

DESCRIPTION OF A NEW SPECIES OF BAT OF THE GENUS CAROL-
LIA, AND REMARKS ON CAROLLIA BREVICAUDA.*

BY

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Carollia is one of the most common of the South American leaf-nosed bats. Notwithstanding its wide range of distribution (it is found from Mexico to the southern limit of Brazil, including the Antilles), the type of the genus is that of the single species also. I have recently examined this form—*Carollia brevicauda*—with the object in view of determining whether or not an example of *Carollia* in the collections of the National Museum might prove to be new.

The facts which led me to suppose that this might be the case were the following:

The specimen was smaller than *C. brevicauda*; the color was of a light chestnut-brown tint, instead of the ashy shade of *C. brevicauda*. The interfemoral membrane was not incised. The nose-leaf was relatively small, delicate, with entire, rounded nostrils, and the lower border sharply defined to a point near the median line, where a small naked space alone was seen.

I have had a knowledge of these facts for a long time, but I hesitated to describe the form as new, for in general appearance in the proportions of the membrane, in the form of the ear, in the markings of the wing membranes, and the shapes of the terminal phalanges the two forms appeared to be essentially the same. I had but a single specimen—a young male from Costa Rica. I concluded that before describing it an examination of all the specimens of *Carollia* should be made. A large number of specimens of the genus were available for the purpose from the collections of the Museum of Comparative Zoölogy, but unfortunately nine only of the twenty-six examples were in good condition.

From among these a young male was found, and I was thus able to

* Read before the American Philosophical Society, December 6, 1889, and printed in the Proceedings of the Society, Vol. xxviii, 1890, pp. 19-26, with a figure of the species. It is here reprinted as a paper based upon a study of the collections of the National Museum.

show that the smaller size of the specimen, as well as the difference of coloration of the new form, as compared with the old, were not due to age.*

As a result of this examination, I venture to describe the single example as a type of a new species in the following language:

Carollia castanea sp. nov.

Smaller than *C. brevicauda*. Fur long and silky. Above, lustrous light chestnut-brown at basal one-half and at the tip. The intervening portion is yellow brown (old gold). Below, the same colors prevail, excepting that over the abdomen and pubis the brownish tip is absent and the body of the hair not golden. There is no hair on the forearm (the parts are slightly rubbed), and scarcely any on the dorsum of the metacarpal bone of the thumb. The distribution of the hair on the wing membrane is as in *C. brevicauda*.†

The general form of the auricle as in *C. brevicauda*, but is proportionately longer. The outer border is more emarginate. When the auricle is laid on the head, it reaches a point as far as the end of the muzzle. The tragus is obscurely acuminate; the inner border, therefore, not straight, but the apical half abruptly narrowed. The outer border crenulate rather than pectinate. The basal lobe and the process above it well developed. The nose-leaf is more delicate than in *C. brevicauda*. The height is 7^{mm}; the breadth 4½^{mm}. The lower border is much more distinct than in *C. brevicauda*. The nostrils are rounded, well defined, and not continuous with a concavity on the outer border.‡ The warts on the mentum are arranged in three obscurely disposed rows, the middle one being the larger, but none of them are elongate. The tail reaches to a point opposite the knee.

Skull.—The general proportions of the skull are the same in the two species. The brain case at the procephalon is inflated and the temporal crest does not extend over the inflated part. Hence the impressions

* The teeth were all erupted, the epiphyses of the radii, metacarpals, and phalanges were united to their shafts, but the tibia was slightly flexible and the foot was covered by a looser skin than is seen in matured individuals. It is not always easy to determine the age of bats.

† The fur of *C. brevicauda* is described as follows:

Above, moderately long only. The base is plumbeous, the tip brown, and the intermediate part pallid—almost white. Below, the fur is short, plumbeous at basal half, and of the peculiar mouse-gray so often seen in Phyllostomidæ. G. E. Dobson (Cat. Chir. Br. Mus., 1878, describes the fur as brown above and beneath. None of the nine specimens examined were so marked. The brown aspect of the animal as seen in spirit is much more apparent than when dried. The nose-leaf is covered with fine short hairs on both sides. The back of the thumb is densely covered with short hair in *C. brevicauda*.

‡ The nostrils are oval in outline, are not separable from the outline of the nose-leaf above, and are continuous with a concavity (as one speaks of the mouth of a pitcher being concave) on the outer border. The peculiarity just named is best seen by holding the specimen so as to keep the vertex of the head upward and looking downward from the tip to the base of the nose-leaf.

for the temporal muscles are not defined on the frontal bone. The upper border of the anterior nasal aperture is on a line with the canine tooth. The distance between the lachrymal ridges is greater than between the lachrymal ridge of one side and the corresponding central incisor. The distance from the last maxillary molar to the posterior limit of the nasal chamber is less than the distance from the point last named to the end of the long endopterygoids. The palatal rugæ are more trenchant, curved, and wider apart opposite the premolars, than is the case with *C. brevicauda*.

Teeth.—The number of the teeth is the same as in *C. brevicauda*, viz:

$$\frac{2}{2} - \frac{1}{1} - \frac{2}{2} - \frac{3}{3} \times 2 = \frac{16}{16} = 32$$

The maxillary central incisors touch their entire lengths.* The lateral incisors are very small and are free from both the central incisor and the canine. The first premolar is distinctly caniniform and does not touch either the canine or the second premolar.

The mandibular second premolar does not touch the third premolar. The distance from the anterior border of the canine to the first molar is 3^{mm}, a distance over $\frac{1}{2}$ ^{mm} greater than that from the anterior border of the canine to the central incisors.

Measurements.

	mm.
Head and body (from crown of head to base of tail)	44
Length of arm	25
Length of forearm	32
First digit:	
Length of first metacarpal bone	4
Length of first phalanx	3
Second digit:	
Length of second metacarpal bone	26
Length of first phalanx	3
Third digit:	
Length of third metacarpal bone	32
Length of first phalanx	16
Length of second phalanx	20
Length of third phalanx	10
Fourth digit:	
Length of fourth metacarpal bone	30
Length of first phalanx	13
Length of second phalanx	11
Fifth digit:	
Length of fifth metacarpal bone	32
Length of first phalanx	11
Length of second phalanx	10
Length of head	15
Height of ear	15

* G. E. Dobson (Cat. Chir. Br. Mus., 1878) gives this as a character of *C. brevicauda*. From my examinations, I can not agree with this writer. The teeth exhibit a A-shaped space between the cutting edges.

	mm.
Height of tragus.....	6
Length of thigh.....	11
Length of tibia.....	13
Length of foot.....	10
Length of interfemoral membrane.....	15
Length of tail.....	8

Costa Rica. Collections of National Museum. Collected by J. C. Zeledon.

The nine specimens of *C. brevicauda*, which formed the basis of my study, were chiefly interesting from the measurements which were made of the peripheral parts. These are arranged in tabular form:

Table of measurements.

	Carollia brevicauda.									Carollia castanea.
	3997 ♀	3129 ♀	3128 ♀	3231 ♀	3998 ♀	3993 ♀	3230 ♂	3229 ♂	4192 ♂	12914 ♂
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Arm*.....	26	26	26	28	25	25	26	27	25	25
Forearm †.....	37	37	39	40	37	38	38	39	35	32
I { Metacarpal.....	5	5	5	5	4	6	5	5	5	4
{ First phalanx.....	4	6	5	5	4	4	5	4 $\frac{1}{2}$	4	3
II { Metacarpal.....	24	30	30	27	30	31	31	28 $\frac{1}{2}$	28	26
{ First phalanx.....	3 $\frac{1}{2}$	5	4	4	3	3	5	4	3 $\frac{1}{2}$	3
{ Metacarpal.....	34	37	37	36	35	-----	37	36	35	32
{ First phalanx.....	13	17	17	17	14	16 $\frac{1}{2}$	17	15	16	16
III { Second phalanx.....	21	22	22	21 $\frac{1}{2}$	20	22	21	18	21	20
{ Third phalanx.....	11	11	11	11	11	11	10 $\frac{1}{2}$	11	10	10
{ Metacarpal.....	32	36	36	35	34	34	34	34	34	30
IV { First phalanx.....	13	13	13	11	13	13	14	12 $\frac{1}{2}$	13	13
{ Second phalanx.....	14	12 $\frac{1}{2}$	12 $\frac{1}{2}$	10 $\frac{1}{2}$	13	12	13	11	12	11
{ Metacarpal.....	36	37 $\frac{1}{2}$	37 $\frac{1}{2}$	35	35	35	36	36 $\frac{1}{2}$	35	32
V { First phalanx.....	11	12	12	12	12	12	12	11	12	11
{ Second phalanx.....	11	11	11	11	11	12	10 $\frac{1}{2}$	10	11	10
{ Femur.....	14	14	15	12	13	12 $\frac{1}{2}$	14	12	12	11
{ Tibia.....	14	14	17	16	15	15	18	18	14	13
{ Foot.....	11	11	11	11	11	11	11	11	11	10
{ Tail.....	7 $\frac{1}{2}$	5	7	6	7 $\frac{1}{2}$	7 $\frac{1}{2}$	7	7	13	8
{ Head.....	22	22	22 $\frac{1}{2}$	24	22	22	23	22 $\frac{1}{2}$	23	20 $\frac{1}{2}$
{ Auricle ‡.....	12	12	13	13	12	13 $\frac{1}{2}$	12	12	12	15
{ Tragus §.....	6	5	6	6 $\frac{1}{2}$	6	6	6	6	6	6
{ Width of second digital interspace.....	6	4	5	5	4 $\frac{1}{2}$	6	6	-----	5	4
{ Width of third digital interspace.....	22	16	20	21	23	21	19	20	20	21
{ Width of fourth digital interspace.....	31	28	32	31	35	35	26	27	28	30

* From top of shoulder to epicondyle.

† From epicondyle to end of radius.

‡ From outer border posteriorly.

§ Outer border.

With the exception of the foot, which is constantly 11^{mm} long, all the measurements are subject to variation—indeed, no two specimens in all respects are alike. This statement is made while making due allowance for the difficulty in taking some of the measurements, as for example those of the thigh and of the membranous expansions. Specimens which had been macerated in weak alcohol were rejected. But among those which were accepted it was not always possible to determine (owing to the contraction of the tissues), the exact extent to which the parts should be extended, so as to represent as far as possible the posi-

tion of the wings in flight. One of the most interesting measurements is that of the width of the third digital interspace. This space, so small in *Pteropidae*, *Molossi*, and in *Noctilio*, is wide in *Phyllostomidae*, excepting *Phyllostoma*. Another interesting feature is the extent of the incision on the free margin of the interfemoral membrane. In well-preserved specimens of *C. brevicauda* the incision is conspicuous, while in the type of *C. castanea*, which is also in good condition, the incision is absent. Yet in slightly macerated specimens of *C. brevicauda* the incision disappears, showing that it is a character which is dependent upon tonicity and not on any distinctive structural peculiarities, and can not, therefore, have much value. One of the marked ranges of measurements is seen in the length of the tail. The shortest tail is 5^{mm}. long and the longest 7^{mm}. The tip of the tail answered in three specimens to the middle of the femur, in four to the junction of the middle with the lower third, and in two the tail lacked one-fifth only in being as long as the femur. In none, therefore, was the tail as long as in the single example of *C. castanea*.

The length of the thigh varies from 12 to 15^{mm}. Hence the relative lengths of these quantities will be also variable, especially so since even in the same individual the length of the tail does not tautogenize* with the length of the femur. The length of the tibia—a character of value in Cheiroptera—varies from 14 to 18^{mm}. The length of the fore-arm, perhaps the most important single measurement which can be taken, varies from 35 to 40^{mm}.

The following includes the variations of the manus and their range:

	From—	Range.
	<i>mm.</i>	<i>mm.</i>
First metacarpal.....	4 to 6	2
Second metacarpal.....	24 35	9
Third metacarpal.....	33 37	4
Fourth metacarpal.....	32 36	4
Fifth metacarpal.....	35 37½	2½
First phalanx, first digit.....	4 6	2
First phalanx, second digit †.....	3 6	3
First phalanx, third digit.....	13 17	4
First phalanx, fourth digit.....	11 14	3
First phalanx, fifth digit.....	10 12	2
Second phalanx, third digit.....	20 21½	1½
Second phalanx, fourth digit.....	10½ 14	4½
Second phalanx, fifth digit.....	10 12	2
Third phalanx, third digit.....	10 11	1

The length of the head appears to be subject to very slight variation, namely, from 22 to 23^{mm}. That of the ear, from 12 to 13½^{mm}, a slight difference, and yet one which might disturb the novice in attempting to identify the species, since the proportion between the height of the ear and the length of the muzzle is so often used in descriptions of bats.

*Tantogeneity—a word introduced by Professor Rolleston as a more correct term in this connection than correlation.

† An apparent anomaly exists on the left side of specimen No. 3993. There are two phalanges to the second digit.

In *Carollia* these quantities are not fixed. The height of the auricle is variable, but the length of the muzzle is constant. No estimate of relations of measurements between them can be undertaken.

The tragus varies in height from 5 to 6^{mm}. It presents different degrees of thickness along the median border. As a rule very thick, this border may be thin and membranous. The processes on the outer border may be two or five, those toward the apex of the tragus tending to merge in one another. This tendency appears to be most marked in males.

The size of the nose-leaf is constant, being 10^{mm} high and 6^{mm} broad. The lower border shows striking peculiarities in some specimens.

Three of the males exhibited warts arranged in one or two rows across the upper lip on the line occupied in *Artibeus*, *Phyllostoma*, etc., with a well-defined ridge or border. This variation is one of generic rather than specific value. At least it does not indicate any disposition to reversion to *C. castanea*, since in this species no warts are seen, the intervals between the margins of membrane at the side of the base of the nose-leaf simply being smaller than usual, and giving to the eye the appearance of extending directly across the lip. I know of no genus in which this variation of the nose-leaf of *Carollia brevicauda* is a constant character.

In *C. brevicauda*, the warts in the second row on the mentum are elongate in all the nine examples, except one in which they are rounded and do not differ from those of the first row. This arrangement resembles that seen in *C. castanea*.

It is probable that the two outermost rows of warts in *C. brevicauda* coalesce to form the elongate wart, which, as a rule, exists.

In reviewing the measurements of *C. castanea*, when placed in tabular form with those of *C. brevicauda*, it is seen that in the species first named that many of the measurements are the same; that is to say, in some one of the examples of *C. brevicauda* the measurement of a given part will be found to be the same as in *C. castanea*. Thus the arm is of the same length in three specimens of *C. brevicauda*. The length of the bones of the digits find their complements in *C. brevicauda*, excepting the metacarpals of the fourth and fifth digits, which are shorter than in any example of that species. The metacarpal of the first digit is of the same length in one specimen of *C. brevicauda*, while the first phalanx is shorter than in any. The head is shorter while the ear is longer. The tragus remains the same in the two species. The thigh and the leg are both shorter in *C. castanea*, while the tail is absolutely longer by 1^{mm}.

The proportion of the widths of the second, third, and fourth interdigital spaces is shown to be subject to variation. Specimens numbered 3129, 3231, 3128, 3230, 3229, and 4192 are of those in the best condition; and it is seen that the differences are less than in the remaining specimens. But after all possible sources of error are eliminated, it will be

seen that in three only of *C. brevicauda* (the males, Nos. 3230, 3229, 4192— and thus suggestive of sexual distinction) is the difference between the widths of the second and third spaces less than 10^{mm}, while in the single example of *C. castanea* (also a male) the difference amounts to but 9^{mm}.

In this connection I may allude to the value which attaches to the last named measurements in the study of the Cheiroptera.

If a specimen of a bat, which is preserved in spirit, is so held in the hand that the wing is supported in the position of flight, it will be seen that the intervals between the metacarpal bones hold a definite relation to each other.

The width of the spaces between the metacarpals, now being recorded (the measurements are taken at their widest parts), it will be seen that the second interspace is the narrowest and the fourth the widest. In this way a formula may be stated. It is proper to add the length of the forearm to the formula, since this measurement is one of relative constancy and is of importance in framing the diagnosis of the species.

Examination of the table herewith presented exhibits at a glance the marked contrasts which obtain in the *Phyllostomidae* in the composition of this formula.

It is especially interesting to note the difference which exists between the widths of the second and third interspaces. It will be observed that no two formulæ are alike, nor is any fixed ratio preserved between the formulæ of genera which are allied. Nevertheless the measurements are sufficiently distinctive to warrant the recommendation that they be taken in all discriminating studies, not only of the *Phyllostomidae*, but of the entire order.

Formule of the widths of second, third, and fourth interspaces in the genera of Phyllostomidae.

	II.	III.	IV.	Forearm.	Difference between III and IV.
	mm.	mm.	mm.	mm.	mm.
Lophostoma.....	7	17	18	49	1
Schizostoma.....	3	16	21	32	5
Macrotus.....	2	15	22	44	7
Desmodus.....	2	21	27	53	10
Vampyrops.....	3	17	27	36	10
Sturnira.....	3	21	31	38	10
Chilonycteris.....	1½	15	17	40	12
Carollia.....	5	20	32	26	9-12
Vampyrus.....	16	41	53	105	12
Lonchoglossa.....	3	19	32	33	12
Monophyllus.....	3	17	34	32	14
Artibeus.....	4	21	39	51	18
Brachyphylla.....	3	25	43	64	18
Mormoops.....	3	16	35	50	19
Phyllostoma.....	4	29	62	81	45
The following includes the formulæ in families other than the Phyllostomidae:					
Rhynchonycteris.....	5	16	25	40	9
Cynopterus marginatus.....	10	18	27	58	9
Vespertilio murinus.....	2	11	31	59	10
Epomophorus franqueti.....	13	21	39	83	11
Rhinopoma.....	3	13	30	64	17
Atalapha.....	0½	9	26	37	15
Molossus rufus.....	0½	5	35	46	30
Noctilio.....	2	13	58	63	45
Pteropus edwardsii.....	18	17	69	145	52

The study of measurements has given valuable results in the study of the human cranium and has enabled anatomists to come to definite conclusions respecting the validity of characters even when derived from scanty and imperfect material.

No reason can be urged why similar methods may not prove acceptable in describing a new species of mammal.

Extended observations on a number of examples of allied species enhance the value of those upon which it is proposed to announce a new one.