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ZOOLOGY

José Celestino Mutis and the gestation of ichthyology in the Viceroyalty of New Granada

José Celestino Mutis y la gestación de la ictiología en el Virreinato de Nueva Granada

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ABSTRACT

José Celestino Mutis, mostly known for his contributions in the botanical field, however; made significant, if little known, scientific additions in fields from mathematics to zoology. In this paper, I present to the public, for the first time, Mutis' work on ichthyology in the Viceroyalty of New Granada, the colonial Spanish denomination for the northern part of South America that includes the present-day countries of Panama, Colombia, Venezuela, and Ecuador, work that, as Linnaeus himself stated, will immortalize Mutis for future generations.

Keywords: Fish, Royal Botanical Expedition of the New Kingdom of Granada, South American Natural History, Zoology.

RESUMEN

José Celestino Mutis, más conocido por sus contribuciones en el campo botánico, sin embargo; hizo aportes científicos significativos, aunque poco conocidos, en campos desde las matemáticas hasta la zoología. En este artículo, presento al público, por primera vez, los trabajos de Mutis sobre ictiología en el Virreinato de Nueva Granada, título colonial español para la parte Norte de América del Sur incluyendo los actuales países de Panamá, Colombia, Venezuela y Ecuador, obras que, como propuso el propio Linneo, lo inmortalizarían.

Palabras clave: Nuevo Reino de Granada, Peces, Real Expedición Botánica, Zoología.

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INTRODUCTION

To speak about José Celestino Mutis (1732–1808) is to tell the story of a man who played a key role in initiating the study of sciences in Latin America, and particularly in what is now Colombia. He served as the medical doctor of Pedro Messía de la Cerda Viceroy of New Granada and also worked as a miner, botanist, naturalist, astronomer, cleric, and mathematics professor at the Colegio Mayor de Nuestra Señora del Rosario (now Rosario University). His mining work took place around 1777 at the Real de Minas de la Montuosa, in the jurisdiction of Pamplona (González Suárez 1905), and then in "El Sapo" mines near Ibagué (Mutis 1760–1790).

Mutis, however, is most recognized for his immense contributions to botany and as director of the Royal Botanical Expedition of the New Granada, an accomplishment that found favor with Carl Linnaeus (1707–1778) himself. Inspired by Linnaeus's regard for Mutis, Alexander von Humboldt (1769–1859) sought to meet Mutis. Humboldt and Mutis then developed a close relationship (Mutis 1760–1790, González Suárez 1905, Vezga 1936, Leal Hernández 2018). As documented in a letter that Linnaeus wrote to Mutis on July 3, 1761 (Mutis 1760–1790), Linnaeus held Mutis in such high regard that he named a genus of plants (*Mutisia*) after him.

Since most plants and animals, he found in these territories were completely unknown for Europeans, the era during which Mutis arrived in New Granada was one of astounding wonder. One of Mutis's objectives was to publish a Natural History of America written by Americans (Mantilla and Díaz-Piedrahita 1995). His studies of these topics, particularly the zoological works of this great undertaking are little known. As Blanco Villero (2008) mentioned, the only study the botanist Mutis undertook at the behest of Linnaeus was the study of the behavior and ecology of ants, a document that would never reach the members of the Academy of Sciences in Upsala (Puig-Samper *et al.* 2004), the purpose of which was to guarantee the induction of Mutis into the Swedish Academy.

Mantilla and Díaz-Piedrahita (1995), Blanco Villero (2008), Fernández and Wilson (2008), Wilson and Durán (2010), and recently Amat-García and Agudelo-Zamora (2020), are some of the few researchers that have documented the zoological observations and descriptions of the Royal Botanical Expedition; the first authors calling attention to the contributions of Fray Diego García (1745–1794), commissioned by Mutis, Blanco Villero covering contributions of Mutis himself including works on ornithology, mastozoology, entomology, and herpetology, and Wilson and Duran (2010) documented Mutis's work with ants, but none of them mentioned ichthyology. Recently, Amat-García and Agudelo-Zamora (2020) mentioned Mutis's work in ichthyology. The only earlier reference to his studies of fish is that of Hernandez de Alba (1986) who, given his area of interest, collected and reported all historical zoological information available.

Mutis's patience, calm nature, and perfectionism (González Suárez 1905), while admirable qualities, eventually proved to be detrimental as they prevented him from publishing most of his findings. Fortunately for science, other people have done so (i.e, Humboldt and López Ruiz: see the review of Don Sebastián José López Ruiz in González Suárez 1905) and continue to do so through to today. In this paper, I document the contributions that Mutis made regarding the fish of Northern South America; contributions that, until now, have been largely unknown and forgotten.

Mutis the zoologist

According to history, Mutis not only had clear ideas about his role in botany (Leal Hernández 2018) but was also a trained expert of natural history, who intended to write "*La Historia Natural de la América*" [The American Natural History] (Ozonas 2009). Mutis always had at least two paintings drawn of each one of his most important specimens (either botanical or zoological): one to be sent to Spain, and another to remain in Santafé as a backup. In his role as a natural historian, Mutis decided to create oil paintings in which several mammals, fishes, butterflies, and birds of the Viceroyalty of the New Granada (Vezga 1936) were painted with real to life colors.

The zoological paintings, according to the "General Inventory Of the Royal Botanical Expedition of the New Kingdom of Granada" [Inventario General De la Real Expedición botánica del Nuevo Reino de Granada] and "Appendix to Inventory of the Drawings of the Royal Botanical Expedition of the New Kingdom of Granada" [Apéndice al inventario de los dibujos de la Real Expedición Botánica Del Nuevo Reyno de Granada] done by Lagasca (ACN 1818 a,b), details what was received in the Botanical Garden of Madrid such as drawings, manuscripts, herbariums, and

other objects belonging to the botanical expedition. In that document, there is no mention of any of the royal boxes that were sent from Santafé, and the boxes whereabouts are currently unknown (Rueda 1986). Several authors, however, noted their arrival at the Royal Cabinet of Natural History in Madrid, Spain (Sarmiento 2009).

Consequently, the only known zoological drawing is that which can be found on the web page of the National Museum of Colombia (Museo Nacional de Colombia c2008), which comes from documents currently in the Royal Botanical Garden of Madrid (ARJBM-CSIC 1760–1808d, San Pío Aladrén 1995). In order to learn more about the zoological studies of the Botanical Expedition, therefore, I studied the documents of Amat-García and Agudelo-Zamora (2020), Leal Hernandez (2018), Mantilla-Meluk *et al.* (2014), Wilson and Durán (2010), Fernández and Wilson (2008), Mantilla *et al.* (1995), Mutis (1760–1790), and the more specific primary sources documented by San Pío Aladrén (1995), concerning ants (lists only), birds (birds of the Magdalena River and names of birds in the vicinity of Santafé), among others.

Ichthyological works of Mutis

Among Mutis's zoological studies, there are several that focus exclusively on fish. Mutis recorded his observations of "*taburones*" [sharks] on his first arrival to Cartagena de Indias in 1760 (Mutis 1760–1790, Blanco Villero 2008), where he stated: "On this day, I saw in the sea four *taburones* that followed the ship. One of them was terribly big. One may fear that a man would fall into the water on such occasions because his life would be in danger" and that they fished "two *picudas* [*Sphyraena barracuda* (Edwards, 1771)], whose genus I could not deduce even though they had very particular characteristics" (Mutis 1760–1790). In the same way, he mentioned remoras (species of the Echeneidae family), but did not include any descriptive information that would allow one to distinguish which of the eight species reported for Colombia they were (Farfán López *et al.* 2009): "I also observed a kind of fish, which according to what I was told by D. Manuel Echaniz, seemed to be glued on, an inseparable companion of the sharks" (Mutis 1760–1790).

Mutis wrote during his trip through the Magdalena River the first list of fishes of the Viceroyalty of New Granada entitled "*Pescados del río de la Magdalena*" [Fishes of the Magdalena River] (ARJBM-CSIC 1761, view figure 3 in Amat-García and Agudelo-Zamora 2020, Table 1), a list that strangely includes other aquatic species that are not fish (i.e., caiman and turtle, among others), but included at least 36 valid species, this being the first contribution to the ichthyology of the north of South America done by a naturalist. However, neither Dahl (1971) nor Cala (2011) reference this list.

Mutis believed it important to document the natural history of areas unexplored by European scientists. Both before and during his time as director of the Botanical Expedition, he included lists of fishes such as the "*Pescados de Luisa y Cumaná*" [Fishes of Luisa and Cumaná] (ARJBM-CSIC 1760–1808a), a list that includes well-known and emblematic species such as the Bocachico [*Prochilodus magdalenae* Steindachner, 1879], Pataló [*Ichthyoelephas longirostris* (Steindachner, 1879)], and Cuchara [*Sorubim cuspicaudus* Littmann, Burr and Nass 2000], and 14 other species shown in Table 1. Even though he did not use scientific names in his writings–as those did not yet exist and would only formally be described much later–these common names allow us to recognize the species that Mutis listed and described and give us a glimpse of the fish that existed during his times, most of which are still found in the same areas.

As he traveled north in New Granada to the province of Pamplona (now Norte de Santander), in a work entitled "*Pescados de Girón*" [Fishes of Girón] (ARJBM-CSIC 1760–1808b) Mutis once again listed the fauna he encountered. Here, again, he included the Pataló, but this time he used a different local name "Hocicón" (Table 1), a species that in 1909, Andrés Posada-Arango (1839–1922) assigned to the genus *Ichthyoelephas*. In this list, Mutis included 21 species (Table 1) and mentioned the Picuda [*Salminus affinis*] and the Dorada [*Brycon* spp], making important discriminations between species of catfishes such as the large Zapo [Zapo grande], medium or ordinary Zapo [Zapo ordinario], and red or small Zapo [Zapo pequeño o rojo], species mainly related to the *Pseudopimelodus* genus. Also, other striking species such as the Guabinas [*Lebiasina* spp], a local genus studied years later by Carlos Ardila (Ardila-Rodríguez 1994, 1999, 2000, 2001, 2002, 2004). Similarly, Mutis cited species as peculiar as those that can regenerate their notochord, specifically the electric fish or Gymnotiformes. Mutis listed these as Culebrino, Peje Ratón, and Cipata [*Sternopygus* spp] (Table 1) a species recently studied by our dearly remembered friend, Javier

Table 1. List of common names of fish registered by Mutis and their actual scientific names. Species from the Magdalena, Luisa and Cumaná, and Girón areas in the 18th–19th centuries in the Viceroyalty of New Granada. *: unpublished name; +: **Castellanos-Morales (2011)**; #: Class; !: Marine species; ^: Common names are related with different scientific names and regions. **ARJBM-CSIC**: Archivo del Real Jardín Botánico de Madrid.

Fish common names used by Mutis	Current scientific names ^		Name listed in		
			AR-JBM-CSIC (1761) Fishes of Magdalena	ARJBM-CSIC (1760–1808a) Luisa and Cumaná	ARJBM-CSIC (1760–1808b) Fishes of Girón
Anguila - Anguilla	*Symbranchus marmoratus* Bloch, 1795		X		X
Bagre blanco	*Sorubin cuspicaudus* Littmann, Burr & Nass, 2000		X		
Bagre pintado	*Pseudoplatystoma magdaleniatum* Buitrago-Suárez & Burr, 2007		X		
Barbudo	*Pimelodus grosskopfii* Steindachner, 1879		X		
Benton, Mohino	*Megaleporinus muyscorum* (Steindachner, 1900)		X	X	
Bocachico	*Prochilodus magdalenae* Steindachner, 1879		X	X	X
Capaz	*Pimelodus* spp			X	
Capitán	*Eremophilus mutisii* Humboldt, 1805			X	X
Capitanejo	*Trichomycterus nigromaculatus* Boulenger, 1887 +	*Astroblepus* spp	X		
Chas	*Curimata mivartii* Steindachner, 1878		X		
Choque o Caraguala	*Chaetostoma* spp	*Dolichancistrus* spp			X
Cieguecito	*Cetopsis othonops* (Eigenmann, 1912)				X
Corcobata					X
Coron_coron	*Pterygoplichthys undecimalis* (Steindachner, 1878)		X		
Corunta	*Parodon magdalenensis* Londoño-Burbano, Román-Valencia & Taphorn, 2011	*Leporellus vittatus* (Valenciennes, 1850)		X	
Corvinata	*Plagioscion magdalenae* (Steindachner, 1878)		X		
Cuchara	*Sorubim cuspicaudus* Littmann, Burr & Nass, 2000			X	
Cuchinito	*Parodon suborbitalis* Valenciennes, 1850				X
Cucho	Loricariidae			X	
Cutumbi			X		
Doncella	*Ageneiosus pardalis* Lütken, 1874		X		
Doncellita vieja			X		
Doneon				X	
Dorada	*Brycon moorei* Steindachner, 1878		X	X	X
Guabina	*Hoplias malabaricus* (Bloch, 1794)	*Lebiasina* spp		X	X
Guacarote	*Lasiancistrus* spp		X		
Gualimoncito			X		
Guapucha	*Atherina guapucha* *	*Grundulus bogotensis* (Humboldt, 1821)	X		

(*Continúa*)

Fish common names used by Mutis	Current scientific names ^			Name listed in		
				AR-JBM-CSIC (1761) Fishes of Magdalena	ARJBM-CSIC (1760–1808a) Luisa and Cumaná	ARJBM-CSIC (1760–1808b) Fishes of Girón
Jabonero	*Hemibrycon* spp	*Trichomycterus* spp	*Astroblepus* spp			X
Jinguemo				X		
Lamprea						X
Machete					X	
Mancagua				X		
Matacayman	*Centrochir crocodili* (Humboldt, 1821)			X		
Mojarra				X	X	X
Nicuro	*Pimelodus yuma* Villa-Navarro & Acero, 2017				X	
Pataconcita, especie de sardina	*Gasteropelecus maculatus* Steindachner, 1879	*Astyanax* spp		X		
Pataló, Hocicon	*Ichthyoelephas longirostris* (Steindachner, 1879)			X	X	X
Peje chucha	*Loricariidae*			X		
Peje espada	*Xiphias gladius* Linnaeus, 1758 !			X		
Peje raton, Peje Varon, Culebrino, Cipata	*Sternopygus* spp	*Apteronotus* spp		X		X
Peje Zapo	*Pseudopimelodus* spp			X		X
Picuda	*Sphyraena barracuda* (Edwards, 1771) !	*Salminus affinis* Steindachner, 1880		X		X
Quinquin - Kin Kin	*Pimelodella* spp +					X
Sabaleta	*Brycon* spp				X	
Sardina	*Astyanax* spp			X	X	
Sardina blanca o grande	*Astyanax* spp					X
Sardina de cadenita	*Astyanax* spp			X		
Sarina pequeña	*Astyanax* spp	*Hemibrycon* spp	*Eretmo-brycon* spp			X
Siete cueros	*Pimelodus* spp			X		
Tapacubito				X		
Tibron-Taburon	Chondrichthyes # !			X		
Tuna - Atún	*Thunnus* spp	*Katsuwonus pelamis* (Linnaeus, 1758)		X		
Vizcaynito	*Pseudocurimata* spp	*Curimata mivartii* Steindachner, 1878		X		
Volador	*Lebiasina* spp	*Gasteropelecus* spp				X
Zapatero	*Sturisomatichthys* spp				X	
Zapo grande, pequeño o rojo, Zapo ordinario o mediano	*Pseudopimelodus* spp					X
Zavalo	*Megalops atlanticus* Valenciennes, 1847 !			X		

Maldonado Ocampo † (de Santana and Maldonado-Ocampo 2004, 2005, de Santana *et al*. 2004, 2007).

It is necessary to indicate at this point that all the knowledge that Mutis was acquiring in his expeditions was not his own knowledge, this great awakening in terms of both botanical and zoological specimens was very surely provided by those people who always accompanied him. That is to say, his assistants, who we do speak of the rivers (ie Magdalena) were very surely the bogas or the indigenous people, these would be the true connoisseurs of the local fauna and flora, as mentioned by Fernández Piedrahíta (1688) in his writings on the captain (*E. mutisii*), or it is evidenced in the findings of Reichel-Dolmatoff (1985) in Monsú on fish for consumption in the lowlands of Colombia, or even more so the modifications that European kitchens underwent with many American products (Prestes-Carneiro and Béarez 2017) and especially the fish of this new continent (Langebaek 1987).

Now in a revision of Mutis lists, I found a total of 60 common names of fish used by Mutis during his travels that can be associated with 48 currently valid scientific names (Table 1). As some common names were used for more than one taxon, a degree of ambiguity remains. The best correlation between common and scientific names is associated with the taxa recorded in the Magdalena River (29 species), followed by 17 from the Girón list, and 14 from the Luisa and Cumaná list.

But Mutis not only devoted himself to compiling lists of what he found in his travels, the sharpness of his observations, and clarity of his work, gave him a reputation outside of New Granada, so much so that the young baron von Humboldt and his companion Aimé Bonpland (1773–1858) divert from their plans to reach Quito through the Pacific and up the Magdalena River, in order to meet with him and admire his accomplishments (Hernández de Alba 1986).

Mutis intended to formally describe some of the species of fish he recorded but never published his findings. For example, based on the meristics noted by Mutis, "*Atherina guapucha* Mutis. Inet. Pect. 8, V. 6, A. 14, D. 9, C. 24" (ARJBM-CSIC 1760–1808c), he had named the Guapucha, *Atherina guapucha* (an unpublished name) presumably before Humboldt described it as *Poecilia bogotensis* (Humboldt and Valenciennes, 1821).

As a second example, regarding a fish that he described as Capitán, Mutis made a special emphasis on its character of "new genus" which he called *Trichocephalus* (an unpublished genus), mentioning: "Capitán. *Trichocephalus* Mutis (nov. Gen). Apod. Cav. gen. esient., Branchial membrane. rad, tentacula cirrhiformia VI, quonum duo breviora (1 al oculos xxxx), nasalia. Pinna dorsalis" (ARJBM-CSIC 1760–1808c).

From the anterior description, several things stand out: i.) The common name used was Capitán, now is the same common name that currently continues to be used for a catfish species of the savanna of Bogotá; ii.) The author of that genus (Mutis); iii.) The term Apod [Ápodo] to refers in zoology to the animals lacking legs; iv.) The branchial membranes, referring to the gills; v.) Cirriform tentacles, referring to the barbels of the species that later Humboldt would dedicate to Mutis; and vi.) A pinna dorsalis, which is the dorsal fin of the fish.

Clearly, the fish that Mutis pretend described is what we know today as *Eremophilus mutisii* Humboldt, 1805, and it is here that we enter into the speculative process about the "unknown" practices of Baron von Humboldt to publish or even copy the work of others. This argument can be based on a letter written by Mariano La Gasca (1776–1839) to Humboldt on May 3rd, 1827, in which he stated that the Baron copied some illustrations: "I am firmly convinced that several of the drawings you published in your papers entitled *Plantae aequinoctiales y Monographia Melastomae et Rhexiae are copied from the Flora of Bogotá*" (Puig-Samper *et al*. 2004). This fact is highly significant, and although it has been debated for quite some time by experts (Puig-Samper *et al*. 2004, José Antonio Amaya, personal observation), Humboldt's vision is interesting as he did admit that plagiarism was something quite common in the middle of the 19th century (Allen 2016).

It was commonly known that Mutis was such a perfectionist that he never managed to publish much of his work (González Suárez 1905). On the other hand, it should be noted that Mutis willingly gave much information to Humboldt and Bonpland, including botanical sheets, notes, and drawings, among other things (Díaz-Piedrahita 2000, Angerstein Carfrae 1843) that would have included the aforementioned descriptions. As the authorship of a scientific name is attributed to the one that publishes it first, and Mutis never published his findings while Humboldt and

Bonpland published almost every one of theirs in a work that largely surpassed their 30-volume report of their American voyage, the taxonomic priority is clear.

When Humboldt met Mutis in Santafé, Humboldt (then 32 years old) may have considered Mutis (69 years old) an old man unlikely to publish his findings. In Humboldt's description of the Guapucha, he indicates: "*Lorsque je dessinai ce poisson à Santa-Fe de Bogota (en Juillet 1801), dans la maison de M. Mutis, je le pris pour une Atherine de Linné, genre de poissons à nageoire dorsale doublé ou simple, qui* ... [When I drew this fish in Santa Fé de Bogotá (in July 1801), in the house of Mister Mutis, I took it for a Linnaean *Atherine*, a fish genus with a double or simple dorsal fin fish, that ...]" (Humboldt and Valenciennes 1821).

It is not my objective to judge the practices of Humboldt nor Mutis. I only wish to mention that, to this day, these events in the lives of both naturalists are largely unknown. Mutis never ventured to describe the species but the Baron did so. Humboldt mentioned that he had seen this fish in a pool at the house of Mutis. In the social life of that time in Santafé, these fish were an important component of the gastronomy of Neogranadians. They were abundant and came from the neighboring Bogotá River, Tinjacá, and Fúquene lagoons. Fish such as the Capitán [*Eremophilus mutisii*] were consumed during the Christmas season, mainly with fritters and chocolate (Restrepo Manrique 2008).

At the beginning of the 19th century, the Botanical Expedition not only produced botanical specimens but also zoological, mineralogical, geographical, and astronomical specimens, data, and documents (Museo Nacional de Colombia c2008). Some of these were later sent to the king of Spain and ended up in the Royal Botanical Garden of Madrid and other European institutions. They also became the first specimens of the Museum of Natural History and the School of Mines that Colombia founded in 1823 (Rodríguez Prada 2010).

In conclusion, Mutis not only devoted himself to the study of plants but was clearly a general naturalist. His contributions to botany, zoology, and other fields of science pioneered scientific endeavors in New Granada and founded a propitious state for the sciences and arts in South America (Blanco Villero 2008, Mantilla and Díaz-Piedrahita 1995). Linnaeus described Mutis as the one whose: "*immortal name that no future time can erase*" (Díaz-Piedrahita 1997). Linnaeus's words ring true today and inspire continued research to shed even greater light on the inexhaustible work that Mutis did for natural sciences, paving the way for future Colombian ichthyologists such as Andres Posada-Arango, Cecil W. Miles, George Dahl, Plutarco Cala, and all of us.

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CONFLICT OF INTEREST

The author declares that he has no conflict of interest

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