

A NEW SPECIES OF *ANOURA*
(CHIROPTERA: PHYLLOSTOMATIDAE) FROM COSTA RICA

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ABSTRACT: A new species of glossophagine bat, closely related to *Anoura cultrata* Handley, is described. This species, here-in named *Anoura werckleae*, was found associated with the malvaceous tree, *Wercklea lutea*, and is so far known only from Lower Montane Rain Forest in the Cordillera de Talamanca of Costa Rica.

In 1961, Richard S. Casebeer and Ronald B. Linsky netted, at approximately 2500 m on the Pacific slope of the Cerro de la Muerte massif, in the Cordillera de Talamanca of Costa Rica, an orange-brown adult male glossophagine bat with yellow pollen in its fur. The only obvious sources of the pollen were the large yellow flowers of *Wercklea lutea* Rolfe (Malvaceae) growing along a nearby stream. In 1963, when the Los Angeles County Museum of Natural History mammalian ectoparasite project (LACM-USACR; see Starrett and Casebeer, 1968) field party was collecting in that area, the same stream locality was visited in the hopes of obtaining more specimens of this bat which had proven to represent an undescribed species of *Anoura*. We succeeded in capturing an adult female, also with yellow pollen in the fur on the head and shoulders, in a mist net set beneath flowering branches of a *Wercklea*, and thus apparently confirmed the supposition that this new bat visited flowers of this tree. Later microscopic comparison of pollen grains taken from the fur of the second specimen with some which I collected from the *Wercklea* flowers at the same time established this as fact.

Because of its association with the flowering tree, *Wercklea lutea*, this species is named

***Anoura werckleae*, new species**

Holotype: LACM 15186, adult male, alcoholic with skull removed, collected July 12, 1961, by Richard S. Casebeer and Ronald B. Linsky, 6.8 mi. S restaurant "La Georgina" along Interamerican Highway, 2500 m, Cerro de la Muerte massif, Province of San José, Costa Rica, original number 1246 AS (A. Starrett).

Paratype: LACM 25438, adult female, alcoholic with skull removed, collected July 16, 1963, by Andrew Starrett and Richard S. Casebeer (LACM-USACR field party), type locality, original number USACR 0-2118.

Distribution: This species is known only from the type locality.

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Diagnosis: A robust member of the genus *Anoura*, closely related to *A. cultrata* Handley (1960), with dense orange-brown pelage and with the distal end of metacarpal III approximately even with the distal end of the first phalanx of digit V when wing is folded. Braincase and rostrum broad, zygomata well ossified. Postdental palate expansive, with incision in posterior margin V-shaped. Basisphenoid pits expanded anterolaterally beneath alisphenoids, partially covered by a raised shelf from the latter. P^2 with occlusal edge flattened and without obvious point, enlarged P_2 similar in profile to P_3 , the highest point not obviously posterior to the center of the tooth.

Description: Pelage dense, velvety, longest individual hairs 8.0 mm long on dorsum and chest, about 4.0 mm on abdomen. Coloration generally rich orange-brown throughout, somewhat paler ventrally; individual hairs of dorsum essentially tricolored with basal two-thirds whitish-yellow gradually darkening distally to more orange (brownish-orange), a subterminal orange-brown band (1 mm), and white or silvery tips (± 1 mm). Fur on head similar but shorter, lacking light tips. Individual hairs on chest similar to those of back but with subterminal band less distinct, especially near the midventral line; hairs of neck, chin and interramal area similar to those of chest but shorter. Hairs of abdomen browner than those of dorsum, each with longer terminal band which is light tan instead of white. Forearm heavily furred on proximal one-third with hairs 2-3 mm long, propatagium furred to about same level, endopatagium with hairs extending out to a line reaching from elbow to knee. Base of thumb heavily furred, bases of metacarpals sparsely so. Tibia and most of uropatagium rather heavily furred dorsally (hairs 2-3 mm long) with uniform light orange-brown hairs, more sparsely furred ventrally and distally on legs. Wing membranes dark brown or blackish; uropatagium, ears and noseleaf light brown, contrasting with color of wing membranes. (The foregoing color descriptions were written originally after the paratype had been in preservative only a short while. Comparison of the paratype with the holotype and with color photographs taken of the latter in the field indicated that little if any color change had occurred at the time the description was recorded.)

Head and body short, about 65 mm (in alcohol), ears and hind feet moderately small, wing elements of roughly the same size as those of *A. cultrata*, but larger in relation to head and body length and differing somewhat in proportions. Third metacarpal about equal in length to forearm and to metacarpal plus first phalanx of digit V when wing is folded. Thumb approximately 11 mm in length. Cranium with braincase long and expanded, rostrum relatively broad, short and flat with a rather abrupt rise to top of braincase. Zygomatic arches well-developed, complete, with jugal strong and well-ossified. Palate relatively short and broad, the postdental portion expansive with V-shaped incisions in the posterior margins. Basisphenoid pits well formed and expanded anterolaterally beneath alisphenoids, covered along anterior and lateral margins and separated from alisphenoid depressions by a distinct raised shelf or septum. Upper molar teeth appearing narrow relative to palate width,

generally quadrangular in occlusal view and arranged in parallel or somewhat arched rows. P^2 short, with occlusal surface flattened rather than pointed; P_2 nearly symmetrical and similar to P_3 in profile.

Measurements (Holotype and paratype, respectively, in mm):

External: forearm, 40.7, 43.2; tail, 3, 3; hind foot, 12.2, 11.9; ear from notch, 14, 14; tibia, 15.7, 16.8; thumb, 11.2, 11.3; metacarpal III, 40.6, 43.1; metacarpal V, 32.7, 34.0.

Cranial: greatest length of skull, 25.8, 26.2; condylobasal length, 25.1, 25.4; length of maxillary toothrow ($C-M^3$), 9.0, 9.2; palatal length, 12.5, 12.8; zygomatic breadth, 10.8, 10.6; greatest rostral breadth, 5.3, 5.3; postorbital constriction, 5.4, 5.3; breadth of braincase, 10.2, 10.1; alveolar breadth across upper canines, 5.2, 5.0; breadth across M^3-M^3 , 6.1, 6.1; length of mandibular toothrow ($C-M_3$), 9.4, 9.7.

Comparisons: *Anoura werckleae* is most similar to *Anoura cultrata* Handley and the two species are distinguished from other members of the genus in essentially the same ways (Handley, 1960). *A. werckleae* can be distinguished from *A. cultrata* by the following characteristics (those of *A. cultrata* in parentheses): orange-brown pelage (shiny blackish), distal end of metacarpal III approximately equal with distal end of first phalanx of digit V when wing is folded (metacarpal III not reaching end of phalanx), postdental palate expansive, incision in posterior margin V-shaped (postdental palate less expansive, incision U-shaped) (Fig. 1), basisphenoid pits expanded anterolaterally beneath alisphenoids and partially covered by a raised shelf (basisphenoid pits depressions with only slight anterior expansions and without raised shelf) (Fig. 1), P^2 rather nondescript, without point (P^2 more like P^3 , with obvious point), and P_2 nearly symmetrical and similar in profile to P_3 (highest point of P_2 obviously posterior to center of tooth). *Anoura werckleae* differs from *A. cultrata* further in having: shorter thumb, absolutely and relative to forearm length; relatively lower, broader braincase and shorter, broader rostrum when compared sex for sex (Fig. 2); stronger zygomatic arches; broader postorbital constriction; greatest rostral breadth equal to or less than postorbital constriction; upper molars quadrangular in occlusal view with lingual faces flattened rather than uneven and rounded. This last character is especially obvious in the M^3 s, which are essentially triangular in *A. cultrata*.

The one specimen of *A. cultrata* known from Costa Rica (Carter, *et al.*, 1966) approaches *A. werckleae* in some measurements and dental features, but in diagnostic characters, as well as in most of the others listed above, it is purely *A. cultrata* and, in my opinion, does not represent a morphological intermediate between the two species.

A new species of *Anoura* from South America, also belonging to the *A. cultrata* group, currently being described by Dillford C. Carter (1968), is readily distinguishable from *A. werckleae* on the basis of fur color (similar to that of *A. cultrata*) and size (smaller in external and cranial measurements). In addition, Carter's new species appears to have a relatively shorter rostrum

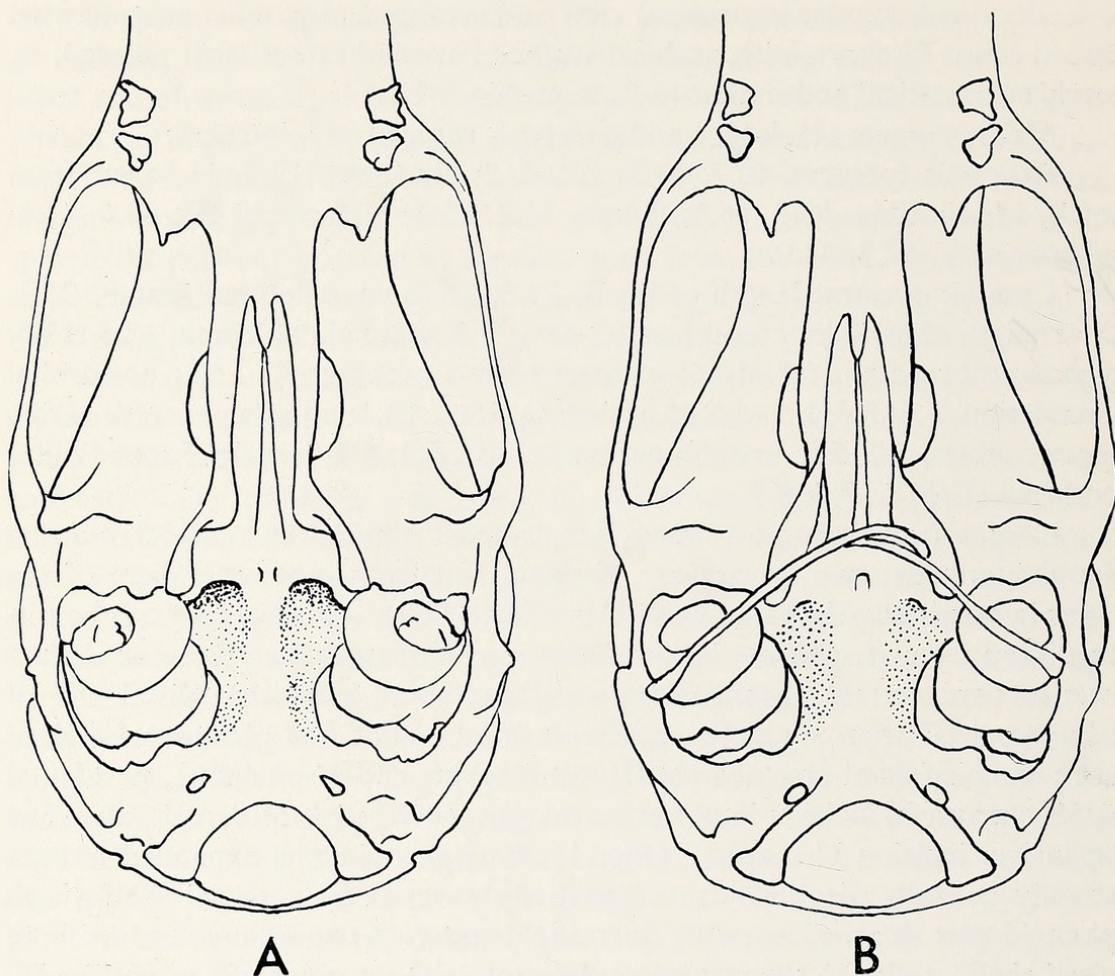


Figure 1. Posterior palate and basisphenoid region of cranium of A. *Anoura werckleae*, sp. n., LACM 15186, ♂, (holotype). B. *Anoura cultrata* Handley, USNM 309398, ♂, (paratype).

and maxillary tooththrow than does *A. werckleae*. In most other diagnostic features, with the possible exception of the characters of the basisphenoid pits, the South American form is separable from *A. werckleae* in the same ways as is *A. cultrata*.

Specimens Examined: *Anoura werckleae*, LACM 15186, ♂, (holotype), LACM 25438, ♀, (paratype); *Anoura cultrata*, USNM 309398, ♂, and USNM 309401, ♀, (paratypes), TCWC 9829, ♂; *Anoura* sp. n. Carter, TCWC 11881, ♀, (paratype).

Remarks: In addition to being separable on the basis of color and other morphological characters, the two Central American species of the *Anoura cultrata* group, *A. cultrata* and *A. werckleae*, appear to have distinct ecological distributions. *A. werckleae* is known only from 2500 m, near the upper limit of Lower Montane Rain Forest, in Costa Rica. (Capitalized forest formation and life zone designations are those of L. R. Holdridge, from Holdridge and Budowski, 1959; Tosi, 1965). *A. cultrata* has been taken only in Costa Rica and Panama, at elevations ranging from 594 to 1615 m (Carter *et al.*, 1966;

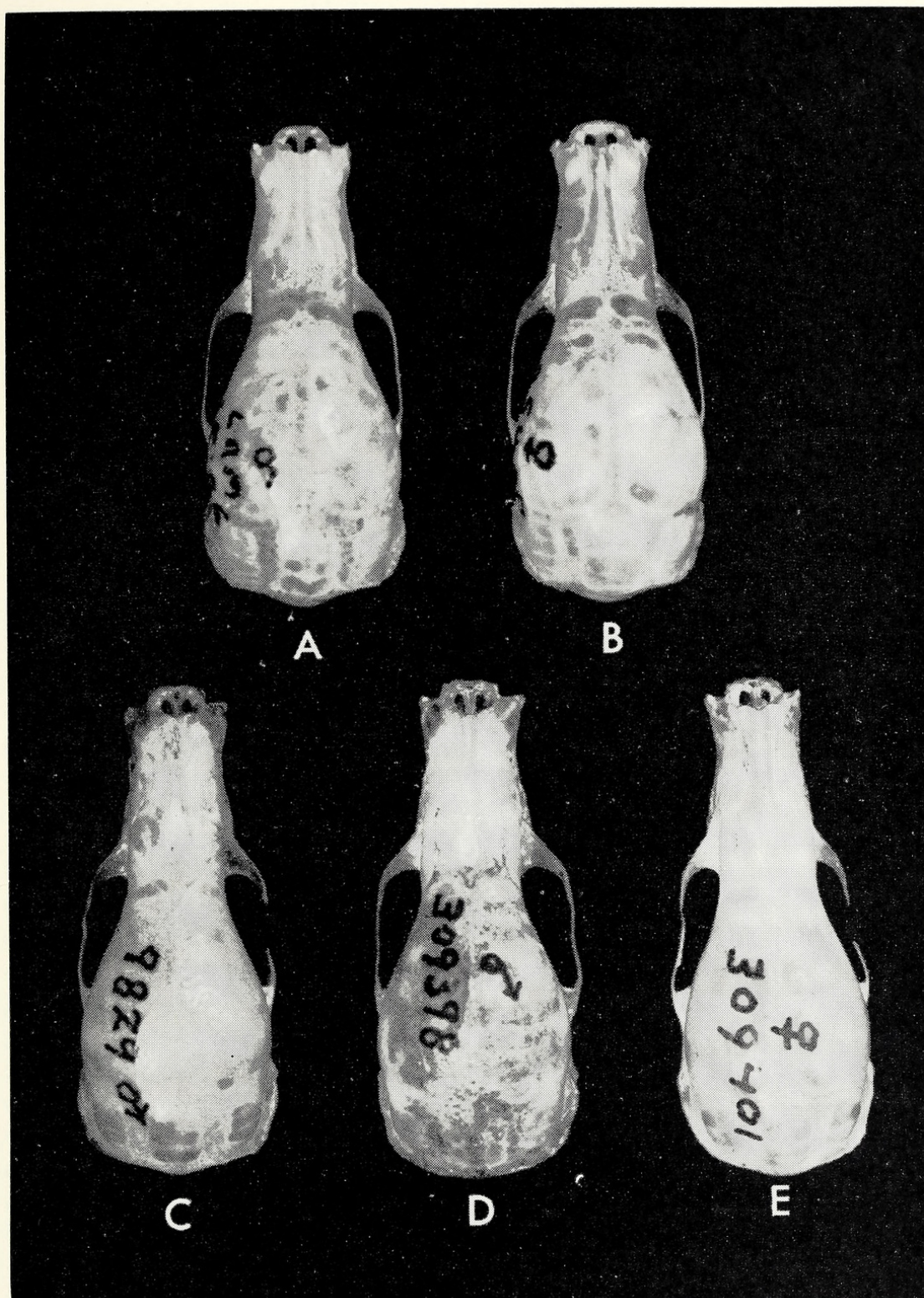


Figure 2. Crania of *Anoura werckleae*, sp. n. and *Anoura cultrata* Handley, dorsal view. A. *A. werckleae*, LACM 15186, ♂, (holotype). B. *A. werckleae*, LACM 25438, ♀, (paratype). C. *A. cultrata*, TCWC 9829, ♂, (Costa Rica). D. *A. cultrata*, USNM 309398, ♂, (paratype). E. *A. cultrata*, USNM 309401, ♀, (paratype).

Handley, 1966), in evergreen forest which is probably mostly within the wetter portions of the Subtropical (Pre-montane) Zone. (The elevation of the type locality of *A. cultrata* was recorded as 975 m in Handley, 1960, and was apparently corrected to 594 m in Handley, 1966; see also Fairchild and Handley, 1966.) The third species of *Anoura* known from Costa Rica and Panama, *A. geoffroyi* Gray, has an altitudinal distribution similar to that of *A. cultrata*; the two species have been recorded from the same locality at least once in Panama (LACM data and Handley, 1966). If, as the small amount of available evidence may suggest, *A. werckleae* replaces one or both of the other species of *Anoura* at higher elevations, then the new species may well turn out to be limited in distribution to the Cordillera Central of Costa Rica and the Cordillera de Talamanca, of which the Chiriquí massif in western Panama essentially forms the eastern end.

Wercklea lutea is apparently restricted to wet situations, such as stream edges, in Costa Rica (and perhaps western Panama), possibly only in Lower Montane Forest. Although it is possible that this tree blooms throughout much or all of the year, when I visited the type locality of *A. werckleae* in April, 1966, in an unsuccessful attempt to obtain more specimens of this new bat, the *Wercklea* flowers were much less abundant than when I had seen them in July and August of previous years and were generally restricted to higher branches in the trees. At that time (April), I observed insects and at least two unidentified species of hummingbirds visiting the flowers during the day. It seems quite unlikely that *Anoura werckleae* is solely dependent on *Wercklea lutea* as a source of food, but a feeding relationship has been demonstrated and the ranges of the two organisms may coincide. The genus *Wercklea* includes one other species, *W. insignis* Pittier and Standley, which occurs at somewhat lower elevations in Costa Rica (and possibly western Panama) and is found in the same type of ecological situation as is *W. lutea*. It is interesting to speculate that a relationship may also exist between *Anoura cultrata* and this purplish-flowered *Wercklea*, although no evidence of such an association is available in the field data which I have seen. The Costa Rican specimen of *A. cultrata* comes from an area in which *Wercklea insignis* is locally abundant, but more definitive information is wanting. The two species of *Wercklea* were considered by Standley (1937-1938) to be Costa Rican endemics, but he also recognized the continuity of floras through the Cordillera de Talamanca to the Chiriquí massif. It is possible that *W. insignis* is not found east of the isthmian lowlands of Panama, in which case *Anoura cultrata* would have a wider distribution than the tree, since this bat does occur in the mountains of eastern Darién (type locality).

The discovery of *Anoura werckleae* is of particular interest because this bat is one of the few to be found at such a high elevation in tropical Middle America. Data for Costa Rica and Panama (LACM records and Handley, 1966) show that, as would be expected, the vast majority of species of bats occur in the Tropical and Subtropical Zones. Between 1500 m (roughly the

upper limit of the Subtropical Zone) and 1800 m the number of species drops off rapidly. Handley (1966) gives no specific elevation above 1768 m for any bat in Panama; Davis (1966) gives a Panamanian record for *Eptesicus andinus* from 1920 m. *Sturnira ludovici*, the only other species of bat taken in the nets with *Anoura werckleae*, has been recorded in Costa Rica from 2820 m on Volcán Turrialba, in the Cordillera Central (Starrett and De la Torre, 1964), and has been netted by LACM-USACR field parties at elevations up to 3050 m, on the Cerro de la Muerte massif. The only other bats to be taken above 1800 m in Costa Rica are *Eptesicus andinus*, up to 2743 m, and *Myotis chiloensis*, 2743 m (inadvertently shown as 2590 m in Starrett and Casebeer, 1968, in which both species were reported). Elevation records for some of these specimens were mentioned previously, in Tamsitt *et al.* (1964), although they were all listed as having been taken on Volcán Turrialba.

ACKNOWLEDGMENTS

Persons involved in the field work which provided the LACM specimens and data referred to in this paper included, in addition to the author: Richard S. Casebeer and Ronald B. Linsky (1961); Richard S. Casebeer, Harry N. Coulombe, Charles L. Hogue, Anthony J. Hollister (1963); George F. Fisler (1966). Funds supporting these field parties came from the following grants (field years and principal investigators): National Academy of Sciences, Bache Fund, No. 465, and National Science Foundation, No. G-18002 (both 1961-Starrett); U.S. Army Medical Research and Development Command, No.s DA-MD-49-183-62-G54 and DA-MD-49-193-63-G94 (1963, 1966-F. S. Truxal and C. A. McLaughlin, Jr.).

I also express my appreciation to William B. Davis and Dillard C. Carter, Texas A. and M. University (TCWC), and Charles O. Handley, Jr., U.S. National Museum (USNM), for loans of specimens and for patience in the face of any inconveniences caused by the length of time it has taken for this description to reach publication. George F. Fisler and Donald R. Patten kindly read the manuscript and contributed useful suggestions. Figure 1 was drawn by Mary Butler, LACM illustrator; the photograph for Figure 2 is the work of Armando Solis, LACM photographer.

RESUMEN

Se describe una nueva especie de murciélago glosófagínido, con base en dos especímenes (hembra y macho adultos) de Costa Rica, colectados en el Bosque Pluvial Montano Bajo, a 2500 m. en el macizo del Cerro de la Muerte, Provincia de San José. A esta especie, la cual está relacionada de cerca con *Anoura cultrata* Handley, se le da el nombre de *Anoura werckleae* en referencia a la asociación que existe entre el murciélago y la planta malvácea, *Wercklea lutea* Rolfe. Los dos ejemplares de esta nueva especie fueron colectados en julio (1961 y 1963) cuando las grandes flores amarillas de *Wercklea* eran abundantes en los árboles que crecen a lo largo de varios arroyos presentes

en la localidad tipo, 6.8 mi. al Sur del restaurante 'La Georgina,' en la Carretera Interamericana. El segundo espécimen fue colectado con una red de seda colocada bajo las ramas de un árbol de *Wercklea* con el propósito específico de obtener algún otro ejemplar de este nuevo murciélago. En la piel de ambos especímenes se encontró polen amarillo proveniente de las flores de éste árbol.

Anoura werckleae se asemeja de cerca a *A. cultrata*, especie de la cual se distingue por su piel pardo-anaranjada, el metacarpo III más largo en comparación con el metacarpo y la primera falange del cuarto dedo, varias características de los dientes, del palatino posterior y del área del basiesfenoides (Fig. 1), asimismo como en la forma del cráneo (Fig. 2). *A. werckleae* se distingue de las otras especies en el género *Anoura* en la misma forma que *A. cultrata* (véase Handley, 1960).

Anoura werckleae puede ser considerada un sustituto altitudinal de *A. cultrata*, la cual ha sido encontrada únicamente en Panamá y Costa Rica, entre 600 y 1600 m. de elevación.

Es probable que *A. werckleae* será encontrada a mayores elevaciones en las masas montañosas de la Cordillera Central de Costa Rica y de la Cordillera de Talamanca en Costa Rica y Panamá, posiblemente coincidiendo con la distribución de *Wercklea lutea*, aunque los datos disponibles no dejan ver ninguna relación de dependencia entre los dos organismos. Parece interesante además, especular sobre la posibilidad de que alguna relación similar pueda existir entre *Anoura cultrata* y la otra especie del género *Wercklea* endémico de Costa Rica, *W. insignis* Pittier y Standley, los cuales ocurren en la misma área general en Costa Rica.

Finalmente, se hace notar que *A. werckleae* es una de las pocas especies de murciélagos encontrados en altitudes que sobrepasan los 1800 m. en Centro América. En Costa Rica, *Sturnira ludovici* ha sido encontrado en elevaciones de hasta 3050 m., *Eptesicus andinus* y *Myotis chiloensis* en altitudes de hasta 2743 m.

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