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GEOGRAPHIC RANGE EXTENSIONS AND TAXONOMIC NOTES ON BATS OF THE GENUS *Lonchophylla* (PHYLLOSTOMIDAE) FROM COLOMBIA

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ABSTRACT: As a result of a systematic review of nectar feeding bats in the genus *Lonchophylla* (Phyllostomidae) deposited in the scientific collections of the Instituto de Ciencias Naturales (ICN) in Bogotá and the Museo de Historia Natural of the Universidad del Cauca (MHNUC) in Popayán, we report range extensions for three Colombian species. *Lonchophylla cadenai* is reported from Pueblo Rico, Risaralda, representing an increase in both altitudinal and latitudinal ranges; *L. handleyi* is reported from Cueva de los Guácharos, Huila, confirming the presence of this taxon in Colombia and representing its northernmost known record; and *L. pattoni* is reported from Leticia, Amazonas, which constitutes the third known collecting locality for this taxon and represents the northernmost known record for the species. In addition, an annotated list of all *Lonchophylla* specimens present in the two studied collections is included.

RESUMEN: Extensiones en los rangos de distribución y notas taxonómicas sobre murciélagos del género *Lonchophylla* (Phyllostomidae) de Colombia. Como resultado de una revisión sistemática de murciélagos nectarívoros del género *Lonchophylla* (Phyllostomidae) depositados en las colecciones científicas del Instituto de Ciencias Naturales (ICN) en Bogotá y el Museo de Historia Natural de la Universidad del Cauca (MHNUC) en Popayán, reportamos extensiones en los rangos de distribución para tres especies. *Lonchophylla cadenai* es registrada de Pueblo Rico, Risaralda, y representa un incremento tanto en su rango altitudinal como latitudinal; *L. handleyi* es registrada para la Cueva de los Guácharos, Huila, lo cual confirma la presencia de este taxón en Colombia, siendo esta la localidad más al norte conocida para esta especie; y *L. pattoni* es registrada para Leticia, Amazonas, la cual constituye el tercer registro conocido para esta especie y el registro más norte de su distribución. Adicionalmente, se incluye una lista anotada de los ejemplares del género *Lonchophylla* revisados en estas dos colecciones.

Key words: Bats. Distribution. Lonchophyllinae. Neotropics.

Palabras clave: Distribución. Lonchophyllinae. Murciélagos. Neotrópico.

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INTRODUCTION

With 14 recognized species the genus *Lonchophylla* (Phyllostomidae: Lonchophyllinae) represents one of the most diverse groups of nectar feeding bats in the Neotropics. Bats in the genus *Lonchophylla* have been the source of recent taxonomic revisions, resulting in species descriptions, taxonomic rearrangements, as well as changes in species distribution limits. Previous analyses on richness distribution patterns place the Colombian territory and particularly the Biogeographic Chocó as the area with the greatest number of species for this genus (Mantilla-Meluk, 2007). Eight of the currently recognized species of *Lonchophylla* are known to occur in Colombia (Mantilla-Meluk et al., 2009a), and three of them have type localities in the country: *L. cadenai* (Woodman and Timm, 2006), *L. fornicata* (Woodman, 2007), and *L. orienticollina* (Dávalos and Corthals, 2008). In spite of the biogeographic importance of the Colombian territory in the evolution of the genus *Lonchophylla*, specimens archived in Colombian collections are still poorly documented. For the most part, Colombian material included in previous systematic assessments of the genus *Lonchophylla* was constituted by specimens deposited in scientific institutions out of the country. To partially fill the gaps created by the lack of attention to Colombian collections, we examined the identifications of specimens in the genus *Lonchophylla* deposited in the collections of the Instituto de Ciencias Naturales of the Universidad Nacional de Colombia (ICN) and the Museo de Historia Natural of the Universidad del Cauca (MHNUC) which holds the largest number of specimens for this taxon in the country. As a result of our reassessment, we report extensions in geographic distribution for the recently described *L. cadenai*, *L. pattoni*, as well as for *L. handleyi* in Colombia.

MATERIALS AND METHODS

Data collection—We examined 56 specimens of *Lonchophylla* representing nine species archived in the collections of the Instituto de Ciencias Naturales of the Universidad Nacional de Colombia (ICN) in Bogotá and the Museo de Historia Natural of the Universidad del Cauca (MHNUC) in the city of Popayán (**Appendix**).

Every specimen was taxonomically identified based on diagnostic characters from descriptions of recognized species, and morphometric ranges of holotypes (*; **Table 1**) were contrasted against our measurements. Relative age was determined based on the degree of ossification of phalangeal epiphyses and completeness of ossification of the basisphenoid suture. We employed digital calipers to take measurements to the nearest 0.1 mm. For each specimen we recorded 12 craniodental measurements and the forearm length. The craniodental and appendicular measurements considered in this study are: forearm length (FA); greatest length of the skull (GLS), greatest distance from the anteriormost projection of the nasal bones to the posteriormost portion of the occipital bone; condylobasal length (CB), distance from the anteriormost projection of the premaxillae to the posteriormost projection of the exoccipital condyles; palatal length (PAL), distance from the anteriormost point of the premaxillae (excluding incisors) to the posterior margin of the horizontal process of the palatine, just in the midline of the horizontal process of the palatine; postorbital constriction (PO), least width across the interorbital constriction at a right angle to the longitudinal axis of the cranium; zygomatic breadth (ZB), distance in between the most external points of the zygomatic process; braincase breadth (BB), greatest breadth across the lateral margins of the parietal at the posterior region to the suture coronalis (measured at a right angle to the longitudinal axis of the cranium); mastoid breadth (MB), distance from the juncture of the midline and coronal–parietal sutures to the inferiormost point of the glenoid fossae; maxillary toothrow length (LTR); M3 breadth (M3M3), greatest breadth across the lateral margins of M3 at a right angle to the longitudinal axis of the tooth; mandibular condylocanine length (ML), greatest distance from the anteriormost point of the lip of the alveolus of the lower canines to the posteriormost point of the mandibular condyles; mandibular toothrow length (MTR), greatest distance from the anteriormost surface of i1 to the posteriormost surface of m3; mandibular depth (MD), greatest depth of the corpus at the level of m2 taken at the point of greatest depth.

Table1

Summary of the forearm and craniodental measurements of studies specimens and measuremens of some holotypes reported in their descriptions. Greatest length of skull (GLS); Condylo-basal length (CB); Palatal length (PAL); Postorbital constriction (PO); Zygomatic Breadth (ZB); Braincase Breadth (BB); Mastoid Breadth (MB); Maxillary tooth row (LTR); Breadth across molars (M-M); Length of the mandible (ML); Length of the mandibular tooth row (MTR); Mandibular depth (MD); and Forearm length (FA); Holotypes (*).

N	FA	GLS	CB	PAL	PO	ZB	BB	MB	LTR	M-M	ML	MTR	MD
L. pattoni													
ICN 11730 ♂	31.22	21.35	20.01	11.07	4.4	9	8.29	8.73	6.61	5.19	14.07	6.98	3.84
* KU 144232	34.1	22.3	20.6	12.1	4.1	8.8	8.3	8.8	7.2	5.2	14.2	7.6	3.9
L. cadenai													
ICN 12210 ♂	32.06	21.73	20.14	11.26	4.20	9.11	8.38	8.09	6.95	5.12	14.26	7.53	3.14
ICN 9169 ♂	32.00	21.52	20.0	11.63	4.30	9.20	8.45	9.10	6.97	5.23	14.00	7.62	3.56
* USNM 483359	31.90	21.70	20.0	11.60	4.10	9.20	8.70	9.20	6.90	5.23	13.70	7.30	4.00
L. handleyi													
MHNUC 718	47.23	29.38	28.6	17.42	5.38	10.36	10.53	11.25	11.03	6.72	21.44	11.39	5.38
* BM(NH) 78.1368 ♀	45.6	28.5	27.2	16.8	5.2	ND	10.2	11.4	10.1	6.7	19.8	10.7	ND
L. thomasi													
N=11	31.69	21.07	19.37	11.18	4.2	8.67	8.22	8.33	6.71	5.06	13.89	6.97	3.42
L. concava													
N=7	33.2	22.23	20.52	12.6	4.3	8.9	8.72	9.3	7.65	5	14.53	7.8	3.23
L. fornicata													
N=3	34.06	30.84	23.6	13.72	4.67	9.77	9.26	9.24	8.61	5.78	17.64	8.94	4.15
L. orienticollina													
N=11	42.98	25.22	23.52	13.24	5.2	10.26	9.97	9.44	8.93	6.22	16.85	9.35	4.43
L. robusta													
N=19	44.36	26.79	25.24	14.37	5.31	10.3	10.26	9.84	9.81	6.67	18.17	10.16	4.75
L. chocoana													
N=1	45	28.74	27.4	15.76	5.3	10.27	10.23	10.13	10.3	7.35	20.03	10.6	5.74

RESULTS AND DISCUSSION

Range extensions—Among the analyzed material we report range extensions for three species in the genus *Lonchophylla* as follows:

Lonchophylla cadenai—Woodman and Timm (2006) described *L. cadenai* from a Colombian specimen, collected at 29 km SE of Buenaventura; east bank of Río Zabaletas, across from the village of Zabaletas (3º44'N, 76º57'W), Department of Valle del Cauca, and reported a second specimen collected at Bajo Calima (4º01'N, 77º00'W) ca. 45 km by air NNE of Buenaventura, along the Río Calima and suggested its presence in northwestern Ecuador in Esmeraldas Province. We report two additional specimens of *L. cadenai* from Colombia, originally identified as *L. thomasi*, deposited at the collections of the ICN. The first specimen corresponds to a male (ICN 9169) preserved as skull and fluid and collected at the type locality of *L. cadenai* and by the same original collector; it is a virtual topotype. The second specimen is a male (ICN 12210) collected on the left bank of Río San Juan near Pueblo Rico, Corregimiento de Santa Cecilia, Department of Risaralda (5º14'N, 76º02'W, 2430 m) and was preserved as skin and skull. Our record from Pueblo Rico, Risaralda, represents an extension in both latitudinal and elevation ranges for the species of 2°28' N and 1554 m from its type locality in Zabaletas (3°42'N, 76°19'W, 876 m; **Fig. 1**). The area of Pueblo Rico is dominated by sub-Andean and Andean mountainous forests ecologically different from the piedmont forests which characterized the area of Zabaletas at the type locality of *L. cadenai*. The presented records of *L. cadenai* are within the morphometric limits reported for the species by Woodman and Timm (2006) (**Table 1**). Specimens ICN 9169 and ICN 12210 exhibited the following diagnostic characteristics of *L. cadenai*: broad rostrum strongly inflated; anterior placement of the posterior border of infraorbital foramen which has a small but distinct lateral projection, as well as P4 with an obvious rooted lingual cusp. The skulls of specimens ICN 9169 and ICN 12210 lack a deep medial groove in the posterior palate as well as the median projection. These specimens also have a short, acutely V-shaped

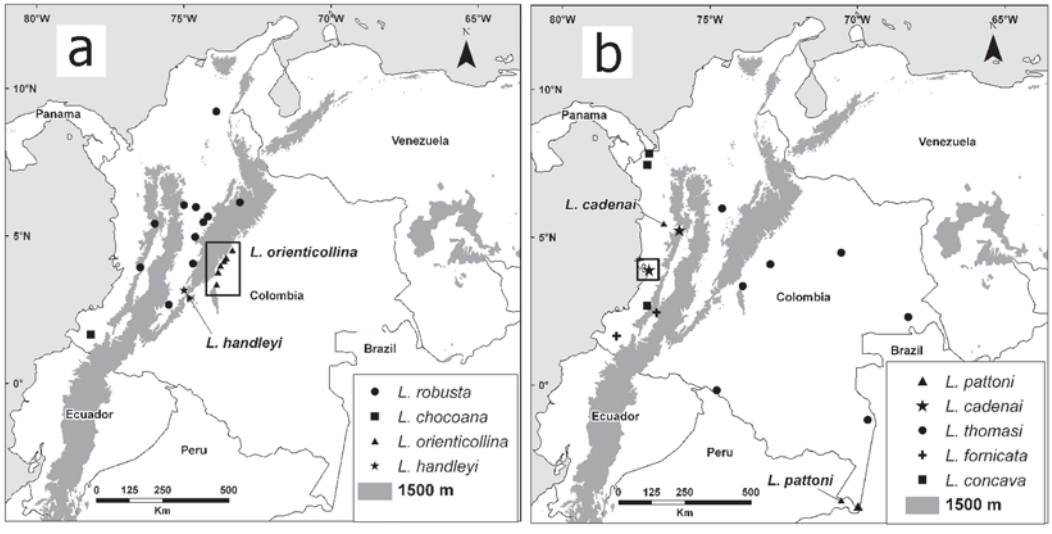

Fig. 1. (a) Localities of large *Lonchophylla* included in this work: the arrow shows extension of *L. handleyi* in Cueva de los Guacharos, Huila, Colombia; studying localities of specimens identified as *L. orienticollina* are enclosed by a rectangle. (b) Localities of small *Lonchophylla* included in this work; arrows show extensions of *L. pattoni* in Leticia, Amazonas, Colombia, and *L. cadenai* in the highlands of the Colombian Andes in Pueblo Rico, Amazonas, Colombia. Type locality of *L. cadenai* is enclosed by a square.

mesopterygoid fossa. In addition, the pterygoid processes of these specimens are broadly inflated; both have shallow basisphenoid pits separated by a broad septum, a short and robust dentary with a low coronoid process, and a short articular process. Typical of *L. cadenai* these specimens also have a gap between i2 and the canine approximately as wide as the length of i2 as described by Woodman and Timm (2006).

Lonchophylla pattoni Woodman and Timm, 2006—*Lonchophylla pattoni* was only known from its holotype collected at Reserva Cuzco Amazónico, southeastern Peru, and from a specimen collected at 5 km east of Puyo, at the Safari Hosteria Park, Pastaza Province, Ecuador (Mantilla-Meluk et al., 2009b). *Lonchophylla pattoni* was represented in the ICN collection by a subadult male (ICN 11730) collected in Leticia, Corregimiento El Encanto, Vereda San José, Amazonas, Colombia (4°12'S, 69°56'W, 83 m). The area enclosing the collecting locality is characterized by primary stratified seasonally inundated forest. Specimen ICN 11730 has the following characters of *L. pattoni* as diagnosed by Woodman and Timm (2006): internal cusp of the P3 absent; a V-shaped mesopterygoid fossa without medial projection; pterygoid process inflated; basisphenoid fossa deep; internal margin of infraorbital foramen located between P3 and P4; evident gap between incisors I1 and I2; rostrum not inflated; infraorbital foramen characterized by lateral projections; and septum of basisphenoid narrow. Some of the measurements recorded from our subadult differed from those reported for the holotype of *L. pattoni* (Woodman and Timm, 2006). Since *L. pattoni* was only known from two individuals, ranges of variation in size for the species are not yet well defined.

Lonchophylla handleyi Hill, 1980—*Lonchophylla handleyi* with type locality in Los Tayos, Ecuador was previously recorded in Colombia (Alberico and Orejuela, 1982; Alberico, 1987; Rivas-Pava et al., 2007). However, Griffiths and Gardner (2008) restricted the distribution to the Ecuadorean and Peruvian Andes and, based on marginal localities, proposed that *L. handleyi* "occurs in eastern Ecuador and eastern Peru" (p. 250) and did not include any locality from Colombia. We revisited specimen MHNUC 718, reported by Rivas-Pava et al. (2007) within a check list of specimens deposited in the collections of the MHNUC, and confirmed its identification as *L. handleyi*. Specimen MHNUC 718 overlaps all morphometric ranges proposed for *L. handleyi* by Griffiths and Gardner (2008) (**Table 1**). Although there is a large overlap in size between *L. chocoana* and *L. handleyi*, specimen MHNUC 718 can be differentiated from *L. chocoana* by the presence of a swollen mesopterygoid fossa, which is preceded by a concaved posterior palate and lacks a ridge (postpalatine torus; see Dávalos, 2004). In addition, specimen MHNUC 718 has a poorly developed lingual cusp on P4; externally, it has the narrow uropatagium with a fringe of short, pale hairs on its edge (Hill, 1980). Therefore, the specimen from Cueva de Los Guácharos, Department of Huila, constitutes the northernmost record of the species, and is the only confirmed record of *L. handleyi* for Colombia (**Fig. 1**).

Taxonomic remarks—Besides the three range extensions reported herein, six other species of the genus were recorded in our assessment as follows: *Lonchophylla robusta* with two distinctive morphotypes under the *L. robusta* epithet. Seventeen specimens from the Biogeographic Chocó and the Inter-Andean Valleys of the Cauca and Magdalena Rivers were larger in all recorded measurements in comparison with specimens from the Eastern Colombian Llanos and matched the description of *L. robusta* Miller, 1912. *Lonchophylla robusta* was described from cave Chilibrillo, Río Chilibrillo, Panama, and is known from Central America, northward into Nicaragua and south into northwestern Venezuela, western and central Colombia, and Peru (Griffiths and Gardner, 2008).

Lonchophylla orienticollina Dávalos and Corthals 2008—Eleven specimens originally misidentified as *L. robusta* from the eastern side of the Colombian Andes corresponded to the recently described *L. orienticollina*

(Dávalos and Corthals, 2008). Although Dávalos and Corthals (2008) reported *L. orienticollina* from both sides of the Eastern Cordillera, there was no support for this hypothesis in the morphology observed among *Lonchophylla* specimens from the western versant of the Eastern Cordillera of the Colombian Andes. All specimens in our analysis having the *L. orienticollina* morphology described by Dávalos and Corthals (2008) are restricted to the eastern side of the Eastern Cordillera (**Fig. 1**). Following the diagnostic criteria proposed by Dávalos and Corthals (2008), specimens ICN 16238, 15294, and 17534 included in the type series of *L. orienticollina* correspond to *L. robusta* (**Fig. 2**). The three mentioned specimens are out of the morphometric ranges proposed for *L. orienticollina* in Dávalos and Corthals (2008). In addition, they do not present the tall braincase, inflated rostrum, and short rostrum characteristic of *L. orienticollina*. Contrasting the thick appearance of *L. orienticollina,* these specimens have a delicate appearance in profile (Dávalos and Corthals, 2008). The palates of specimens ICN 16238, 15294, and 17534 are not particularly wide and do not exceed the morphometric limits of that in *L. robusta.* The spatial placement of P4 in the above mentioned specimens do not have the 15° angled position with respect to P3 used as diagnostic character to differentiate *L. robusta* and *L. orienticollina* (Dávalos and Corthals, 2008), as is exemplified by specimen ICN 16238 (**Fig. 2**). Differences between specimens ICN 16238, 15294, and 17534 and typical *L. orienticollina* are so evident that it is probable that these specimens were included in the type series based on the relative proximity of their collecting localities without direct systematic examination. Further systematic analyses using datasets other than morphology are recommended to clarify the geographic limits between these two taxa in Colombia.

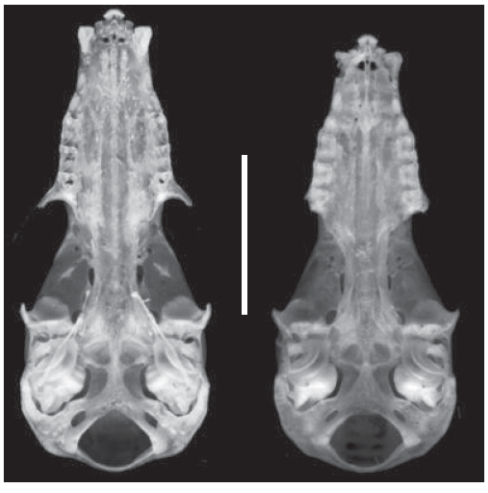

Fig. 2. *Lonchophylla robusta* male specimen ICN 16238 (left) incorrectly assigned as *L. orienticollina* and male *L. orienticollina* specimen ICN 9702 (right).

Lonchophylla thomasi Woodman and Timm 2006—Discrete and continuous characters used to identify *L. thomasi* (Woodman and Timm, 2006), including the relative position of the postorbital foramen, an enlargement of the postorbital region, and the presence of projections on the postorbital region, are extremely variable among small representatives of this taxon in Colombia. We identified twelve of our specimens as *L. thomasi* (**Appendix**). Nevertheless, further revision of this taxon, including datasets other than morphology (i.e., karyotypes) is required to clarify the taxonomic affinities of small *L. thomasi* populations in Colombia. Although different karyotypes have been reported for *L. thomasi* (Baker, 1973, 1979; Gardner, 1977; Baker et al., 1982; Haiduk and Baker, 1982; Ribeiro et al., 2003) no formal analysis has been conducted to associate them to newly describe small *Lonchophylla*.

Lonchophylla concava Goldman 1914— Six medium-sized *Lonchophylla* from localities west to the Andes (**Appendix**), previously identified as *L. mordax*, were reassigned to *L. concava* based on their geographic range, morphometric ranges (**Table 1**), and morphology. Although Handley (1966) considered medium sized populations from the Middle American province and northwestern South America as *L. mordax*, Albuja and Gardner (2005) restricted the distribution of *L. mordax* to Brazil and eastern Bolivia and recognized the medium-sized *Lonchophylla* ranging from

northwestern Ecuador to Costa Rica as *L. concava* Goldman, 1914. Specimens identified as *L. concava* in this work presented the following characters used by Albuja and Gardner (2005) to distinguish between these two taxa: obsolete lingual cusp on last upper premolar; posterior margin of anterorbital foramen within the relatively small contour of the lateral margin of the rostrum; pit-like groove along the posterior palate, medial posterior projection of the palate (peninsular projection of the palate) absent; space between second lower incisor and canine wide or wider than the crown of lower second incisor; first lower premolar large and blade-like with reduced posterior cusp. Although a low coronoid process has been mentioned as a useful character to distinguish *L. concava* from *L. mordax* by Albuja and Gardner (2005) and Griffiths and Gardner (2008), ranges of this variable reported by Woodman (2007) for *L. concava*, *L. fornicata*, and *L. mordax* largely overlap.

Lonchophylla fornicata Woodman 2007—A male from Barbacoas, Nariño (ICN 13647), in addition to two males (MHNUC 817 and 818) from Playa Rica (570 m), and La Gallera (1560 m), Cauca, previously identified as *L. mordax,* were reassigned to *L. fornicata* based on morphometric ranges (**Table 1**). *Lonchophylla fornicata* is the only other medium-size *Lonchophylla* present in northwestern South America and its morphology superficially resembles *L. concava*. All morphometric characters distinguishing *L. fornicata* from *L. concava* proposed by Woodman (2007) were present in specimens MHNUC 817 and 818 from Cauca and specimen ICN 13647 from Nariño as follows: wider posterior palate, proportionally greater zygomatic breadth, supraorbital breadth, and lengths of the maxillary and mandibular tooth row; longer maxillary toothrow relative to mandibular toothrow; greater height of coronoid process relative to mandibular toothrow (**Table 1**).

Lonchophylla chocoana Dávalos, 2004—*Lonchophylla chocoana* is known from Alto Tambo, Ecuador (Holotype ROM 105786), La Guarapería, Department of Nariño, Colombia (Paratype ICN 13649), and Los Pambiles, Esmeraldas Province, Ecuador (USNM 57571). Griffiths and Gardner (2008) extended the distribution of *L. chocoana* to Río Zabaletas, 29 km SE of Buenaventura; east bank of Río Zabaletas, near the village of Zabaletas (3°44'N, 76°57'W), based on specimen USNM 483361. Dávalos (2004) mentioned the presence of trilobed lower incisors as a useful character to separate *L. chocoana* from *L. robusta*; however, trilobed lower incisors were observed in a specimen of *L. orienticollina* (ICN 12968) from Meta, Colombia, and the characters appear to be variable in both species (**Fig. 2**).

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APPENDIX

Specimens examined

Lonchophylla cadenai (2). COLOMBIA: **Risaralda**: Pueblo Rico, Santa Cecilia, left margin of Río San Juan (ICN 12210); **Valle del Cauca**: 29 km SE of Buenaventura; east bank of Río Zabaletas, across from the village of Zabaletas (ICN 9169).

Lonchophylla chocoana (1). COLOMBIA: **Nariño**: Barbacoas, La Guarapería (ICN 13649).

Lonchophylla concava (7). COLOMBIA: **Chocó**: Río Sucio, Caño Las Mureres, Parque Nacional Natural Los Katíos (ICN 7009-14); Sautatá, Parque Nacional Natural Los Katíos (ICN 7015).

Lonchophylla fornicata (3). COLOMBIA: **Cauca**: Playa Rica (MHNUC 817); La Gallera (MHNUC 818); **Nariño**: Barbacoas, Altaquer (ICN 13647).

Lonchophylla handleyi (1). COLOMBIA: **Huila**: Cueva de Los Guácharos (MHNUC 718).

Lonchophylla orienticollina (11). COLOMBIA: **Cundinamarca**: Medina, Choapal, Río Gazaguan (ICN 10848); **Meta**: Acacías, Brisas del Guayuriba (ICN13839-40); Acacías, San José (ICN 9702); Cubarral, El Vergel, Finca La Estrella (ICN 14399,14400); San Juan de Arama, parte norte Serranía de La Macarena, Caño La Curia (ICN 10278-79), San Juan de Arama, parte norte Serranía de La Macarena, Caño Guamalito and Caño La Curia (ICN 10280); Restrepo (ICN 10114); Villavicencio (ICN 12968).

Lonchophylla pattoni (1). COLOMBIA: **Amazonas**: Leticia, El Encanto, San José (ICN 11730);

Lonchophylla robusta (19). COLOMBIA: **Antioquia**: San Luis (ICN 13320); **Boyacá**: Otanche, La "Y", Escuela La "Y" (ICN 16238); Puerto Boyacá, La Esmeralda, Quebrada La Fiebre, 1 Km, NE, Campamento Techint (ICN 14807); Puerto Boyacá, Puerto Romero, La Fiebre, Quebrada La Fiebre (ICN 14852); **Caldas**: Samaná, surroundings Campamento CHEC (ICN 10810-11); **Cesar**: Serranía de Perijá, La Victoria de San Isidro, El Zumbador (ICN 18499); **Cundinamarca**: La Vega, El Tabacal (ICN 1552); Yacopí, La Laguna, Finca La Planada (ICN 13792); **Huila**: Yaguará, Upar (ICN 17760); **Magdalena**: Santa Marta, Alto de Mira, 3 Km, O, Río Buritaca, Sierra Nevada de Santa Marta (ICN 13020); Santa Marta, Parque Nacional Natural Tayrona, Arrecifes (ICN 7854, ICN 7983); **Nariño**: Barbacoas, Altaquer (ICN 13648); **Santander**: Encino, Vereda Río Negro, Las Tapias, Finca El Aserradero (ICN 17534); **Tolima**: Cunday, Cueva El Eden, Hacienda Camelia (ICN 5610); **Valle del Cauca**: Calima, Vereda Río Azul, Campamento CVC (ICN 4397, ICN 9167-68).

Lonchophylla thomasi (11). COLOMBIA: **Boyacá**: Puerto Boyacá, Puerto Romero, La Cristalina, Quebrada La Cristalina (ICN 14483); Puerto Boyacá, La Fiebre, Puerto Romero, 1 km. Campamento Techint, Quebrada La Fiebre (ICN 15853); **Guainía**: Serranía de Naquén (ICN 12026); **Meta**: Puerto López, Menegua, Finca El Lagunazo (ICN 9479); San Juan de Arama, parte norte Serranía de La Macarena, Caño La Curia (ICN 10281); **Putumayo**: Puerto Leguizamo, El Guadual, Finca de Bolivar López, Lomas II, Parque Nacional Natural La Paya (ICN 13742-44); **Vaupés**: La Libertad, Serranía de Taraira (ICN 12736-37); **Vichada**: Centro Experimental Gaviotas (ICN 9636).