullinex, 1979
Eyes reduced, but at least lateral eyes present, pedipalp with proximal three spines (vf1-vf3) largest; anterior portion of cephalothorax bilobed in front (Fig. 4)..... 2
2. Median eyes absent, pedipalp tarsus subdivided into a post-tarsus; anterior portion of cephalothorax straight or evenly rounded in front (San Luis Potosí) *P. velmae* Mullinex, 1975
Median eyes reduced but present, pedipalp tarsus entire 3
3. Pedipalp tarsus with a small ventral tooth (Quintana Roo, Yucatán)..... *P. chacmool* (Rowland, 1973)
Pedipalp tarsus lacking such a tooth 4
4. Pedipalp vf1 spine straight distally, vp16 pointed 5
Pedipalp vf1 spine curved dorsodistally, vp16 rounded (Fig 1) (Oaxaca)..... *P. grubbsi* new species
5. Legs relatively long, femur I more than four times as long as cephalothorax (Tamaulipas)..... *P. baeps* Mullinex, 1975
Legs relatively short, femur I less than twice as long as cephalothorax [this character may be incorrect; Rowland stated that the only known specimen had femur I slightly less than 3.5 times longer than carapace, but he gives the measurements as: carapace 8.7, femur I 13.6] (Tabasco)..... *P. chiztun* (Rowland, 1973)

Paraphrynus Moreno

Hemiphrynus Pocock, 1902 (preoccupied).

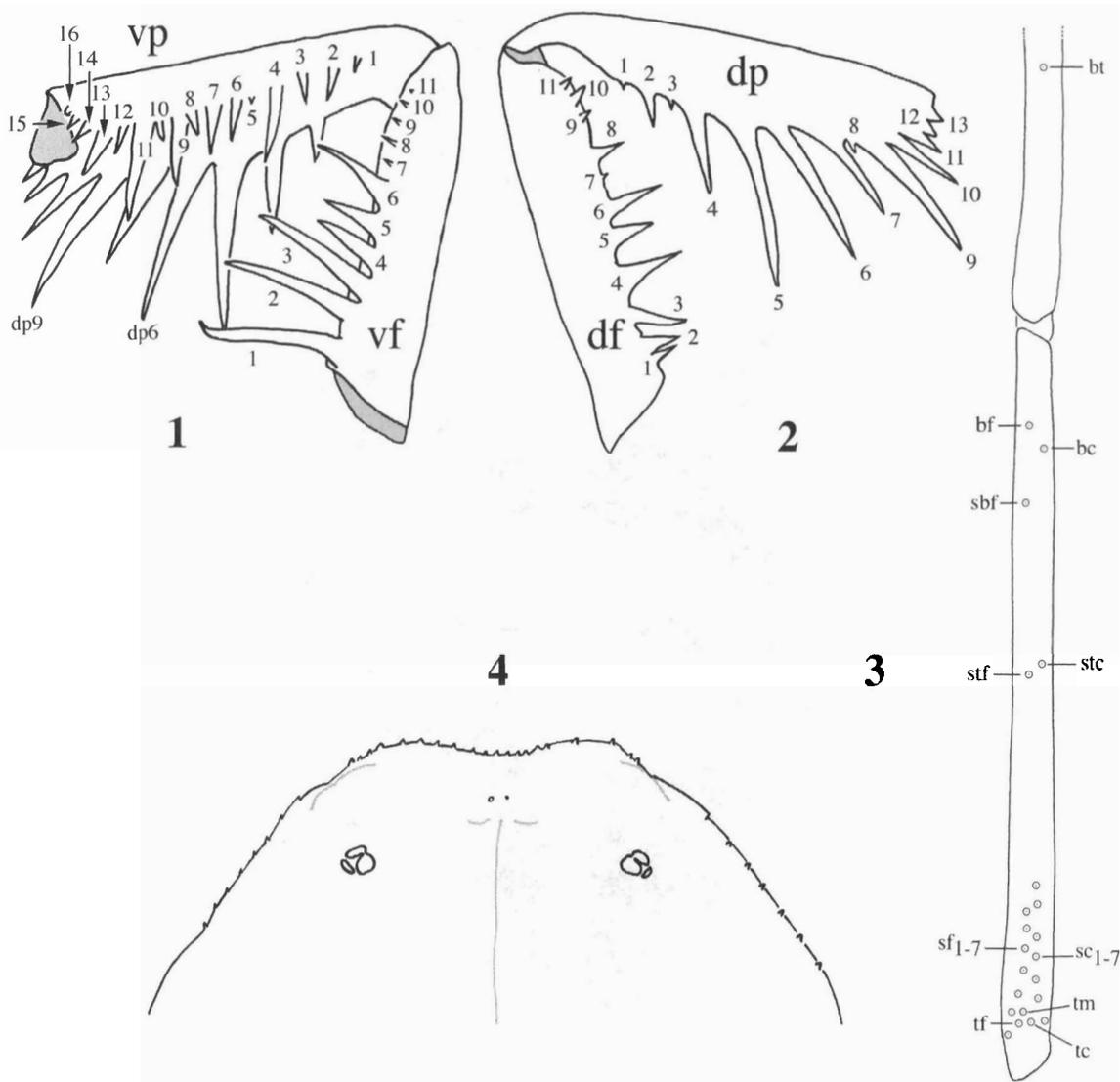
Paraphrynus Moreno, 1940:167-168, Mullinex, 1975:1-80 (replacement name).

Diagnosis.—Dorsal margin of the pedipalp patella with two spines (Fig. 2- dp6, dp7) between the two longest spines (Figs. 2, 6- dp5, dp9). Without subcylindrical sclerotized apophysis on the ventral surface of the pedipalp trochanter [present in *Heterophrynus* Pocock (Quintero, 1981: fig. 11)]. Tibia of pedipalp armed with at least more than one long spine dorsally (Quintero, 1981: fig. 3). Anterior margin of cephalothorax with small pointed tubercles (Fig. 4).

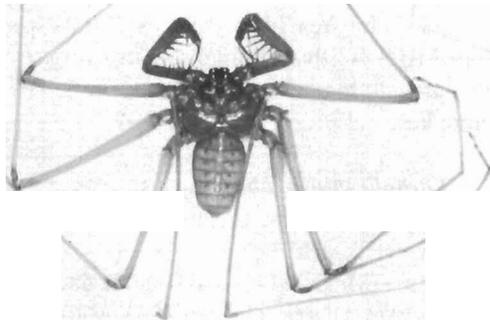
Identification.—The eyed species of *Paraphrynus* can be identified by using the taxonomic keys by Mullinex (1975) for North American species and Quintero (1983) for West Indian species. The six species of troglobitic (with reduced or missing eyes) *Paraphrynus* (all from Mexico) can be identified by the taxonomic key.

Paraphrynus grubbsi, new species
(Figs. 1-10)

Type Data.—México: Oaxaca: Huautla de Jiménez, Nita Lajao (-50 m, DL26), 11 April 1983, Mark Minton (male holotype, AMNH); Sótano de San Agustín, San Agustín, 5 km SE Huautla de Jiménez, April 1987, A.



Figs. 1 - 4.—*Paraphrynus grubbsi* new species. 1, ventral view of male pedipalp femur (vf) and patella (vp) showing position and numbering of spines. 2, dorsal view of male pedipalp femur (df) and patella (dp) showing position and numbering of spines. 3, left distal portion of the basitibia and distitibia IV of male showing positions and numbering of trichobothria. 4, dorsal view of the anterior portion of the male cephalothorax.



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Fig. 5.—*Paraphrynus grubbsi* new species. 5, dorsal view of male.

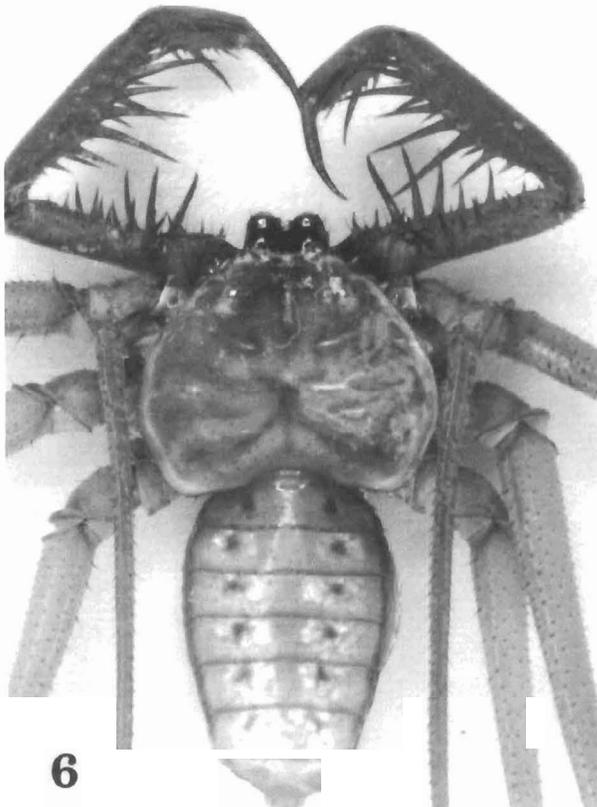
G. Grubbs, J. Smith, E. Holiday (female paratype, TMMC Arth. Cat. # 8643); Cueva del Escorpión, San Miguel Dolina, San Miguel, 5 km SE Huautla de Jiménez, January 1978, Roy Jameson, Patty Mothes (female paratype, TMMC Arth. Cat. # 8642); Cueva

cerca de la Puente sobre el Río Huautla, 28 Dec. 1977, Roy Jameson (female paratype, TMMC Arth. Cat. # 8641; female allotype, AMNH).

Distribution.—Known only from higher elevation caves in the Huautla de Jiménez region of Oaxaca, Mexico.

Etymology.—The specific epithet is a patronym for Andy G. Grubbs of San Marcos, Texas, for helping to collect part of the specimens upon which this paper is based.

Diagnosis.—Medium-sized species (male body length 14.7 mm); color in alcohol orange-brown to light yellow-brown. Pedipalp tibia spine I longer than III. First three spines on ventral surface of pedipalp femur more or less diminishing evenly in length; spine vf1 curved dorsodistally on tip. Proximal end of dorso-inner lateral surface of pedipalp tarsus (next to cleaning organ) without small spine (spine shown by Mullinex, 1975: fig. 8h). Pedipalp tarsus and post-tarsus fused (shown separated in Mullinex, 1975: fig. 12g). Darkly pigmented median ocular tubercle absent, but two minute colorless eyes present (Fig. 4).



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Figs. 6-7.—*Paraphrynus grubbsi* new species. 6, dorsal view of male body and pedipalps. 7, ventral view of male body and pedipalps, genitalia extended.

Description.—Male: Cephalothorax (Fig. 4) brownish anteriorly, intergrading to yellow-brown posteriorly; anterior edge moderately bilobed. Darkly pigmented median ocular tubercle absent, ocular area concolorous with rest of cephalothorax. Two minute median eyes, unpigmented. Lateral eyes reduced in size, unpigmented, small area under eyes with silvery tapetum. Measurements: length 5.5 mm, width 7.7 mm, sulcus from anterior edge 3.4 mm. Lateral eyes small and unpigmented: from each other about 2.5 mm, from lateral edge 0.4 mm, from anterior edge 0.9 mm; anterior edge of two most anterior lateral eyes joined.

Chelicerae basal segment with two teeth on outer edge of anteroventral surface, the distal one slightly smaller and somewhat blunt.

Pedipalps light orange-brown; dorsal, ventral, and lateral surfaces with small setiferous tubercles and fine granules. Ventrally, coxa with a narrow area of white ventrad to the longitudinal row of setae located on white mesal surface. Femur and patella spination as in Figs. 1, 2, 6, 7; all spines pointed except vp16 rounded with a terminal seta; all larger ventral spines with thin, inconspicuous setae on and along sides; length of some setae on vf1 and fv2 greater than width of spine; vf1 curved dorsodistally at tip. Tibia with dorsal spines I longer than III; dorsally with two spines between II and III, and two small spines distal to III; ventrally I and III well developed with I slightly longer; with two spines between II and III with the spine directly proximal to III slightly more than half the length of III. Tarsus without small spine on proximal end of dorso-inner lateral surface; tarsus not divided into a post-tarsus. Measurements: Femur: length 5.0 mm, width 1.0 mm. Patella: length 6.2 mm, width 1.4 mm, length of longest dorsal spine (dp5) 2.6 mm. Tibia: length 3.1 mm, width 0.9 mm. Metatarsus: length 3.0 mm.

Legs: Relatively long (Fig. 5), femur I four times as long as cephalothorax. Yellow-brown and lighter than pedipalps, except for femur of antenniform legs which is orange-brown and about the same color as the pedipalps. Second tarsomere of all tarsi with light transverse line on distal end. Measurements: Antenniform leg: femur 22.1 mm. Leg II: femur 14.5 mm, basitibia 13.9 mm, distitibia 7.2 mm, metatarsus 1.6 mm, first tarsal segment 0.5 mm, third tarsal segment 1.3 mm. Leg III: femur 15.9 mm, basitibia 16.6 mm, distitibia 8.3 mm, metatarsus 1.8 mm, first tarsal segment 0.7 mm, third tarsal segment 1.3 mm. Leg IV: femur 14.1 mm, basitibia 16.1 mm (first 9.6 mm, second segment 1.6 mm, third segment 4.9 mm), distitibia 7.9 mm, metatarsus 1.8 mm, first tarsal segment 0.7 mm, third tarsal segment 1.4 mm. Trichobothrial pattern of basitibia 3 and distitibia IV as in Fig. 3.

Abdominal dorsal surface uniform pale yellow-brown, about same color as legs, 9.2 mm long. Genital operculum: length 0.4 mm, width 0.8 mm. Genitalia as in Figs. 7-9.

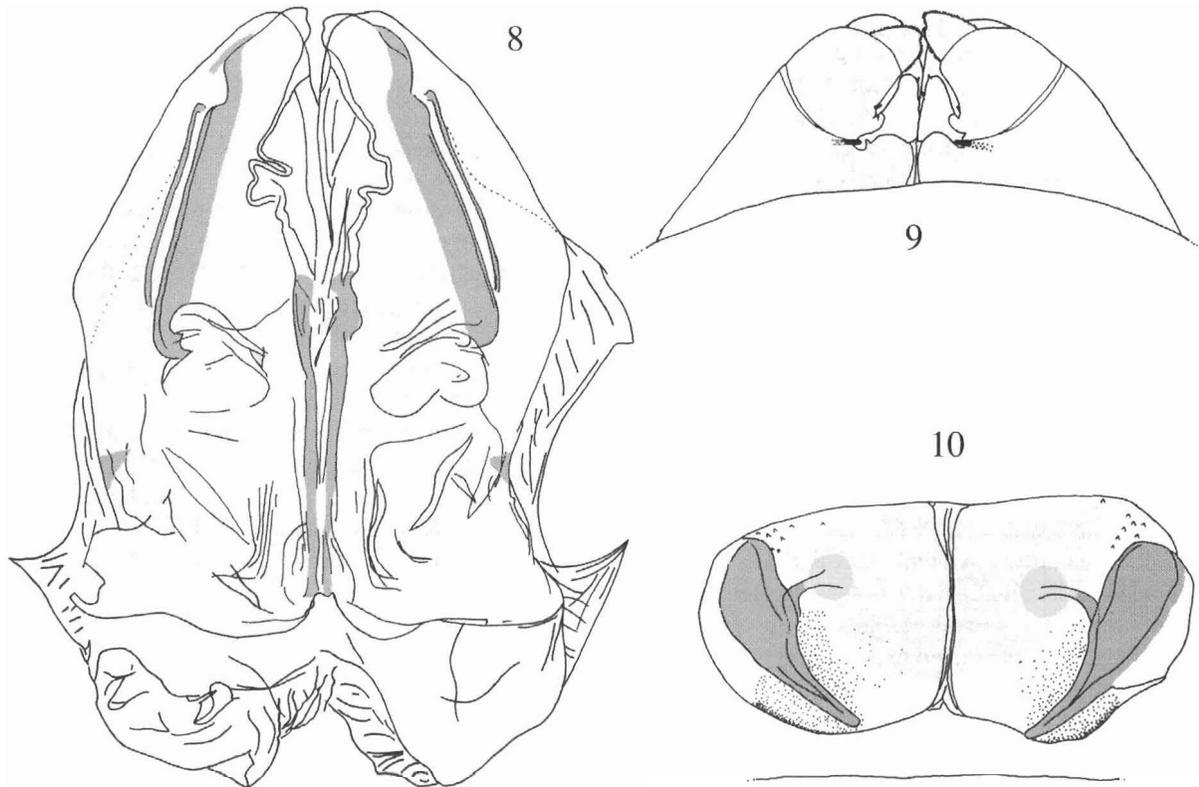
Female (Allotype): Similar to male except as follows: Cephalothorax. Measurements: Length 6.2 mm, width 8.7 mm, sulcus from anterior edge 4.0 mm. Lateral eyes: from each other about 3.1 mm, from lateral edge 0.6 mm, from anterior edge 1.0 mm; most lateral pair of lateral eyes touching, tapetum very small and only found under largest lateral eye pair.

Pedipalps: Measurements: Femur: length 6.3 mm, width 1.2 mm. Patella: length 7.3 mm, width 1.7 mm, length of longest dorsal spine (dp5) 3.3 mm. Tibia: length 3.8 mm, width 1.2 mm. Tarsus: length 3.9 mm.

Legs: Measurements: Antenniform leg: femur 24.1 mm. Leg II: femur 16.3 mm, basitibia 16.0 mm, distitibia 8.6 mm, metatarsus 1.8 mm, first tarsal segment 0.7 mm, third tarsal segment 1.5 mm. Leg III: femur 17.7 mm, basitibia 18.7 mm, distitibia 9.5 mm, metatarsus 2.1 mm, first tarsal segment 0.7 mm, third tarsal segment 1.5 mm. Leg IV: femur 15.7 mm, basitibia 18.5 mm (first segment 10.8 mm, second segment 2.0 mm, third segment 5.7 mm), distitibia 9.1 mm, metatarsus 2.1 mm, first tarsal segment 0.8 mm, third tarsal segment 1.5 mm.

Abdominal length 9.4 mm. Genital operculum length 0.5 mm, width 1.0 mm. Internal genitalia as in Fig. 10; posterior region beneath seminal receptacles (distal end of "beak") with many micropores.

Variation.—Significant variation was noted in the material examined. The median eyes of the holotype are of unequal sizes (left one twice as large as right), obviously an anomaly. The eye sizes, interdistances and size of tapetum vary between individuals. The tapetum is apparent under all the eyes in the male and ranges in size down to complete absence in a female. One female had all the lateral eyes separate, whereas each of the others has at least a tiny portion of two eyes (pairs vary) touching or joined. Because the eyes are not pigmented and the lenses are small this observed variation might be due in part to the difficulty in viewing these structures. There is also variation in the spination patterns of the pedipalps. Figs. 1, 2, 6, 7 show the number of spines as found on the single male. Variations found in the females were mostly bifurcations of spines and missing smaller spines. The variations found were: (female from Sótano de San Agustín) vf4+vf5 combined to form single bifurcate spine on one pedipalp; tiny spine added between dp5, dp6 and dp9, dp10 on one pedipalp; df9, df11, dp8 missing. (Cueva del Escorpión) dp12 on both pedipalps with small tooth on spine; vf1 on one pedipalp replaced with tiny spine; single tiny spine in front of dp1 on one pedipalp; vp5 missing. (Cueva cerca



Figs. 8-10.—*Paraphrynus grubbsi* new species. 8, ventral view of male genitalia extending beyond edge of sternite. 9, dorsal view of male genitalia. 10, dorsal view of female (from Cueva del Escorpión) genitalia.

de la Puente sobre el Río Huautla) df11 + df12 combined into bifurcate spine on one pedipalp, df10 + df11 combined into bifurcate spine on other pedipalp of smaller female; dp5 missing on both females. The position and number of distitibia trichobothria vary little except for the sf and sc series. The single male had (sf-sc) 8-8 whereas the females had 8-9 to 8-11 trichobothria. Several of the trichobothria forming the 8-11 were petite (on two different females); their bases being half the sizes of the normal bases. The interdistances between individual sf and individual sc trichobothria varied with no apparent pattern.

Comments.—There is a single subadult female *Paraphrynus* from near the type locality of *P. grubbsi* (Centipede Cave, Río Iglesia Dolina, Huautla de Jiménez, Oaxaca, 26 March 1981, A. Grubbs, S. Zeman, TMMC). This specimen is much smaller than *P. grubbsi* and the eyes are well developed and placed on pigmented tubercles. Reddell (pers. comm. 1999) informed us that he had identified another *Paraphrynus* from caves in Oaxaca. These specimens were similar to *P. chiztun* (Rowland) and were collected from low elevation caves in the Acatlán Region. *Paraphrynus grubbsi* and the unidentified juvenile are from the

Huautla de Jiménez region; which is located in higher elevation mountains.

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